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Studies, Modification and Application of Electrostatic Precipitators - A Review

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ABSTRACT

Air pollution is a serious problem caused by the growing industrialization. It becomes major problem if exhaust gases contain excess amounts of sulphur dioxide, nitrogen oxides and particulate matter. Removal of particulate matter can be carried out by various methods such as fabric filters, cyclone separators, electrostatic precipitators (ESP). Particulate matter is a major concern in boiler units and power generation sector. It is important to use effective and economical treatment method for the particulate matter removal. Many investigators have carried out studies on modification, design and operation of ESPs. The present review summarizes research and studies carried out on ESPs. This review gives insight into application, advancements and modification of ESPs for better and efficient treatment of waste gases.

Keywords: Particulate Matter, Collection Efficiency, Voltage, Frequency.

I. INTRODUCTION

Air pollution and water pollution are the undesirable side effects of industrialization. The water pollutants like organic matter, heavy metals, pathogens etc. can be removed from wastewater by various physical, chemical and biological methods \cite{1,2,3,4,5}. The air pollutants can be broadly divided into two categories, particulate matter and waste gases. The gaseous pollutants contain oxides of sulphur and nitrogen, hydrogen sulphides and other specific gases with respect to the type of process and reaction \cite{6,7,8}.

The gases can be removed from the exhaust by using absorption. Various solvents selectively absorbs certain gases like sulphur dioxide(SO\textsubscript{2}), nitrogen oxide(NO\textsubscript{2}) etc\cite{9,10}. Various membrane separation techniques can also be used. The removal of particulate matter can be carried out by using inertial separators, cyclone separators, fabric filters and electrostatic separators. Electrostatic separators uses charged electrodes to attract the particles and collect them. The present review summarizes the research and studies carried out on electrostatic separators.

II. STUDIES AND RESEARCH ON ELECTROSTATIC SEPARATORS

Sharma and Sahu carried out modeling of electrostatic separators \cite{11}. They discussed the performance of ESP’s in a power plant, which is situated right in the centre of a mega city. They installed another ESP with existing one and carried out performance guarantee (PG) tests. Their results indicated a significant deterioration of collection efficiency of old ESP unit at the level of (90-93\%) against designed value of more than 99\%. They also observed that the new ESP unit, which was put ahead of old ESP unit, was operating in the range of (93-96\%) of collection efficiency.

Youwen and Weiping carried out review on Chinese electrostatic precipitator technology \cite{12}. According to the author, ESP made in China not only meets the domestic requirement, but also be exported to decades of countries. Power plant is one of the major industrial sectors using ESP. Electric power sector was major customer of the ESP. According to their estimates, from 1990 to 2000, dust emitted from power plant was kept...
below 4000000 ton while total thermal power units increased from 76011 MW to 220000 MW. Zukeran et.al. carried out investigation on electrostatic precipitator re-entrainment phenomena under diesel flue gases[13]. They used two stages ESP in their research. According to them, collection efficiency often becomes negative in an experimental ESP. This happens because of the re-entrainment of particles. They carried out research to find the reasons for decrease in collection efficiency of ESP. They observed that the decrease in the collection efficiency was caused by re-entrainment of particles during the ESP operation. Also their research revealed that re-entrainment phenomena depended on the gas-flow velocity.

Wanjari and Narkar studied modification of rapping system to improve the dust collection efficiency of electrostatic precipitator [14]. According to them space required is main constraint in the use of ESP. This constrain can overcome by increase the height and accordingly the collection area. They studied new methods to increase height of rapping system. Commercial software was used for analysis. They concluded that side rapping system is more effective than top rapping for cleaning of collecting plates. Comparative study of the conventional electrostatic precipitator was carried out by Krishnan et.al. [15]. They proposed a new ESP model (smart ESP). They proposed that the location of the transformer rectifier should be on the top of the ESP which is approximately 36 meters above the ground level and thus the total length of control cables used for erection will be around eight to nine kilometers. Thus it was possible to reduce quantity of control cable and perforated cable trays. Also it was possible to reduce the cost for cable laying and the perforated cable tray work. Bohidar et al. carried out review on role of ESP in industry [16]. According to the studies ESPs are mainly used for particles >1 mm, with dust resistivity’s between approximately 104 and 1011 Ω cm. For a given electrode configuration, the efficiency is related to the specific power input (W/m²).

Haque et.al. carried out investigation on flow distribution inside an electrostatic precipitator [17]. They studied effects of uniform and variable porosity of perforated plate. They presented a numerical flow model applied to a 3D geometry of an electrostatic precipitator (ESP). They modeled the perforated plates as thin porous media of finite thickness with directional permeability. They found that the variable porosity of perforated plate was effective to achieve uniform flow distribution inside the ESP. The model they proposed was useful for operation and maintenance improvement activities by ESP tuning, optimizing flow distribution, field charging and rapping cycles and necessary plant modifications. Vukosavic et.al proposed power electronics solution to dust emissions from thermal power plants[18].They found that the ESPs used need large effective surface of the collection plates and a large weight of steel construction in order to achieve the prescribed emission limits. They found that high frequency high voltage power supply(HF HV) reduces emission two times in controlled conditions while increasing energy efficiency of the precipitator. They concluded that the equipment comprising HF HV supplies are the best solution for new ESP installations, as well as for the reconstruction of existing facilities. Ariana et.al. carried out investigation on exhaust gas recirculation studies to study effect of electrostatic precipitator [19]. The research carried out by them shows that an electrostatic precipitator (ESP) can successfully reduce marine diesel particle matter. They also developed a combined Exhaust gas recirculation, EGR and ESP system capable of simultaneously reducing NOx and particulate matter (PM). They observed that a combined EGR/ESP system reduces NOx and PM concentrations in exhaust gas.

Shanthakumar et.al. studied flue gas conditioning for reducing suspended particulate matter (SPM) from thermal power stations[20]. They discussed various equipments used for the reduction of SPM including ESP. They explained advantages of ESP such as high collection efficiency (E99.9%) on removal of submicron particulates; low-operating costs; low-pressure drop; relatively large gas flows, which can be easily handled; and its suitability for dealing with particles of different sizes and variable flue gas volumes. Jagtap et.al. discussed primary details and general information related to plate type ESP’s[21]. According to them, resistivity is an important factor that significantly affects collection efficiency. According to them, it is not possible to have an electrostatic precipitator that works at 100 per cent efficiency levels, but with point compromises, the optimal conditions can be achieved. Thongleek and kiatsiriroat used of pulse-energized electrostatic precipitator to remove submicron particulate matter in exhaust gas[22]. They tested a wire-
cylinder ESP. They observed that the pulse peak voltage supply could be set much higher than the sparking limit of the DC energized unit. The collection efficiency increased at higher pulse frequency. Kumar and Knapik studied application of ESP for best performers in coal-fired power plants[23]. They discussed the results of stack emissions testing conducted at several coal-fired power plants during the last three years. According to their studies the two important aspects of the investigations on ESPs are the continuing efforts of plant operators to maintain ESP performance, and the co-benefits of wet flue gas desulfurization units, FGDs in reducing stack filterable emissions. According to them proper flyash conditioning is important to achieve maximum collection efficiency.

More and Burande presented FEA approach for modeling and analysis of collecting electrodes in an electrostatic precipitator using Implicit transient dynamic analysis approach [24]. In their investigation, they observed that the vibration excitation of collecting electrodes mainly depends upon impact force and system geometry. Also, there was good agreement between FEA method and testing data. They concluded that the method was much simpler, cost effective and time saving as compared to actual physical testing of the system.

Despotovic and Vukosavic presented theoretical consideration and simulation results for one HF resonant converter, which energizes ESP [25]. According to them the qualitative improvement of electrostatic precipitation of particle from the smoke gas was possible. A new more sophisticated solution which include high voltage high frequency (HVHF) transistor converter instead of conventional thyristor converter module and 50Hz high voltage transformer. According to these studies reaction time and quality precipitation can be bettered compared to the thyristor controlled electrostatic precipitator (ESP). Adner carried out research on generation of nanoparticle-protein solution [26].According to him; one of the most important features regarding deposition efficiency is the possibility to charge the particles. He carried out experiments to test the protein reaction to the materials used in the Aeroid. He also observed that the fractional losses were greater for small particles. Patra and Sarangi carried out experimentation in order to enhance performance of ESP of thermal power plant [27]. They observed that, at the higher frequency operating level of switch-mode power supply, SMPS controller, the response time can be as quick as 100 microseconds compared to the response time of a typical Silicon-Controlled Rectifier, SCR controlled transformer rectifier, 8.33 milliseconds. Jaworek et.al. investigated two-stage electrostatic precipitator for dust particle for dust particle removal[28].They observed that the cohesive forces play the fundamental role in two-stage electrostatic precipitators. According to them, A two-stage ESP can be effective only, if the cohesiveness of the dust is sufficiently large. Nikolic and Stevanovic carried out investigation on power quality measurement analysis of the electrostatic precipitator in thermal power [29].They carried out studies under different working conditions. They proposed measurement methodology based on EU power quality standard EN 50160. They found that this method demonstrated better energy efficiency of intermittent control strategy (about 8%) and lower high-order harmonic values (especially current) up to 25%.

Haque et.al. proposed a Computational Fluid Dynamics (CFD) model for a wire-plate electrostatic precipitator (ESP)[30]. They validated simulated results with experimental data. They found that there was reasonable agreement with experimental data. Adamiec-Wójcik presented a model of a rapping system of an electrostatic precipitator [31].In their model; they combined the rigid finite element (RFE) method with the classical finite element method. They observed that , Motion of an RFE is limited only by the influence of primary elements, Thonglek and Kiatsirirat developed a wire-cylinder electrostatic precipitator (ESP) for control of submicron particles generated in exhaust gas[32]. They carried out research aimed at improvement of electrostatic precipitator for submicron particle collection by non-thermal plasma pre-charger. During their investigation it was observed that the efficiency was not high. It was in a range of 70-80% for submicron particles. In the improved ESP, very fine particles could be agglomerated to have bigger sizes which can be captured in ESP. By inclusion of non-thermal plasma, NTP precharger, the overall efficiency was greater than 90%. Kawakami et.al. Carried out research for reducing diesel exhaust particle by using ESP [33]. They investigated the effect of electrode configuration on collection performance of diesel particulates. They estimated the collection efficiencies as a function of the electrode length and the particle diameter.
observed that the collection efficiency for the collection electrode length of 150 mm decreased with increasing particle size in the two-stage type ESP due to re-entrainment.

III. CONCLUSION

The decrease in the collection efficiency was caused by re-entrainment of particles during the ESP operation. Space requirement is main constraint in the use of ESP. Side rapping system is more effective than top rapping for cleaning of collecting plates. High frequency high voltage power supply(HF HV) reduces emission two times in controlled conditions while increasing energy efficiency of the precipitator. The collection efficiency increased at higher pulse frequency. Non thermal plasma can be used to agglomerate small particles in order to increase collection efficiency. It can be concluded that the conventional ESPs and the collection methods can be modified in order to improve efficiency and economy.

IV. REFERENCES


A Comparative Study of M/ZSM-5 (M = Pd, Ag, Cu, Ni) Catalysts in the Selective Reduction of Nitrogen (II) Oxide by Ammonia

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ABSTRACT

The improvement of H-ZSM-5 catalyst for NO removal from stack of nitric acid unit was studied in this research. Selective catalytic reduction of NO was investigated on Pd, Ag, Cu and Ni impregnated on ZSM-5 in the presence of excess of oxygen. The new prepared catalysts were characterized by XRD, FTIR, H₂-TPR and N₂ adsorption-desorption methods. Successively, NO conversion increased with the reaction temperature transmission through a maximum, and then decreased at higher temperatures, because of the combustion of the ammonia on Pd/ ZSM-5 and Cu/ ZSM-5 catalysts. The apparent activation energies in NO removal reaction have been determined for the prepared catalysts and it changes from 23 to 48 kJ/mol. In synthesis catalysts, partial dealumination were confirmed by XRD results. The results exhibited that the Cu/ZSM-5 and Pd/ZSM-5 catalysts had acceptable activity between 200 to 400 °C and under 250°C, respectively. It is found that the NO₅ removal efficiency does not obey from the same pattern by rising temperature in all of these catalysts.

Keywords: ZSM-5; Selective catalytic reduction; Nitrogen oxides; cation effect

I. INTRODUCTION

Anthropogenic nitrogen oxides (NOₓ, as NO and NO₂), mainly emitted from stationary and mobile combustion sources, are hazard for the environment and human health [1]. By the pioneering works [2], it has been well established that iron zeolites are among the most active catalysts for the selective catalytic reduction of nitrogen oxides by ammonia.

Noble metals or metal oxides (such as, MoO₃, CuO, Fe₂O₃, MnO₂, NiO, and V₂O₅) supported on suitable components have excellent catalytic activity for the selective reduction of NO to N₂ with NH₃ at relatively high reaction temperatures (greater than 250°C) [3-6]. Amongst these formulations, V₂O₅/WO₃/TiO₂ and Cu/HZSM-5 are available commercially [7]. The catalytic activity of some different ion exchanged zeolite such as doped- chabzite and MFI were reported by the other authors and imply that aluminosilicates are good supports for these types of catalysts [8].

Despite of the great number of references in literature, few detailed studies dealing to the comparison of the catalytic activity for the SCR of NO of different catalysts have been reported.

The present study was undertaken with aim of assessing the effect of four different transition metal chlorides and their reduction properties on activity of M/ZSM-5 zeolite (M= Ni, Pd, Ag, Cu) in ammonia selective catalytic reduction of NO to N₂. The ZSM-5 zeolite was impregnated with transition metal chloride in constant concentration of M/Al. The catalysts characterized after preparation by different method. In the new approach, the apparent activation energies and conversion in NO removal reaction have been determined for the prepared catalysts.

II. METHODS AND MATERIAL

18.33 gr of the commercial ZSM-5 zeolite (Si/Al=20) was added to an aqueous solution of 7.2 mmol of metal
chloride (Ni, Pd, Ag, Cu) under vigorous magnetic stirring and homogenized for 3 hours then ultrasonic treatment did for 45 min. The obtained solid samples were dried at 100 °C for 8 h and subsequently calcined at 480 °C for 3h. This method allows controlling the desired amount of metal ions in the zeolite. The chemicals were purchased from Merck Company.

The catalysts were characterized by various techniques: X-ray powder diffraction (Philips diffractometer with Cu-Kα radiation), temperature programmed reduction (Belcat A instrument), N2 adsorption-desorption (Quantachrome corporation NOVA 2200) and FTIR spectroscopy (Bruker vertex 80).

The SCR activity measurements were conducted in an Inconel-800 fixed bed reactor (i.d. 15 mm) using 4 g of the catalyst with feed gas composition of 700 ppm NO; 500 ppm NH3, 2.6 % O2 and N2 balance gas. The space velocity was 20000 h⁻¹. The conversion of NO was measured as a function of time and the concentration of O2, NO and NO2 were measured by gas analyser (Testo 340). The mass reaction rate of NO consumption and activation energy was calculated [9].

III. RESULTS AND DISCUSSION

A. Catalytic activity measurement

Figure 1 illustrates the temperature dependence of catalytic activity acquired in nitric oxide selective catalytic reaction with NH3 for M/ZSM-5 samples. With raising reaction temperature in Cu/ZSM-5 activity increase and the NO conversion meets a maximum about 99.8% at 250°C and then it slowly decreases until 90% at 450°C. The performance of Pd/ZSM-5 catalyst passes a through maximum at 200°C because it involves competition ammonia oxidation at higher temperature. The catalyst with palladium is fit for low temperature and Ni/ZSM-5 and Ag/ZSM-5 exhibit acceptable activity in high temperature.

According to the literature [10], the SCR reaction is not dependent of the oxygen and ammonia concentration and is also first order with regard to the concentration of NO under the reactor testing conditions. Consequently, the first order rate constant can be estimated from NO conversion (X) by

\[
K = \frac{V \ln(1-X)}{m}
\]

Where V is the gas flow at the reaction temperature and m is the catalyst weight in grams. An approximation of the activation energy in agreement with \( K = A. \exp \left(-\frac{E_{\text{act}}}{RT}\right) \) was lead the Arrhenius plots were procured in 250 to 350°C range by calculating the rate of NO conversion data. The activation energy estimated from the regression lines are 35.9, 48, 23.2 and 25.0 kJ/mol for Cu/ZSM-5, Ni/ZSM-5, Pd/ZSM-5 and Ag/ZSM-5, respectively.

B. Structural properties –XRD and FTIR spectroscopy

The powder X-ray diffraction was managed to determine the crystalline structure, lattice parameter and crystallinity of the catalysts. Fig. 1 exhibits the XRD patterns of all prepared catalysts after calcination. All catalysts were characterized by typical peaks at 7.92, 8.84, 23.12 and 23.8° in the XRD pattern of samples (JCPDS card NO: 049-0657) corresponding to the characteristic MFI structure peaks of zeolites, respectively. Copper oxides are not detectable by XRD technique, which implies that they are highly dispersed on the ZSM-5 carrier [11-12]. Besides the pattern of the Ni/ZSM-5, Pd / ZSM-5 and Ag / ZSM-5 illustrated nickel oxide (2θ=43.9°), palladinite( 2θ=43.9°) and chlorargyrite(2θ=32.4, 46.4 and 28.0°) phases, respectively. The orthorhombic cell parameters of the ZSM-5 phase for these catalysts were calculated and results (table 1) showed small change in unit cell volume of them.
These results offer that the major amount of framework aluminum remained intact even after the impregnation and thermal treatment.

**TABLE 1**

LATTICE PARAMETERS OF M/ZSM-5 CATALYSTS

<table>
<thead>
<tr>
<th>samples</th>
<th>Lattice parameter</th>
<th>volume</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>Cu/ZSM</td>
<td>20.07</td>
<td>19.3615</td>
</tr>
<tr>
<td>Ni/ZSM</td>
<td>20.036</td>
<td>19.3473</td>
</tr>
<tr>
<td>Ag/ZSM</td>
<td>20.08</td>
<td>19.37315</td>
</tr>
<tr>
<td>Pd/ZSM</td>
<td>20.104</td>
<td>19.3666</td>
</tr>
<tr>
<td>ZSM-5</td>
<td>20.092</td>
<td>19.3498</td>
</tr>
</tbody>
</table>

According to table 2, it can be observed that all of samples indicate a relative crystallinity higher than 77%; therefore, the position of the peaks between 2θ=22-25° are slightly effected by framework dealumination.

**TABLE 2**

STRUCTURE PROPERTIES FROM XRD

<table>
<thead>
<tr>
<th>samples</th>
<th>Crystal size (nm)</th>
<th>Relative Cryst. (%)</th>
<th>Micro-stress (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cu/ZSM</td>
<td>37.6</td>
<td>96.4</td>
<td>0.47</td>
</tr>
<tr>
<td>Ni/ZSM</td>
<td>67.5</td>
<td>81.7</td>
<td>0.5</td>
</tr>
<tr>
<td>Ag/ZSM</td>
<td>42.1</td>
<td>77</td>
<td>0.64</td>
</tr>
<tr>
<td>Pd/ZSM</td>
<td>58.4</td>
<td>94.2</td>
<td>0.36</td>
</tr>
<tr>
<td>ZSM-5</td>
<td>90</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The determined FAL (framework aluminum) contents of the catalysts were correlated to the symmetric stretching of the external linkage in the tetrahedral structural at ≈790-802 cm⁻¹. Triantafillidis and et al.[14] proposed the follow equation for an approximate calculation of FAL content per gram of samples:

\[ Q_{FAL} = (802.5 - ν_2) / 9.75 \]
Where $Q_{\text{FAL}}$ is the FAL content (in mg-atoms per gram hydrated catalyst) and $\nu_2$ is the frequency of main symmetric stretching vibrations of FTIR spectra. $Q_{\text{TAL}}$ (total content Al for the samples was determined by XRF ($\approx 0.76$-0.83). The difference between the values of $Q_{\text{TAL}}$ and $Q_{\text{FAL}}$ gives EFAL content of the samples. The contents of extra-framework Si- and Al expressed as $\% \text{SiO}_2$ and $\% \text{Al}_2\text{O}_3$ and the Si/Al ratio of the extra framework/amorphous phases. Regards to table 3, an amount of amorphous material was present in these samples which principally included of Si species. The Si/Al ratio of the framework phases of these catalysts altered between 21.7 for ZSM-5 to 25.8 for Pd/ZSM-5.

### TABLE 3

**COMPOSITIONAL AND STRUCTURAL PROPERTIES OF THE CATALYSTS (XRF AND FTIR)**

<table>
<thead>
<tr>
<th>Sample</th>
<th>$\nu_2$</th>
<th>$Q_{\text{FAL}}$ (mg-atoms g$^{-1}$)</th>
<th>Si/Al(fr)</th>
<th>SiO$_2$ (wt %)</th>
<th>Amorphous</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZSM-5</td>
<td>796.6</td>
<td>0.61</td>
<td>21.7</td>
<td>8.94</td>
<td></td>
</tr>
<tr>
<td>Ni/ZSM-5</td>
<td>798.0</td>
<td>0.46</td>
<td>25.7</td>
<td>16.4</td>
<td></td>
</tr>
<tr>
<td>Cu/ZSM-5</td>
<td>796.2</td>
<td>0.64</td>
<td>22.2</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>Pd/ZSM-5</td>
<td>797.2</td>
<td>0.54</td>
<td>25.8</td>
<td>4.34</td>
<td></td>
</tr>
<tr>
<td>Ag/ZSM-5</td>
<td>797.5</td>
<td>0.51</td>
<td>21.8</td>
<td>21.4</td>
<td></td>
</tr>
</tbody>
</table>

**C. Temperature-Programmed Reduction (TPR)**

The TPR profiles of the catalysts are shown in Fig. 4. In general, the broad feature peaks in these samples may be related to the reduction of the reducible species on surface or inside the different cages of ZSM-5 zeolite. Similar to literature [17] the Cu/ZSM-5 samples showed two reduction regions. The first reduction was shown a sharp peak at 189 °C with a shoulder at 211°C ascribed to the bulk like CuO phase including large clusters of CuO. The second relatively broad peak with maximum at 315 °C assign to the highly dispersed copper species interacted strongly with ZSM-5 zeolite. The Cu/ ZSM-5 sample showed some broad peaks which implied the copper cations capture in the different sites in the zeolite. In The TPR profile of Ni/ ZSM-5 catalyst showed two overlapping peaks at centred 376 and 494 °C for bulk NiO and high dispersed nickel oxide in different sites of ZSM-5 zeolite, respectively [18].

Small peak in Ag/ ZSM-5 samples around 140°C attributed to the Ag$_2$O reduction and the peak at 335°C probably belong to silver silicates or silver aluminates species.

According to the literature [19], the reduction profile of PdO is attributed by a single peak at 55°C. Two reduction profiles are observed for the Pd/ZSM-5 catalysts. The first TPR peak temperature of Pd/ZSM-5 catalyst is at 55°C and the second peak is higher than that of PdO. This assigns that ZSM-5 inhibits the reduction partial of PdO. Easy reduction in M /ZSM-5 promotes NO removal. High dispersions of metal ions on ZSM-5 zeolite promote intimate contact between metal ions and surface.
M-O-(Si or Al) bonding forming is related to M-O-M bonding prevailing. The new bond formation between impregnated metal ions and Si or Al in zeolite framework is confirmed by changes in the location of reduction peaks in comparing by their bulk oxides. The presence of Si or Al in the coordination sphere of M^{n+} should change the electronic density and reducibility of metal ions in the catalyst.

The results showed that the activated phase in Ag/ ZSM-5 and Pd/ ZSM-5 may be a noble metal.

D. Textural and structure Properties

The isotherms of nitrogen adsorption- desorption (Fig.5) on the whole samples are similar to type I [20]. According to table 4, the meso-pore area of M/ZSM-5 (M=Ni, Cu, Pd) became larger than the parent ZSM-5. It was also proved that the meso-pores were generated during the modification process. Total surface area of these catalysts usually decreased between 7 to 16% after reaction. The shape of hysteresis loop signalizes the presence of inkstand-like pores in the catalysts.

**TABLE 4: SORPTION PROPERTIES OF THE M/ZSM-5 CATALYSTS**

<table>
<thead>
<tr>
<th>component</th>
<th>S_{BET} (m^2/g)</th>
<th>S_{ext} (m^2/g)</th>
<th>V_{µp} (cm^3/g)</th>
<th>S_{µp} (m^2/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ni/ZSM-5</td>
<td>233</td>
<td>20</td>
<td>0.10</td>
<td>213</td>
</tr>
<tr>
<td>Cu/ZSM-5</td>
<td>223</td>
<td>31</td>
<td>0.09</td>
<td>192</td>
</tr>
<tr>
<td>Pd/ZSM-5</td>
<td>264</td>
<td>21</td>
<td>0.12</td>
<td>244</td>
</tr>
<tr>
<td>Pd/ZSM-5-A</td>
<td>245</td>
<td>23</td>
<td>0.11</td>
<td>222</td>
</tr>
<tr>
<td>Ag/ZSM-5</td>
<td>168</td>
<td>12</td>
<td>0.08</td>
<td>156</td>
</tr>
<tr>
<td>Cu/ZSM-5</td>
<td>279</td>
<td>23</td>
<td>0.12</td>
<td>256</td>
</tr>
<tr>
<td>Ni/ZSM-5</td>
<td>291</td>
<td>28</td>
<td>0.13</td>
<td>263</td>
</tr>
<tr>
<td>ZSM-5</td>
<td>348</td>
<td>34</td>
<td>0.17</td>
<td>314</td>
</tr>
<tr>
<td>A: After reactor</td>
<td>µp: Micro Pore</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IV. CONCLUSION

Impregnation by metal chloride partially caused dealumination ZSM-5 zeolite. Among the catalysts prepared in this study Cu/ZSM-5 illustrated high performance in the all reaction temperature range. At the 360 °C, temperature supplied necessary activation energy for starting reaction for all of the catalysts; therefore, we did not observe strongly effect of variety of apparent activation energy in the performance of catalysts. The cell volume of ZSM-5 in these catalysts increased in comparing to parent ZSM-5. The redox properties play more important role than acidic properties in this reaction. To regard of our knowledge the reduction of bulk metal oxide usually starts at a lower temperature than M/ZSM-5 catalysts in this research. Furthermore, the higher reduction temperature of supported metal ions showed a strong interaction between metal and support. The rate-determining step in the SCR reaction may be the same for M/ ZSM-5 (M= Ni, Cu), while it appeared to be different for the Pd/ ZSM-5 and Ag/ ZSM-5. The first group is metal oxide in the reaction condition and the second group is metal state, therefore, shows lower apparent activation energy.
V. ACKNOWLEDGMENT

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VI. REFERENCES


Bioinformatics Approaches for Gene Finding

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ABSTRACT

Gene finding as process of identification of genomic DNA regions encoding proteins, is one of the important scientific research programs and has vast application in structural genomics, functional genomics, metabolomics, transcriptomics, proteomics, genome studies and other genetic related studies including genetics disorders detection, treatment and prevention. It is prominent that for study of all above mentioned research programs, identification of fundamental and essential elements of genome such as functional genes, intron, exon, splicing sites, regulatory sites, gene encoding known proteins, motifs, EST, ACR, etc are formed principle basis of the studies and these functions are employed by gene prediction or finding process. So gene finding process plays significant role in the study of genome related programs. Several methods are available for gene finding such as laboratory-based approaches, feature-based approaches, homology-based approaches, statistical and HMM-based approaches. In this paper, we aim to discuss Insilco approaches for gene prediction in order to make scientist familiar with available bioinformatics tools for gene finding to take benefit from their advantages including low in cost, rapid in time, high in accuracy and large in scale.

Keywords: Gene finding, Gene prediction, bioinformatics tools, genome study, Insilco approaches.

I. INTRODUCTION

The process of identification of genomic DNA regions encoding proteins is defined as gene prediction or gene finding. Gene finding is one of the most significant process in understanding and analysis of an organism's genome after its sequencing. Previously the process of gene finding was relied on effortful experimentations on organisms and living cells which required high expenditure in cost and time but recently with advancement in statistical and bioinformatics tools, these troubles have been decreased. Statistical approaches in combination with computational techniques provide analysis of homologous recombination rates of various genes which lead in determination of their order on a particular chromosome and obtained information from such experiments are helpful in creation a genetic map which help in specification the rough locus of known genes related to each other. Availability of vigorous computational tools aided gene finding to demonstrate significant position in genome studies. Gene finding process is able to distinguish determination of function of gene or its product from a functional gene, although prediction of a gene function and its confirmation still demand in vivo, gene knockout experimentations and other assessments, but bioinformatics approaches have great ability to predict the gene function based on its sequence alone. Additionally, gene finding process is able to predict structural genes which are fundamental basis for understanding biochemical process within the cells including transcription. Protein-protein interactions and regulatory system process which contributed in Omics fields’ research such as structural genomics, functional genomics, metabolomics, transcriptomics and proteomics. It is clear that for each research process, knowledge of fundamental elements are required, in application gene finding for research studies knowledge of some bases are essential such as, gene definition, gene structure types of genes, differences between types of genes, gene feature and DNA characteristics. In this part we briefly discuss such issues for better understanding gene finding.
process. A DNA segment expressed for production of a functional product like a protein or RNA is called as a gene. Generally genes structure consist of following parts: upstream (intergenic region), promoter (for example, TATA box with consensus sequence TATA(A/T)A(A/T), first exon (transcriptional start, 5'-UTR), intron(s) (frequent stop codons), exon(s) (CDS/ORF and enhancer sites), intron(s) (frequent stop codons), last exon (transcriptional stop, Poly A insertion sites, downstream (intergenic region)). Generally there are two types of genes based on organism: prokaryotic and eukaryotic genes which show following features: prokaryotic genome: small in size, high gene density, terminator important, no introns (or splicing), no RNA processing, similar promoters, and overlapping genes. Eukaryotic genome: large in size, low gene density, terminator not important, presence of introns (or splicing), presence of RNA processing, heterogeneous promoters, polyadenylation. Knowledge of pattern recognition including gene feature and DNA characteristics are also important and prior to applying gene finding process, these are such as coding sequences (open reading frames (ORFs), GC-rich, CpG-content), PolyA-signals (consensus sequences), translational start and stop sites (start codons (ATG), stop one TAA, TAG, TGA), splice sites (consensus sequences) promoter regions (TATA, shine Dalgarno, Kozak consensus, CpG content, Prinbnow). Totally gene finding methods can be divided into two types: laboratory based approaches and web based approaches which itself consist of three types namely: feature-based, homology based and statistical and HHM based approaches. Laboratory based approaches are such as southern blotting, northern blotting methods, Zoo blots, S1 nuclease mapping, Primer extension, Exon trapping, Reverse transcriptase polymerase chain reaction (RT-PCR) and In situ hybridization (ISH). In this paper we aim to introduce several online database and tools related to feature-based, homology based and statistical and HHM based approaches in order to utilize their benefits in gene prediction processes. [1-4].

II. METHODS AND MATERIAL

Computational tools for gene finding:

CRAIL (Gene Recognition and Analysis Internet Link) (http://compbio.ornl.gov/grailexp/). It is one the most known computational tools mostly used for ORF identification. This tool analyses potential of a DNA sequence for protein coding. The scheme provided by CRAIL is variable-length windows tailoring to each possible ORF by a pair of start, acceptor and stop sites. This scheme provides more genomic context information such as translation starts, splice junctions, non-coding scores of 60 base regions on both sides of putative exon. [5].

FindPatterns (http://www.accelrys.com/products/gcg_wisconsin_package/programlist.html#FindPatterns) is another computational tools used to scan patterns of ORFs. [1]. Sequencher (https://www.genecodes.com/). It is a computational tools used for different analysis purpose such as ORFs analysis, restriction enzyme mapping, contig assembly, cDNA to Genomic DNA large map alignment, SNP analysis, motif analysis and heterozygous detection. [6]

Mac Vector 6.5 (http://www.sxst.it/oxm_mcv.htm). Used for detection of ORFs based on Fickett's statistical method. [7]

TestCode (http://www.accelrys.com/products/gcg_wisconsin_package/) is another computational tools used for verification of potential of ORFs to encode a proteins. For example this tool helps in determination of correspondence of the codons in ORFs to those used in other genes of the same organism, possibility of ORFs translation into amino acid sequences and so on. [8]

Procrustes software program (http://hto13.usc.edu/software/procrustes). This program is based on homology and its entity is one genomic DNA sequence and one or more protein sequences. The targets are similar to the protein encoded in the genomic DNA sequence and exon chain is found by this homology based finding. [1]

GeneMark (http://www.ebi.ac.uk/gensemarker). Is another computational program based on statistical and HHM approaches used for gene identification. [1,9]

HMMgene (http://www.ebs.dtu.dk/services/HMMgene/). It is a computational approach based on HMM used for gene prediction in an anonymous DNA. [1,10]

Glimmer (http://www.tigr.org/software/glimmerm). Prediction of genes in microbial DNA can be performed computationally using this tool. This system also uses IMMs approach for identification of coding regions and their distinguishing from non-coding regions. [11,12]

Veil system (www.tigr.org/-salzberg/veil.html). This program used to identify genes in Eukaryotic DNA based on HMM approach. [1]

GENSCAN (http://genes.mit.edu/GENSCAN.html). It is a computational tool used for prediction of complete

III. RESULT AND DISCUSSION

To understand the proteins encoded by the genes and their function and dysfunction, it is very important for scientists in order to analyse the cause of disturbance and find out treatment approaches. Of course for analysing and identification of causing agents for diseases, knowing the structures and specific genes encoding disease involving proteins are essential. One of the branches aids in this issue is gene finding. Gene finding provides applicable tools for researchers for searching genes encoding proteins. These tools are used for identification of different DNA features and corresponding DNA characteristics such as coding sequences (CDS) (ORFs, GC-rich, CpG-content), Splice sites (consensus sequences), Translational start and stop sites (codon start(ATG) and stop (TAA, TGA, TAG), promoter regions (TATA, Pibnow) and Poly A signals. Additionally the gene finding methods provides researchers with tools for identification of different gene structures such as protein binding sites in DNA sequences, exons, introns, combination of exons and introns, prediction of TATA signal, transcription factors, prediction of homologies of signal sequences, promoter sequence analysis, prediction of coding regions, analysis of repetitive elements in DNA sequences, prediction of tRNA and so on. SO understanding above characteristics and elements of encoding genes are essential and basis for the researcher for proper study of genomics, proteomics and other related studies. Although these gene finding approaches based on computational methods are very fast and economics as compared to lab based techniques which have limitation in time, cost and scale but they also have their own limitation in prediction type, sensitivity, specificity, sensitivity of exon and introns, sensitivity of exact exon and missed exons. Recently due to advancement in science and identification of many factors related to disease’s emergence and treatment like biomarkers, targets and drug targets such as ion channels, aquaporins, GPCRs, CDKs, and genes encoding them, these tools are applicable and can be used for identification of genes.
related to the above elements for better analysis of the factors involve in cause and treatment of diseases specially cancers and take benefits of their advantages such as rapid in time and save in cost, high in accuracy and large in scale. [18-23].

IV. REFERENCES


[6] Sequencher® version 5.3 sequence analysis software, Gene Codes Corporation, Ann Arbor, MI USA http://www.genecodes.com


A System Line Overload Index for Contingency Assessment of Nigeria’s 330kV Transmission System

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ABSTRACT

Contingency analysis is an abnormal condition in electrical network. It puts the whole system or a part of the system under stress. It occurs due to sudden opening of a transmission line, generator tripping, sudden change in generation and sudden change in load value.

This paper presents a System Line Overload Index (SLOI) for contingency assessment of Nigeria’s 330kV transmission system. The analysis started with the determination of the receiving and sending end voltages of the buses in order to compare their values for safety operation. The ratio of the receiving and sending end voltages of the buses was determined as a basis for the mathematical computation of the System Line Outage Index (SLOI).

The results of the work showed that the outage of Osogbo to Aiyede had the most critical effect on the system because, at this line, a peak SLOI value of 0.99998 was obtained with sending and receiving end voltages of 1.84V and 1.81192V respectively. The outage of Osogbo to Ikeja West line had the least SLOI value of 0.069, hence the least critical effect on the system. This SLOI value gave a corresponding receiving and sending end voltages of 1.04272V and 1.12V respectively. Additional lines should be used to connect Osogbo to Aiyede to create more links for power to be transmitted to Lagos area so as to reduce the SLOI value of Osogbo to Aiyede line.

The work will stress the importance of operating the transmission system defensively to avoid system collapse due to overloading so as to improve the lines’ active power capability contingency event using Flexible AC Transmission (FACT) devices because of their fast switching ability.

Keywords: Contingency, SLOI, Sending End Voltage, Receiving End Voltage, Transmission System, Power Grid.

I. INTRODUCTION

A contingency is a failure of any one piece of equipment (line or transformer), which can be caused by either external or internal disturbances. Power system should be able to withstand the failure of any one piece of equipment and still function normally. Contingency analysis in power system area refers to the study of different situations where one or more of the system components, including a transmission line, generator, transformer, etc., are out of service either intentionally or due to fault[13], [19].

Contingencies are defined as harmful disturbances that occur during the steady state operation of a power system.

Contingencies can lead to some disturbances such as over voltage at some buses, overloading on the lines, which if are unloaded can lead to total system collapse [9], [17].

Power system engineers use contingency analysis to predict the effect of any component failure. Periodically, maintenance operations are carried out on generating units or transmission lines. During this period, a unit is
taken offline for servicing. The effect of this forced outage on other parts of the system can be observed using contingency analysis [4], [15].

Furthermore, contingency analysis is the study of the outage of elements such as transmission lines, transformers and generators, and investigation of the resulting effect on line power flows and bus voltages of the remaining system. It represents an important tool to study the effect of elements outages in power system security during operation and planning [11], [18]. Contingencies referring to disturbances such as transmission element outages or generator outages may cause sudden and large changes in both the configuration and the state of the system. Contingencies may result in severe violations of the operating constraints. Consequently, planning for contingencies forms an important aspect of secure operation. Contingency analysis allows the system to be operated defensively [12], [20]. Many of the problems which occur in the power system can cause serious troubles within a short time if the operator could not take fast corrective action Therefore, modern computers are equipped with contingency analysis programs which model the power system and are used for outage events and alert the operators of potential overloads and voltage violations [2],[6],[7].

The most difficult methodological problem to cope with in contingency analysis is the accuracy of the method and the speed of the solution of the model used. Then operator usually needs to know if the present operation of the system is secured and what will happen if a particular outage occurs [1],[3],[8].Operations personnel must recognise which line or generator outages will cause power flows or voltages to go out of their limits. In order to predict the effect of outages, contingency analysis technique is used. Contingency analysis procedures model a single equipment failure, that is one line or one generator outage, or multiple equipment failure events, that is to transmission lines, a transmission line and a generator, one after another in sequence until all credible outages have been studied. For each outage tested, the contingency analysis procedure checks all power flows and voltage levels in the network against their respective limits [16], [21].

1.1 Classification of Contingencies.
Contingency analysis involves abnormal conditions in electrical network, it puts the whole system or part of the system under stress.

It occurs due to [5], [10], [14]:
- Sudden opening of a transmission line.
- Generator tripping.
- Sudden change in generation.
- Sudden change in load value

1.2 The Nigerian National Grid Systems.

The Nigerian National Grid System is made up of various buses with assigned numbers. Figure 1 shows the grid map of Nigeria while Figure 2 shows the single line diagram of the Nigerian power grid. It shows the various bus numbers and their numbers. The buses include Kainji G.S, Birnin-Kebbi, Kano, Jos, Gombe, Kaduna, Shiroro, Jebba G.S, Jebba T.S, Katampe, Osogbo, Ajaokuta, New-Haven, Aiyede, Ikeja-West, Benin, Onitsha, Alaoji, Akangba, Sapele, Egbin, Afam, Aja and Aladjja.

Figure 1: Grid Map of Nigeria

Figure 2: Single line diagram of the Nigerian Power grid
II. METHODS AND MATERIAL

i. Computation of the bus receiving-end voltage $V_R$

ii. Determination of the bus sending-end voltage $V_S$

iii. Compute $\frac{V_R}{V_S}$

iv. Compare $V_R$ and $V_S$ to ensure that $\frac{V_R}{V_S} < 0.95$ for safety operation.

v. Compute System Line Outage Index (SLOI) as

$$SLOI = 1 - \left(\frac{V_R}{V_S}\right)^k$$

where $V_R$ = Bus Receiving end voltage

$V_S$ = Bus Sending end voltage

$k$ = Number of lines whose $\frac{V_R}{V_S} < 0.95$

III. RESULT AND DISCUSSION

The variation of the receiving end voltages with the sending end voltage is illustrated in Figure 3. From Osogbo to Ikeja-West, the sending and receiving-end voltages were 1.12V and 1.04272V respectively indicating that the sending end voltage was greater than the receiving end voltage thus making the ratio of the receiving end voltage to the sending end voltage to be 0.931. Thus at this instance, Osogbo to Ikeja-West line recorded the least value of the sending end voltages. These two buses appeared to be the least critical line.

From Osogbo to Ikeja-West line, the receiving and sending end voltages were 1.81192V and 2.84V respectively because, the outage of the line between these two buses appeared to be the most critical lines. Figure 4 illustrates how the receiving end voltages varied with the System Line Outage Index. Observations showed that the receiving end voltages varied linearly as the System Line Outage Index Thus as the receiving end voltage increased, the System Line Outage Index also increased.

From Osogbo to Ikeja West line, the System Line Outage Index was 0.069 at a receiving end voltage of 1.04272 which appeared to be the least in the range and at a receiving end voltage of 1.08088, the System Line Outage Index was 0.16094. The highest SLOI value of 0.99998 was recorded from Osogbo to Ikeja West at a corresponding receiving end voltage of 1.81192V.

The relationship between the sending end voltage and the SLOI is illustrated in Figure 5. The sending end voltage increased as the SLOI increased. From Osogbo to Ikeja West line, the sending end voltage of 1.12V gave a SLOI value of 0.069 while at a SLOI value of 0.16094, the sending voltage was 1.18V. This trend continued throughout the study period until a sending end voltage of 2.84V obtained at an SLOI value of 0.99998 from Osogbo to Ikeja West line. This appeared to be the highest sending end voltage and SLOI in this range.

Figure 6 shows the variation of voltage ratio with SLOI. The voltage ratio decreased because of the inverse relationship between the quantities. Thus, at a voltage ratio of 0.931, the SLOI was 0.069 from Osogbo to Ikeja West line. The voltage ratio and the SLOI value at this instance appeared to be the highest and least values respectively in this range. When the voltage ratio was 0.894, the SLOI value was 0.36122 from Ikeja West to Afam line. A least voltage ratio of 0.638 was obtained from Osogbo to Ikeja West line with a corresponding SLOI value of 0.99998. At this instance, the SLOI value appeared to be the highest value so far in this range because, a reduction in the voltage ratio called for a boost in the value of the SLOI from Osogbo to Ikeja West line.

Figure 7 shows the variation of the receiving end voltage with the voltage ratio. As more voltages were received at one end, the voltage ratio decreased proportionately because the voltage ratio is a function of the receiving end voltage.

When the receiving end voltage was 1.04272V, the voltage ratio was 0.931 and at a voltage ratio of 0.695, the receiving end voltage was 1.43865V because the two quantities- receiving end voltage and the voltage ratio were inversely related. The least receiving end voltage from Osogbo to Ikeja West line was 1.04272V which gave a corresponding highest voltage ratio of 0.931.

The highest receiving end voltage of 1.81192V gave a corresponding least voltage ratio of 0.638 because of the inverse relationship existing between the two quantities- receiving end voltage and voltage ratio. The relationship between the sending end voltages with the voltage ratio is shown in Figure 8. The voltage ratio decreased progressively as more voltages were sent at one end. At a voltage of 0.931V from Osogbo to Ikeja West, the sending end voltage was 12V. From Ikeja West to Egbin line, a voltage ratio of 0.894 required a voltage of about 1.29V at the sending end because of the inverse relationship existing between the two quantities. From Osogbo to Ikeja West line, the least value of sending end voltage of 1.12V gave the highest voltage ratio of 0.931. From Benin to Sapele line a voltage ratio of 0.708 gave
a corresponding sending end voltage of 1.99V. The highest sending end voltage of 2.84V gave rise to a corresponding voltage ratio of 0.638 which appeared to be the least voltage ratio from Osogbo to Aiyede line because of the inverse relationship existing between these two quantities.

Figure 3: Variation of Receiving End Voltage with Sending Voltage

Figure 4: Variation of Receiving End Voltage with SLOI
Figure 5: Variation of Sending End Voltage with SLOI

Figure 6: Variation of Voltage Ratio with SLOI
**Figure 7:** Variation of Receiving End Voltage with Voltage ratio

**Figure 8:** Variation of Sending Voltage with Voltage ratio
IV. CONCLUSION

A System Line Overload Index (SLOI) for contingency assessment of Nigeria’s 330kV transmission system has been presented.

The outage of Osogbo to Aiyede line had the most critical effect on the system because, on this line, a peak SLOI value of 0.999998 was obtained with sending and receiving end voltages of 1.84V and 1.81192V respectively. The outage of Osogbo to Ikeja West line had the least SLOI value of 0.069, hence the least critical effect on the system. This SLOI value gave a corresponding receiving and sending end voltages of 1.04272V and 1.12V respectively.

The lines active power capability contingency event can be improved using Flexible AC Transmission (FACT) devices because of their fast switching ability.

Osogbo to Aiyede should be connected with additional lines through different routes to create more links for power to be transmitted to Lagos area so as to reduce the SLOI value of Osogbo to Aiyede line.

V. REFERENCES


A Quantitative Evaluation of Security Indices for Nigerian National Grid System

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ABSTRACT

Security of a power system is the degree of risk and ability to survive imminent disturbances (contingencies) without interruption of continuous service. Security indices are parametric variables used to represent the degree of operation or malfunction of power system before the system faces interruption of service or the element faces outage or malfunction. A concept opposite to security is vulnerability concept. An element or a system is vulnerable if contingencies lead to an interruption of service at a point or the entire element or system. Vulnerability index (VI) and Margin index (MI) are quantitative security indices that provide comprehensive information about the individual parts and the whole system.

This paper presents a quantitative evaluation of security indices for the Nigerian national grid Mathematical models were formulated for the two prominent security indices. Twenty four generators, Twenty four buses and Twenty four branches were selected as case studies on the Nigerian national grid system while their impacts on the vulnerability and margin indices were stressed. The vulnerability indices increased as more generators were added while the margin indices also decreased proportionately as the number of generators increase. The average value for the vulnerability index was 0.0275 per generator while the average margin index was 0.8073 per generator. The vulnerability indices increased as more buses were added into the system while the margin index between 6 and 7 buses remained constant at 1.0 suggesting that the buses appeared to be at optimum even though, as the number of buses increased, the margin indices decreased. The average vulnerability and margin indices for the buses were 9.921 per bus and 14.0495 per bus respectively. The vulnerability indices for the branches increased with increase in branches while the margin indices decreased as more branches were included in the system. The average vulnerability and margin indices for the branches were 0.1906 and 0.4640 per branch respectively.

The results from this work will assist power system engineers and utility staff in safe-guarding various contingencies emanating from violation of the power system operational limits.

Keywords: Security, Vulnerability Index, Margin Index, Static Security, Dynamic Security, Transient Stability, Contingency.

I. INTRODUCTION

To The security of a power system is its ability to withstand a set of severe but credible contingencies and to survive transition to an acceptable new steady-state condition [2]. It refers to the technical performance and quality of service when a disturbance causes a change in system conditions. This is assessed by detection of operating limit violations and contingency analysis. Security assessment is the process of determining whether a probable contingency will cause the system to enter the emergency state or not [5], [6].
Security assessment can be categorised into static security assessment and dynamic security assessment.

1.1 Static Security Assessment

A static security assessment is usually based on a load flow analysis and deals with steady-state limit violation. Load flow studies are used to ensure that electrical power transfer from generators to consumers through the grid system is stable, reliable and economical. Conventional techniques for solving the load flow problems include iterative, the Newton-Raphson or the Gauss-Siedel methods [7], [11].

The process of obtaining this steady-state condition is known as security monitoring, while the process of obtaining limit violation depicts static security assessment. In addition to steady-state operation of a power system, the power system must be able to survive dynamic events [8],[9].

1.2 Dynamic Security Assessment

Dynamic security assessment is an evaluation of the ability of a certain power system to withstand a defined set of contingencies and to survive the transition to an acceptable steady-state condition [3]. This is dependent on the transient stability evaluation which provides information in relation to the ability of a power system to retain stable operation during major disturbances resulting from either the loss of generation or transmission facilities, sudden or sustained load changes, or monetary faults. In the event of disturbances, the electro-mechanical oscillation of synchronous generator will be used to measure the transient stability. It is determined by observing the variation of the rotor angle as a function of time throughout the duration of the fault [4], [10]. The transient stability depends on the magnitude of the fault, duration of the fault and the speed of the protective device [11]. If the system is transiently stable, the oscillations of the rotor angle will damp down to a safe operating limit. Dynamic security assessment identifies those disturbances that cause instability and the results of the transient stability analysis are used to determine the system’s security level [1].

Dynamic security assessment is more computationally intensive as it requires the electro-mechanical transient stability analysis of the system which concerns the transient behaviour of the power system when moving from the pre to the post-contingency operating point [1].

**Figure i:** State Transition Diagram of a Power system

The operating states of power system are defined as follows:

i. The normal state implies that all system variables are within the normal range and no equipment is overloaded, while all customer demands are met.

ii. In the alert state, the system variables are still within limits and constraints satisfied. However, the system has been weakened to a level where a contingency may cause an overloading of equipment.

iii. If a sufficiently severe disturbance occurs when the system is in alert state, the system on occasion enters the emergency state.

iv. If the control measure initiated at the emergency state should fail, the system will go into the disintegrating sections and all constraints are violated and the system no longer remains intact.

v. The system enters the restorative state if there were any remaining equipment operating within their total capacity or some equipment had been restarted following the total collapse. It is known that an underlying pattern exists to the event that could cause transition from the alert state to the other state. The initiating event could be a disturbance of natural origin, a malfunction of equipment, or a consequence of human factors.
The security condition of the system operation is very essential. They can take some control actions when the system security is being or has been threatened [6], [11]. Vulnerability can be taken as a measure opposite to security. The system is vulnerable if contingencies lead to an interruption of service to a point or the entire system. The element is vulnerable if contingencies or changing conditions lead to violation of the element limit, outage or malfunction of the element [7].

Some indices can be used to represent the degree of vulnerability and security before the power system faces interruption of service or the element faces outage, or malfunction. Vulnerability index (VI) and margin index (MI) represent comprehensive and quantitative vulnerability and security information of the individual part and whole system [4], [7], [11].

### 1.3. Line Loadability

This refers to transmission –line voltage decrease when heavily loaded and increase when lightly loaded. When voltages on Extra High Voltage lines are maintained within xxx5% of rated voltage, corresponding to about 10% voltage regulation, unusual operating problems are not encountered. Ten percent voltage regulation for lower voltage lines including transformer voltage drops is also considered good operating practice. In addition to voltage regulation, line loadability is an important issue. The three major line loading limits include: the thermal limit, the voltage-drop limit and the steady-state stability limit. The thermal limit is determined by the maximum temperature of a conductor. The loadability of short transmission lines is usually determined by the voltage-drop limit.

### II. METHODS AND MATERIAL

#### Model Development

Consider a power system with ‘m’ generators, ‘n’ buses and ‘p’ branches.

The Vulnerability Index (VI) and Margin Index (MI) are defined as:

(a) For Generators:

Vulnerability index and margin index are expressed as

\[ VI_{Pgi} = \frac{W_{Pgi}}{2N} \left( \frac{P_{gi}}{P_{gimax}} \right)^{2N} \]  (1)

\[ VI_{Qgi} = \frac{W_{Qgi}}{2N} \left( \frac{Q_{gi}}{Q_{gimax}} \right)^{2N} \]  (2)

\[ VI_{\text{gen,loss i}} = W_{\text{gen,loss i}} k_{\text{gen,loss i}} \]  (3)

\[ VI_{\text{gen}} = \sum_{i=1}^{m} (VI_{Pgi} + VI_{Qgi} + VI_{\text{gen,loss i}}) \]  (4)

\[ MI_{Pgi} = I - \frac{P_{gi}}{P_{gimax}} \]  (5)

\[ MI_{Qgi} = I - \frac{Q_{gi}}{Q_{gimax}} \]  (6)

(b) For buses: vulnerability index and margin index are expressed as

\[ VI_{vi} = \frac{W_{vi}}{2N} \left( \frac{V_{i} - V_{i}^{\text{sche}}}{\Delta V_{lim}} \right)^{2N} \]  (7)

\[ VI_{\text{loadabi}} = \frac{W_{\text{loadabi}}}{2N} (VI_{\text{loadabi}})^{2N} \]  (8)

\[ VI_{\text{load-loss}} = W_{\text{load-lossi}} k_{\text{load-lossi}} \]  (9)

\[ VI_{\text{bus}} = \sum_{i=1}^{m} (VI_{vi} + VI_{\text{loadabi}} + VI_{\text{load-loss}}) \]  (10)

\[ MI_{V,i} = I - \frac{V_{i} - V_{i}^{\text{sche}}}{\Delta V_{lim}} \]  (11)

\[ MI_{\text{loadabi}} = I - r_{\text{loadabi}} \]  (12)

(c) For branches, vulnerability index and margin index are expressed as

\[ VI_{Pf} = \frac{W_{Pf}}{2N} \left( \frac{P_{f}}{S_{imax}} \right)^{2N} \]  (13)
\[ V_{I_{Q_i}} = \frac{W_{Q_i}}{2N} \left( \frac{Q_{i}/S_{\text{max}}}{S_{\Sigma}} \right)^{2N} \]  
(14)

\[ V_{I_{Q_i}} = \frac{W_{Q_i}}{2N} \left( \frac{Q_{i}/S_{\Sigma}}{S_{\Sigma}} \right)^{2N} \]  
(15)

\[ V_{\text{line},\text{angle}} = \frac{W_{\text{line},\text{angle}}}{2N} \left( \frac{I_{ab}/I_{\text{alim}}}{I_{\text{alim}}} \right)^{2N} \]  
(16)

\[ V_{\text{Relay},i} = \frac{W_{\text{Relay},i}}{2N} \left( \frac{1/d_{\text{str},i}}{1/d_{\text{str}}} \right)^{2N} + \left( \frac{1/d_{\text{rai}}}{} \right) \]  
(17)

\[ V_{\text{line},\text{line},i} = \frac{W_{\text{line},\text{loss},i}}{2N} \text{line},\text{loss},r \]  
(18)

\[ V_{\text{line}} = \sum_{i=1}^{p} \left( V_{\text{P}_i} + V_{I_{Q_i}} + V_{\text{line},\text{angle}} + V_{\text{Relay},i} + V_{\text{line},\text{line},i} \right) \]  
(19)

\[ M_{I_{Q_i}} = 1 - \frac{S_{Q_i}}{S_{\text{max}}} \]  
(20)

\[ M_{\text{line},\text{angle}} = 1 - \frac{I_{\text{line},\text{angle}}}{I_{\text{alim}}} \]  
(21)

\[ M_{\text{Relay},\text{str},i} = d_{\text{str}} - K_{\text{str}} \sin \left( \frac{\pi}{2} - \alpha_i + \theta_{\text{str}} \right) \]  
(22)

\[ M_{\text{Relay},\text{rs},i} = d_{\text{rai}} - K_{\text{str}} \sin \left( \frac{\pi}{2} - \alpha_i + \theta_{\text{str}} \right) \]  
(23)

where:

- \( V_{I_{xx}} \) = vulnerability index for different parameters,
- \( xx = P_{g}, Q_{g}, \text{gen-loss etc.} \)
- \( W_{xx} \) = margin index for different parameters,
- \( K_{\text{loss},i} = 0 = \text{no loss,} \)
- \( 0 - 1 = \text{complete loss,} \)
- \( 0 - 1 = \text{loss ratio,} \)
- \( x = \text{gen, load, line,} \)
- \( N = 1 \) in general,
- \( r_{\text{load ab}} i = \text{bus i loadability,} \)

\[ r_{\text{load ab} i} = \frac{Z_{\text{th},i}}{Z_{\text{Li}}} \]

\[ Z_{\text{th}} = \text{thevenin equivalent system impedance seen from bus i,} \]

\[ Z_{\text{Li}} = \text{equivalent load impedance at bus i at steady state,} \]

\[ P_{g}, Q_{g}, S_{g} = \text{real, reactive and apparent power of line i,} \]

\[ Q_{\Sigma} = \text{line charging,} \]

\[ Q_{\Sigma} = \text{the total reactive power input of all generators or total reactive power supply of the whole system.} \]

\[ M_{\text{Relay},i} = \text{distance from the apparent impedance seen by the transmission line.} \]

**III. RESULT AND DISCUSSION**

**A. Effect of Generators on Vulnerability Index and Margin Index.**

The initial real power increased as the number of generator increased. For 3 generators, the initial real power was 0.81 kW. The initial real power for 1 generator was 0.75 kW while that of 50 generators was 5.10 kW indicating that the more the number of generators, the more the initial real power in the system as illustrated in Figure 1. This is due to the fact that the initial real power and the number of generators are linearly related. Figure 2 illustrates the variation of final real power with the number of generators. The final real power was constant for different number of generators because the generators appeared to have attained their peak values/operational limits at this instance. The final real power was 12.30 kW for 5 generators and also 12.38 kW for 50 generators.

The variation of real power ratios with the number of generators is also illustrated in Figure 3. The ratio of initial real power to the final real power with the number of generators decreased as more generators were added to the system because the generators varied linearly as the initial real power. Thus, for 7 generators, the ratio of the initial real power to the final real power was 0.0840 kW and for 40 generators, the ratio was 0.2771 kW. Figure 4 shows the variation of the vulnerability index with the number of generator. The vulnerability index increased as more generators were added to the system because the index depends majorly on the initial real power. Thus, when there were 6 generators, the
vulnerability index was 0.0038 and for 30 generators, the index was 0.0247.

The Margin index varied with the number of generators as shown in Figure 5. The margin index decreased as more generators were added, even though, at constant final real power, the initial real power increased as more generators were added into the system. Thus, for 24 generators, margin index was 0.8253 and for 38 generators, the index was 0.7488. Figure 6 expresses how the vulnerability indices and margin indices varied with the number of generators. The vulnerability index increased as more generators were added. The margin index also increased as more generators were added into the system mainly because as more generators were added, the initial real power increased proportionately. Thus for 18 generators, the vulnerability and margin indices were 0.0117 and 0.8603 respectively.

The vulnerability indices varied with the margin indices as shown in Figure 7. As the number of generators increased, the vulnerability index increased. The margin index decreased appropriately because the initial real power decreases proportionately as more generators were added even though, the final real powers remained constant throughout at 12.38 W.

### B. Effect of Buses on Vulnerability Indices and Margin Indices.

Figure 8 shows the relationship between the bus loadability and the bus number. The more the number of buses, the more loaded the buses are. In this case, the bus loadability increased as the number of buses increased. This is because the loading of the buses depends on the number of buses in the system. For 10 buses, the bus loadability was 7.6 while for 30 buses, the bus loadability was 0.71. The initial bus varied with the buses as illustrated in Figure 9. The bus voltage at the output increased as the number of buses increased. Thus, for 2 buses, the initial bus voltage was 1.6 V and for 12 buses, the initial bus voltage was 4.7 V. The bus voltage at start increased as more buses were added to the system.

The relationship between the initial bus voltage and the bus number is shown in Figure 10. The initial bus voltage increased as the number of buses increased. Thus, at a final bus voltage of 10.1 V, there were 14 buses and at 23 buses, the final bus voltage increased proportionately to 17.1 V. This trend is followed throughout the study period. Figure 11 illustrates the variation of the absolute value of change in bus voltage with the buses. The change in bus voltage increased as more buses were added to the system. Thus when the absolute value of change in bus voltage was 0.6 V, there were 4 buses and at 12 bus, the change in bus voltage had increased to 3.1 V.

The correlation between the vulnerability index and buses is shown in Figure 12. The vulnerability index increased as more buses were added into the system because the vulnerability index varied inversely as the number of buses. For 10 buses, the vulnerability index was 23.10 while for 18 buses, the vulnerability index was 7.40. Figure 13 shows how the absolute value of change in bus voltage varied with the buses, the absolute value of the change in bus voltage increased as more buses were added and vice versa because the initial and final bus voltages increased as more buses were introduced into the system. The variation of vulnerability index with margin index is shown in Figure 14. At 6 buses, the vulnerability and margin indices are 33.86 and 1.0 respectively. Between 6 and 7 buses, the margin indices are 1.0 and 1.0 respectively suggesting that the buses appeared to be at optimum here even though, as the number of buses increased, the margin indices decreased as well with corresponding increase in the vulnerability indices.

### C. Effect of Branches on Vulnerability Indices and Margin Indices.

Figure 15 shows the relationship between the final reactive power and the branches. Observation shows that the final reactive power increased as more branches were introduced into the system because more branches indicated the need to have more final real power into the system. Thus, with 10 branches, the final reactive power was 1.29 kVAR and for 20 branches, the final reactive power increased to 1.81 kVAR. The least and highest final reactive powers were 0.8 kVAR and 3.61 kVAR respectively corresponding to 1 and 50 branches respectively. The maximum reactive power varied with the branches as illustrated in Figure 16. The final reactive power increased as more branches were present in the
system and vice-versa. The least final reactive power for the branches was 0.8 kVAR and the highest final reactive power for 50 buses was 3.80kVAR.

Figure 17 shows how the reactive power ratio varied with the branches. The ratio of the reactive powers increased due to the fact that both the initial and final reactive powers increased as more branches were introduced into the system. Thus, the least reactive power ratio of 0.6950 corresponds to ‘1’ branch and the highest real power ratio of 0.4311 corresponds to ‘24’ branches. The variations of the reactive power (both initial and final) with the branches are illustrated in Figure 18. Both the initial and final powers varied linearly with the branches because the initial and reactive powers increased as more branches were introduced into the system.

Figure 19 shows the variation of vulnerability index with the branches. This index increased as more branches were introduced. This is because more real power were required in the system. For 10 branches, the vulnerability index was 0.1624 while this index increased to 0.2221 for 24 branches. The least and highest vulnerability indices for 1 and 24 branches are 0.1211 and 0.2221 respectively confirming the assertion that the vulnerability index increased as the number of branches increased and vice-versa. The variation of the margin index with the branches is illustrated in Figure 20. The margin indices for 5, 10, 15 and 20 branches are 0.5906, 0.5838, 0.5701 and 0.5110 respectively indicating reduction in margin indices as the number of branches increased.

Figure 21 illustrates the variation of the vulnerability index with the margin index. The vulnerability indices increased with the increase in the number of branches while the margin indices decrease proportionately as the numbers of branches reduce. Thus, as the vulnerability indices increased, the margin indices decreased proportionately as the number of branches increased.
Figure 3: Ratio of Initial Real Power to Final Real Power versus Number of Generator.

Figure 4: Variation of Vulnerability Index with Generator

Figure 5: Variation of Margin Index with Generator

Figure 6: Variation of Vulnerability index and Margin Index versus Generator.
Figure 7: Variation of Vulnerability Index with Margin Index.

Figure 8: Variation of Bus Loadability with Bus number.

Figure 9: Variation of Initial Bus Voltage with Buses.

Figure 10: Variation of Final Bus Voltage with Buses.

Figure 11: Change in Bus Voltage versus Buses.

Figure 12: Variation of Vulnerability Index with Buses.
Figure 13: Variation of Margin Index with Buses.

Figure 14: Variation of Vulnerability Index with Margin Index.

Figure 15: Final Reactive Power versus Branches

Figure 16: Maximum Reactive Power versus Branches

Figure 17: Ratios of Reactive Powers versus Branches

Figure 18: Variation of Final Reactive Power and Maximum Reactive Power with branches
IV. CONCLUSION

A quantitative assessment of security indices for the Nigerian national grid system has been presented. Twenty four generators, twenty four buses and twenty four branches were selected on the Nigerian national grid system as case studies while their impacts on the vulnerability and margin indices were stressed. The vulnerability indices increased as more generators were added while the margin indices also decreased proportionately as the number of generators increased. The average value for the vulnerability index was 0.0275 per generator while the average margin index was 0.8073 per generator. The vulnerability indices increased as more buses were added into the system while the margin index between 6 and 7 buses remained constant at 1.0 suggesting that the buses appeared to be at optimum even though, as the number of buses increased, the margin indices decreased. The average vulnerability and margin indices for the buses were 9.921 per bus and 14.0495 per bus respectively. The vulnerability for the branches increased with increase in branches while the margin indices decreased as more branches were included in the system. The average vulnerability and margin indices for the branches were 0.1906 and 0.4640 per branch respectively.

V. REFERENCES


Risk Level of Viet Nam Human Resource and Medical Equipment Industry Under Financial Leverage During and After The Global Crisis 2007-2009

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ABSTRACT

During the financial crisis 2007-2009 with certain impacts on the Viet Nam economy and especially, the stock exchange, there is un-diversifiable risk that influences the whole computer and electrical industries. Hence, the risk re-estimation for the listed firms in these industries becomes necessary.

First of all, by using quantitative and analytical methods to estimate asset and equity beta of four (4) groups of listed companies in Viet Nam electrical, software, hardware and telecommunication industries with a proper traditional estimating model, we found out that the beta values, in general, for most companies are acceptable, excluding just a few cases. There are 88% of listed firms with lower risk, among total 64 firms, whose beta values lower than (<) 1. Secondly, through comparison of beta values among three (3) above industries, we recognized there are still 13% of total listed firms in the above group companies with beta values higher than (>) 1 and have stock returns moving more than the market benchmark.

Ultimately, this paper generates some results that could provides both internal and external investors, financial institutions, companies and government more evidence in establishing their policies in investments and in governance.

Keywords: Equity Beta, Financial Structure, Financial Crisis, Risk, Asset Beta, Computer Industry

I. INTRODUCTION

Market risk is a fundamental financial terminology that could be estimated by using various research methods. In this research sample, we perform a market risk analysis based on asset and equity beta of 64 listed companies in the category of electrical, software, hardware and telecommunication firms. This paper, hence, emphasizes on analyzing un-diversifiable risk in the above industry in one of emerging economies, and esp.: Vietnam stock market during the financial crisis 2007-2009. After the previous published research article on estimated beta for listed construction company groups, we will compare the estimated beta results of listed Viet Nam electrical companies to those in its supply chain activities such as computer and telecommunication companies to make a comparative analysis and risk re-evaluation after global crisis. No research, so far, has been done on the same topic.

The organization of this document is as follows. In Section 2 (Methods and Material), I’ll give detail of research issues, literature review, conceptual theories and methodology. In Section 3 (Result and Discussion),
II. METHODS AND MATERIAL

Research Issues
We mention a couple of issues on the estimating of beta for listed computer and electrical companies in Viet Nam stock exchange as following:

Hypothesis/Issue 1: Among the four (4) companies groups, under the financial crisis impact and high inflation, the beta or risk level of listed companies in electrical and electronic industries will relatively higher than those in the rest three (3) industries.

Hypothesis/Issue 2: Because Viet Nam is an emerging and immature financial/technological market and the stock market still in the recovering stage, there will be a large disperse distribution in beta values estimated in the computer and electrical industries.

Hypothesis/Issue 3: With the above reasons, the mean of equity and asset beta values of these listed computer and electrical companies tend to impose a high risk level, i.e., beta should higher than (>1).

Literature Review
Beta, a financial and risk measure, is used widely in the financial world even though there are a lot of arguments. As Sharpe, Lintner (1964), and Black. (1972) with CAPM model identified the expected stock return is linearly proportional to its market beta. Fama, Eugene F., and French. Kenneth R., (2004) also indicated in the three factor model that “value” and “size” are significant components which can affect stock returns. They also mentioned that a stock’s return not only depends on a market beta, but also on market capitalization beta. The market beta is used in the three factor model, developed by Fama and French, which is the successor to the CAPM model by Sharpe, Treynor and Lintner. As Luis E. Peirero (2010) pointed, the task of estimating cost of equity in emerging markets is more difficult because of problems such as collecting data in short periods. Marcin, Mariusz, Marek, and Karol (2012) mentioned that the reliability and fitness of calculated betas are relevant to the valuation and investment of investors in emerging markets. And Xiaowei Kang (2012) found that combining weighted or alternative beta strategies can gain significant traction in investment community and reduce risk.

Conceptual theories
Determinants of Equity and Asset Beta
Risk-taking or risk-adverse is different risk attitude of various investors on the stock exchange. Based on their risk preference or acceptance, investors including individuals or groups, can create an investment portfolio that could use market risk or beta as one of determinant components.

The European Central Bank (2010) mentioned it, beta or systematic risk, as a risk of financial instability with so widespread.

Several factors affecting beta include, but not limit to, the volatility of expected return of a single stock, or the volatility of the expected return of the entire stock market index, or general factors such as interest rates or consumer price index (CPI). In fact, similar to inflation, to some extent, beta implies volatility of price of a kind of financial asset, or security price.

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In theory, market risk cannot be eliminated through diversification. However, to some extent, our researches on various groups of industries of listed companies in the Viet Nam stock exchange could generate the viewpoint that different industries have different impacts from the crisis on the business and hence, beta measure, which include equity and asset beta.

Methodology
The period 2007-2009 is the time with impacts from financial crisis. Therefore, we use the data from the stock exchange market in Viet Nam (HOSE and HNX) during the 2 years period to estimate systemic risk results.

First, we use the market stock price of 64 listed companies in the electrical, software, hardware and telecommunication industries in Viet Nam stock exchange market to calculate the variability in monthly stock price in the same period; second, we estimate the equity beta for these 4 listed groups of companies and make a comparison. Third, from the equity beta values of these listed companies, we perform a comparative analysis between equity and asset beta values of these 4 companies groups in Viet Nam. Finally, we use the
results to suggest policy for both these enterprises, financial services institutions and relevant organizations. The below table gives us the number of computer and electrical firms used in the research of estimating beta:

<table>
<thead>
<tr>
<th>Market</th>
<th>Listed Electrical and Electronic equipment companies (1)</th>
<th>Listed Software companies (2)</th>
<th>Listed Communication companies (4)</th>
<th>Note (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viet Nam</td>
<td>7</td>
<td>3</td>
<td>7</td>
<td>Estimating by traditional method</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>3</td>
<td>15</td>
<td>Estimating by comparative method</td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
<td>6</td>
<td>22</td>
<td>Total firms in groups: 64</td>
</tr>
</tbody>
</table>

(Note: The above data is at the December 12th, 2009, from Viet Nam stock exchange)

III. RESULTS AND DISCUSSION

General Data Analysis

The research sample uses data of 64 firms in 4 categories of industries: electrical, software, hardware and telecommunication companies groups, and the mean of equity beta is valued at 0.572 while that of asset beta is about 0.339. These data are acceptable values during the crisis. Moreover, the sample variance of asset beta is quite low (0.059) which is a good number, while that of equity beta is a little bit higher (0.10). This shows us that the systemic risk for the whole industry has declined due to the effectiveness of using financial leverage.

In addition to, the max and min values of beta are still somewhat fine. Max equity beta value is up to 1.180, compared to max asset beta value is just 1.022 that is acceptable. Looking at the table 2 (below), we can see there is 13%, or 8 listed firms still have beta values larger than (>) 1, whereas there is 88% or 56 firms whose beta values lower than (<) 1 and higher than (>) 0. Value of equity beta varies in a range from 1.180 (max) to 0.084 (min) and that of asset beta varies in a range from 1.022 (max) to 0.007 (min). Only a few companies still has larger risk exposure than most of the others. There are no listed companies whose betas are lower than (<) 0.

Next, Asset beta max value is 1.022 and min value is 0.007 which show us that if beta of debt is assumed to be zero (0), the company’s financial leverage contributes to a decrease in the market risk level. Only 2% of total firms has asset beta value > 1 whereas 98% of total firms has beta < 1.

Lastly, we can see the relatively small difference between max equity and max asset beta values, which is about 0.1573, whereas there is a smaller difference between equity and asset beta variance values which is just 0.0427; so, there is certain impact on systemic risk of certain firms in term of using leverage while it indicates for most of firms that financial leverage can enable them to reduce market risk. And there is not quite big effect from financial leverage on the gap between company’s beta variance values.

Table 1 – Estimating beta results for Four (4) Viet Nam Listed Computer and Electrical Companies Groups (as of Dec 2009) (source: Viet Nam stock exchange data)

<table>
<thead>
<tr>
<th>Statistic results</th>
<th>Equity beta</th>
<th>Asset beta (assume debt beta = 0)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX</td>
<td>1.180</td>
<td>1.022</td>
<td>0.1573</td>
</tr>
<tr>
<td>MIN</td>
<td>0.084</td>
<td>0.007</td>
<td>0.0765</td>
</tr>
<tr>
<td>MEAN</td>
<td>0.572</td>
<td>0.339</td>
<td>0.2331</td>
</tr>
<tr>
<td>VAR</td>
<td>0.1017</td>
<td>0.0590</td>
<td>0.0427</td>
</tr>
</tbody>
</table>

Note: Sample size : 64

Table 2 – The number of companies in research sample with different beta values and financial leverage

<table>
<thead>
<tr>
<th>Equity Beta</th>
<th>No. of firms</th>
<th>Financial leverage (average)</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0</td>
<td>0</td>
<td>0.00%</td>
<td>0%</td>
</tr>
<tr>
<td>0&lt;beta&lt;1</td>
<td>56</td>
<td>45.12%</td>
<td>88%</td>
</tr>
<tr>
<td>Beta &gt; 1</td>
<td>8</td>
<td>44.16%</td>
<td>13%</td>
</tr>
<tr>
<td>total</td>
<td>64</td>
<td>44.4%</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Asset Beta</th>
<th>No. of firms</th>
<th>Financial leverage (average)</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0</td>
<td>0</td>
<td>0.00%</td>
<td>0%</td>
</tr>
<tr>
<td>0&lt;beta&lt;1</td>
<td>63</td>
<td>44.99%</td>
<td>98%</td>
</tr>
<tr>
<td>Beta &gt; 1</td>
<td>1</td>
<td>6.14%</td>
<td>2%</td>
</tr>
</tbody>
</table>
Empirical Research Findings and Discussion

A- Electrical and Electronic listed companies group
Despite of difficulties during the crisis 2007-2009, the market for these companies is still potential. The market for these firms has been affected because selling prices increase.

The table 3 below shows us the research of 18 listed firms in this category during the above period. In general, the mean of equity beta and asset beta are 0.473 and 0.254, accordingly. These values are good numbers in term of showing a low un-diversifiable risk. The market demand for electronic/electrical products is still high.

Next, the variance of equity and asset beta of the sample group equals to 0.09 and 0.05 accordingly which are lower than the variance of the entire sample equity and asset beta of 0.10 and 0.059. The effect from financial leverage makes these beta values fluctuate a little bit less than the sample beta mean.

We might note that equity and asset beta mean values of 18 firms in this material category are the lowest among those of firms in the rest three groups. This might be considered as one characteristic of these industries. Among four industries, the systemic risk of material group companies is a bit lower than those of the rest groups.

Besides, the estimated equity beta mean is 0.473 and sample variance is 0.09, which is not supporting our 2nd research hypothesis or issue that there would be a large disperse distribution in beta values estimated in this industry as well as our 3rd research hypothesis or issue that the mean of equity and asset beta values of these listed companies tend to impose a high risk level or beta should higher than (> ) 1.

Table 3 – Estimating beta results for Viet Nam Listed Electrical and Electronic Equipment Companies (as of Dec 2009) (source: Viet Nam stock exchange data)

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Company stock code</th>
<th>Equity beta</th>
<th>Asset beta (assume debt beta = 0)</th>
<th>Note</th>
<th>Financial leverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TSB</td>
<td>0.18</td>
<td>0.050</td>
<td>CJC as</td>
<td>76.9%</td>
</tr>
</tbody>
</table>

Table 4 – Statistical results for Vietnam listed Electrical and Electronic Equipment companies

<table>
<thead>
<tr>
<th>Statistic results</th>
<th>Equity beta</th>
<th>Asset beta (assume debt beta = 0)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX</td>
<td>1.067</td>
<td>0.843</td>
<td>0.224</td>
</tr>
<tr>
<td>MIN</td>
<td>0.084</td>
<td>0.007</td>
<td>0.076</td>
</tr>
<tr>
<td>MEAN</td>
<td>0.473</td>
<td>0.254</td>
<td>0.219</td>
</tr>
<tr>
<td>VAR</td>
<td>0.0919</td>
<td>0.0536</td>
<td>0.038</td>
</tr>
</tbody>
</table>
In an emerging developing economy such as Viet Nam, the market for software firms is definitely established and potential because of the public need for computer and products although it may be affected by impacts from the financial crisis and demand from hardware industry. However, the number of listed firms is still limited.

The Table 5 below shows us the equity and asset beta mean of 6 listed software companies, with values of 0.596 and 0.369, accordingly. This result, which means the risk is low and acceptable although the equity/asset beta values are higher than those of the electrical/hardware firms.

Besides, the variance of beta values among these 6 listed firms is normal, from 0.1889 to 0.1004 for equity and asset beta, accordingly.

Please refer to Exhibit 2 for more information.

Table 5 – Statistical results for Vietnam listed Software companies

<table>
<thead>
<tr>
<th>Statistic results</th>
<th>Equity beta</th>
<th>Asset beta (assume debt beta = 0)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX</td>
<td>1.156</td>
<td>0.886</td>
<td>0.269</td>
</tr>
<tr>
<td>MIN</td>
<td>0.115</td>
<td>0.081</td>
<td>0.034</td>
</tr>
<tr>
<td>MEAN</td>
<td>0.596</td>
<td>0.369</td>
<td>0.228</td>
</tr>
<tr>
<td>VAR</td>
<td>0.1889</td>
<td>0.1004</td>
<td>0.088</td>
</tr>
</tbody>
</table>

Note: Sample size : 6

C- Hardware listed companies group

Among 4 groups, this is the group with the largest number of listed firms (sample size = 22) and with the average equity/asset beta values of about 0.554 and 0.327. Besides, the asset and equity beta var of about 0.068 and 0.109 are average values in 4 groups. The values of market risk generally are lower than those of software and electrical industries. The using of leverage has influenced these firms’ risk, relatively, a bit less than the other groups.

Although max asset beta value is 1.022 that is higher than those of electrical, telecommunication and software industries, the equity and asset beta values are distributed in an acceptable range, from 0.098 to 1.138, and from 0.026 to 1.022, indicating the effectiveness of using financial leverage.

Please refer to Exhibit 3 for more information.

Table 6 – Statistical results for Vietnam listed Hardware companies

<table>
<thead>
<tr>
<th>Statistic results</th>
<th>Equity beta</th>
<th>Asset beta (assume debt beta = 0)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX</td>
<td>1.138</td>
<td>1.022</td>
<td>0.116</td>
</tr>
<tr>
<td>MIN</td>
<td>0.098</td>
<td>0.026</td>
<td>0.072</td>
</tr>
<tr>
<td>MEAN</td>
<td>0.554</td>
<td>0.327</td>
<td>0.227</td>
</tr>
<tr>
<td>VAR</td>
<td>0.1092</td>
<td>0.0679</td>
<td>0.041</td>
</tr>
</tbody>
</table>

Note: Sample size : 22

D- Comm. & Telecommunication listed companies group

Different from firms in the other three (3) industries, 18 listed comm./telecom firms has the highest equity and asset beta mean values, 0.687 and 0.431 accordingly. Max beta value of 1.180 and min beta value of 0.315 are the highest among 4 groups. This indicates a relatively high level of market risks among firms in this industry. However, the asset beta and equity beta var value are 0.03 and 0.07 accordingly, are the lowest in 4 groups, showing the more concentration impacts of market risk exposure during the crisis period.

Please refer to Exhibit 4 for more information.

Table 7 – Statistical results for Vietnam listed Comm. and Telecommunication companies

<table>
<thead>
<tr>
<th>Statistic results</th>
<th>Equity beta</th>
<th>Asset beta (assume debt beta = 0)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX</td>
<td>1.180</td>
<td>0.802</td>
<td>0.377</td>
</tr>
<tr>
<td>MIN</td>
<td>0.315</td>
<td>0.147</td>
<td>0.168</td>
</tr>
<tr>
<td>MEAN</td>
<td>0.687</td>
<td>0.431</td>
<td>0.256</td>
</tr>
<tr>
<td>VAR</td>
<td>0.0697</td>
<td>0.0345</td>
<td>0.035</td>
</tr>
</tbody>
</table>

Note: Sample size : 18

Comparison among 4 groups of computer and electrical companies

In the below chart, we can compare among the 4 groups, equity and asset beta values of the electrical group are the lowest (0.47 and 0.25 accordingly). Assuming debt beta is 0, financial leverage has helped many listed firms in these industries lower the un-diversifiable risk.

Additionally, we see the asset beta mean values of all 4 groups have not big difference and acceptable. Therefore,
it also rejects our 3rd hypothesis that the mean values of equity/asset beta of all 4 groups impose higher risks. Then, we recognize that during the crisis period, the telecommunication industry has the highest values of equity and asset beta (0.69 and 0.43 accordingly).

Next, we can recognize from the chart that, the risk in the electrical industries higher than those in the other 3 industries. So, it supports our 1st hypothesis.

Finally, if we compare beta values of 4 above industries to those of construction group companies, we see the asset beta mean values in the electrical and computer industries are a little bit lower (see exhibit 5).

Chart 1 – Statistical results of four (4) groups of 64 listed VN computer and electrical firms during/after the crisis period 2007-2011

<table>
<thead>
<tr>
<th>Industry</th>
<th>Equity Beta Mean</th>
<th>Asset Beta Mean</th>
<th>Equity Beta Var</th>
<th>Asset Beta Var</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical &amp; Electronic</td>
<td>0.47</td>
<td>0.25</td>
<td>0.09</td>
<td>0.05</td>
</tr>
<tr>
<td>Software</td>
<td>0.06</td>
<td>0.07</td>
<td>0.19</td>
<td>0.10</td>
</tr>
<tr>
<td>Hardware</td>
<td>0.03</td>
<td>0.07</td>
<td>0.11</td>
<td>0.07</td>
</tr>
<tr>
<td>Comm/Telecom</td>
<td>0.60</td>
<td>0.37</td>
<td>0.19</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Risk analysis
The electrical and computer industries still have the market demand established together with the economic growth in Viet Nam. During the crisis, there is negative influence from the whole decreasing demand in the local market. Additionally, the slowdown on the real estate market has also made the development of these industries slow. Besides, many small IT firms have to compete with each other to offer various IT services to their customers.

However, the computer industry, software and hardware, could create a good barrier for competitors who want to enter the industry. And also the speed and the need of using information technology in many companies, both governmental and non-governmental, become more widely. Last but not least, the market for the ERP system is still potential because just a small proportion of Vietnamese companies use it while many more firms use basic IT solutions.

IV. CONCLUSION

Electrical and electronic industry
Although beta mean values are fine, this is the industry which has the lowest equity/asset beta mean values (0.47 and 0.25). During the crisis, this industry has lower market risk and beta values of firms in the group are less fluctuated than those of software and hardware groups. After increasing rates period (see exhibit 1), financial services institutions, the government and central banks have certain proper policies to support businesses and internal investors.

Software industry
This is the industry which has middle values of equity and asset beta mean, among 3 groups. However, it has the highest values of equity and asset beta var (0.19 and 0.1) though its values are quite small. The using of financial leverage can be a reason to reduce market risk, from 0.6 (equity beta mean) to 0.37 (asset beta mean). The market risk is more dispersed.

Hardware industry
In our comparative analysis on asset beta values, this is the industry which has the middle values of market risk exposure than those of above industries when we consider values of equity/asset beta mean, or asset/equity beta var. Also the beta variance shows a small dispersion and smaller than electrical firms.

Comm. & Telecommunication listed companies group
This is the industry whose equity and asset beta var have the smallest values while equity and asset beta mean have the highest values (0.69 and 0.43). It indicates a higher market risk concentration.

In general, our empirical findings state that they are not in favor of our 2nd and 3rd hypotheses or research issues. However, the findings support our 1st hypothesis that
under the financial crisis impact and high inflation, the beta or risk level of listed companies in electrical and electronic industries will relatively higher than those in the rest three (3) industries.

In summary, though Viet Nam is an emerging market with imperfect financial system, the beta values estimated are at acceptable level with 88% firms in the research sample while just a few companies’ beta values are risky (about 13% firms).

Additionally, it indicates the higher the using of financial leverage, the lower the beta values. In reality, there are 88% of computer and electrical firms (58 among 64 firms) which has 0<equity beta<1 in this research sample and 98% with 0< asset beta < 1 (63 among 64 firms). If used effectively, using leverage can be good for risk management.

Furthermore, if we compare these data and values to those of construction and real estate firms in our previous research (see exhibit 5), we might see that in here, both the equity and asset beta mean can be a little bit lower while the impacts from the crisis happens on the overall market. So, the crisis might have less influence on the firms in this research.

Finally, this paper suggests implications for further research and policy suggestion for the Viet Nam government and relevant organizations, economists and investors from current market conditions.

V. REFERENCES

The heading of the References section must not be numbered. All reference items must be in 8 pt font. Please use Regular and Italic styles to distinguish different fields as shown in the References section. Number the reference items consecutively in square brackets (e.g. [1]).


Exhibit 1 – Interest rates, Inflation, GDP growth and macroeconomics factors (source: Viet Nam commercial banks and economic statistical bureau)

<table>
<thead>
<tr>
<th>Year</th>
<th>Basic rates</th>
<th>Lending rates</th>
<th>Deposit rates</th>
<th>Inflation</th>
<th>GDP</th>
<th>USD/VND rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>n/a</td>
<td>12% - 15%</td>
<td>9%</td>
<td>6.81%</td>
<td>5.03%</td>
<td>20.828</td>
</tr>
<tr>
<td>2011</td>
<td>9%</td>
<td>18% - 22%</td>
<td>13% - 14%</td>
<td>18%</td>
<td>5.89%</td>
<td>20.670</td>
</tr>
<tr>
<td>2010</td>
<td>8% - 9%</td>
<td>19% - 20%</td>
<td>13% - 14%</td>
<td>11.75%</td>
<td>6.5%</td>
<td>19.495</td>
</tr>
<tr>
<td>2009</td>
<td>7%</td>
<td>9% - 12%</td>
<td>9% - 10%</td>
<td>6.88%</td>
<td>5.2%</td>
<td>17.000</td>
</tr>
<tr>
<td>2008</td>
<td>8.75% - 14%</td>
<td>19% - 21%</td>
<td>15% - 16.5%</td>
<td>22%</td>
<td>6.23%</td>
<td>17.700</td>
</tr>
<tr>
<td>2007</td>
<td>8.25%</td>
<td>12% - 13%</td>
<td>9% - 11%</td>
<td>12.63%</td>
<td>8.44%</td>
<td>16.132</td>
</tr>
</tbody>
</table>
No note

Exhibit 2 – Estimating beta results for Viet Nam Listed Software Companies (as of Dec 2009) (source: Viet Nam stock exchange data)

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Company stock code</th>
<th>Equity beta</th>
<th>Asset beta (assumed debt beta = 0)</th>
<th>Financial leverage</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FPT</td>
<td>1.15</td>
<td>0.431</td>
<td>63.9%</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>CMG</td>
<td>0.44</td>
<td>0.161</td>
<td>50.0%</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>SRB</td>
<td>0.91</td>
<td>0.886</td>
<td>7.3%</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>VLA</td>
<td>0.11</td>
<td>0.102</td>
<td>3.2%</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>HIG</td>
<td>0.82</td>
<td>0.550</td>
<td>42.8%</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>SRA</td>
<td>0.12</td>
<td>0.081</td>
<td>48.0%</td>
<td></td>
</tr>
</tbody>
</table>

Exhibit 3 – Estimating beta results for Viet Nam Listed Hardware Companies (as of Dec 2009) (source: Viet Nam stock exchange data)

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Company stock code</th>
<th>Equity beta</th>
<th>Asset beta (assumed debt beta = 0)</th>
<th>Financial leverage</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CMT</td>
<td>0.44</td>
<td>0.216</td>
<td>54.1%</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>SVT</td>
<td>0.74</td>
<td>0.560</td>
<td>44.0%</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>VIE</td>
<td>0.24</td>
<td>0.046</td>
<td>84.8%</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>HPT</td>
<td>0.09</td>
<td>0.026</td>
<td>81.1%</td>
<td></td>
</tr>
</tbody>
</table>

Exhibit 4 – Estimating beta results for Viet Nam Listed Comm. and Telecommunication Companies (as of Dec 2009) (source: Viet Nam stock exchange data)

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Company stock code</th>
<th>Equity beta</th>
<th>Asset beta (assumed debt beta = 0)</th>
<th>Note</th>
<th>Financial leverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CMT</td>
<td>0.44</td>
<td>0.216</td>
<td></td>
<td>54.1%</td>
</tr>
<tr>
<td>2</td>
<td>SVT</td>
<td>0.74</td>
<td>0.560</td>
<td></td>
<td>44.0%</td>
</tr>
<tr>
<td>3</td>
<td>VIE</td>
<td>0.24</td>
<td>0.046</td>
<td></td>
<td>84.8%</td>
</tr>
<tr>
<td>4</td>
<td>HPT</td>
<td>0.09</td>
<td>0.026</td>
<td></td>
<td>81.1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>ECI</td>
<td>0.47</td>
<td>1</td>
<td>0.351</td>
<td>IHK as comparable</td>
</tr>
<tr>
<td>2</td>
<td>INN</td>
<td>0.46</td>
<td>7</td>
<td>0.250</td>
<td>ALT as comparable</td>
</tr>
<tr>
<td>3</td>
<td>PTP</td>
<td>0.42</td>
<td>5</td>
<td>0.203</td>
<td>ALT as comparable</td>
</tr>
<tr>
<td>4</td>
<td>DHI</td>
<td>0.89</td>
<td>4</td>
<td>0.660</td>
<td>TPH as comparable</td>
</tr>
<tr>
<td>5</td>
<td>IHK</td>
<td>0.59</td>
<td>3</td>
<td>0.340</td>
<td>TPH as comparable</td>
</tr>
<tr>
<td>6</td>
<td>HTP</td>
<td>1.03</td>
<td>5</td>
<td>0.802</td>
<td>ECI as comparable</td>
</tr>
<tr>
<td>7</td>
<td>TPH</td>
<td>0.92</td>
<td>4</td>
<td>0.411</td>
<td>DHI as comparable</td>
</tr>
<tr>
<td>8</td>
<td>IN4</td>
<td>0.31</td>
<td>5</td>
<td>0.189</td>
<td>ECI as comparable</td>
</tr>
<tr>
<td>9</td>
<td>ADC</td>
<td>0.51</td>
<td>3</td>
<td>0.258</td>
<td>DHI as comparable</td>
</tr>
<tr>
<td>10</td>
<td>HST</td>
<td>0.65</td>
<td>4</td>
<td>0.455</td>
<td>HEV as comparable</td>
</tr>
<tr>
<td>11</td>
<td>SGD</td>
<td>1.18</td>
<td>0</td>
<td>0.630</td>
<td>Material</td>
</tr>
<tr>
<td>12</td>
<td>DAE</td>
<td>1.01</td>
<td>3</td>
<td>0.399</td>
<td>Construction</td>
</tr>
<tr>
<td>13</td>
<td>HEV</td>
<td>0.86</td>
<td>9</td>
<td>0.596</td>
<td>Real Estate</td>
</tr>
<tr>
<td>14</td>
<td>ALT</td>
<td>0.77</td>
<td>2</td>
<td>0.617</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>EFI</td>
<td>0.44</td>
<td>7</td>
<td>0.422</td>
<td>INN as comparable</td>
</tr>
<tr>
<td>16</td>
<td>EID</td>
<td>0.59</td>
<td>9</td>
<td>0.433</td>
<td>ALT as comparable</td>
</tr>
<tr>
<td>17</td>
<td>DAD</td>
<td>0.86</td>
<td>8</td>
<td>0.588</td>
<td>SGD as comparable</td>
</tr>
<tr>
<td>18</td>
<td>SED</td>
<td>0.31</td>
<td>9</td>
<td>0.147</td>
<td>EID as comparable</td>
</tr>
</tbody>
</table>

**Exhibit 5** – Statistical results of three (3) groups of 103 listed construction firms during crisis period

**Exhibit 6** – VNI Index and other stock market index during crisis 2006-2010

**Author note**: My sincere thanks are for the editorial office and Lecturers/Doctors at Banking University and Intl University of Japan. Through the qualitative analysis, please kindly email me if any error found.
To Assess the Knowledge of Anaemia among Studied Population of Shimla Hills

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ABSTRACT

Anaemia is one of the major public health problems, affecting both sexes and all ages. It adversely affects the cognitive performance, behaviour, and physical growth of infants, preschool and school-aged children. In view of the immense public health consequences of anaemia this study was conducted in the field practice areas of Department of Community Medicine, IGMC, Shimla, for a period of one year. A total of 421 girls were studied. They were clinically examined, & predesigned & pre tested proformas were filled up. Haemoglobin assessment was done using Filter paper Cyanmethemoglobin technique. It was concluded that girls who were aware about sources of iron rich diet, adverse effect of anaemia on academic performance and increased requirement of iron by the girls, were less likely to be anaemic.

Keywords: Anaemia, Cyanmethemoglobin, Haemoglobin, Nutrition, folic acid, vitamin B12

I. INTRODUCTION

One common etiological classification of anaemia identifies three main causative groups of anaemia nutritional, marrow disease and hemolytic. Nutritional anaemia is by far the most common type of anaemia worldwide and mainly includes iron, folic acid and B12 deficiencies. By far the most common cause of nutritional anaemia is iron deficiency anaemia which itself is caused by insufficient dietary intake of iron, chronic gastrointestinal bleeding especially from hookworm infestation, malabsorption conditions and infection.

Anaemia can affect psychological and physical behaviour. Several studies have shown that anaemia affects cognitive functioning, growth, motor performance and educational achievements. According to Food policy 2003 study, anaemia in adults & children cost developing countries billions of dollars. Adults who lack sufficient iron in their diets are more lethargic which leads to lower productivity. The study also indicated that on an average, a country loses 0.6% of its gross domestic product (GDP) due to physical productivity loses from adults lacking iron. When learning & motor impairment in anaemic children is added the figure rises dramatically to 4% of its GDP.

For a pregnant woman anaemia can result in severe morbidity and reduces the resistance to blood loss, with the result that death may result from blood loss associated with normal delivery. Forty percent of all maternal perinatal deaths are linked to anaemia. Favourable pregnancy outcomes occur 30-45% less often in anaemic mothers, and their infants have less than one-half of normal iron reserves. Such infants require more iron than is supplied by breast milk, at an earlier age than, than do infants of normal birth weight.

Though the state of Himachal Pradesh has made significant progress in the health front but the nutritional status of adolescent girls is poor as indicated by NFHS survey. In Himachal Pradesh not much work has been done on anaemia in adolescent population, hence the
present exercise is an attempt to find out prevalence of anaemia among school going adolescent girls and to correlate the associated socio-demographic factors. An attempt was also made to assess the knowledge of the adolescent girls about anaemia.

**AIMS & OBJECTIVES**

To assess the knowledge of anaemia amongst the study subjects.

**II. METHODS AND MATERIAL**

**Study Population:** The present Cross sectional study was carried out amongst school going adolescent girls studying in 6th – 12th classes in the government schools located in rural & urban field practice areas of Department of Community Medicine, Indira Gandhi Medical College, Shimla. WHO has defined adolescence as period of life between 10-19 years of age, therefore girls falling in this age group were taken in the study.

**Definition of Anaemia for the purpose of study :** WHO has defined the thresholds below which person is said to be anaemic.

<table>
<thead>
<tr>
<th>Age group</th>
<th>Haemoglobin below g/l</th>
<th>m/1000</th>
<th>l/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children 5-11 years</td>
<td>115</td>
<td>7.1</td>
<td>3</td>
</tr>
<tr>
<td>Children 12-14 years</td>
<td>120</td>
<td>7.4</td>
<td>5</td>
</tr>
<tr>
<td>Non-pregnant women</td>
<td>110</td>
<td>6.8</td>
<td>3</td>
</tr>
</tbody>
</table>

**Sample Size:** In this study, sample size to be studied has been calculated taking into consideration prevalence of 50% & with allowable error of 10%. Sample size is as under:

\[
\begin{align*}
    n &= 4pq/L^2 \\
    p &= \text{prevalence ie 50%} \\
    q &= 100-p \text{ ie 50%} \\
\end{align*}
\]

Thus a sample of 421 subjects was studied. Outs of those 209 were studied in the urban & 212 subjects were taken from rural area.

**Study Duration:** Study was conducted for a period of one year.

**Sampling:** To start with all the government senior secondary schools falling in the field practice areas were listed. One school from each area (urban/rural) was selected randomly & permission from the Head of the Institution was taken to conduct the study. Number of subjects was selected proportionate to the total strength of the girl students in each school by systematic random sampling technique. A total of 421 girl students from rural & urban areas were selected. The selected students were given consent forms in advance to obtain the consent of parents/guardian for participation in the study. History, general physical examination & clinical examination were done and noted on pre designed & pre tested proformas. This was followed by collection of blood samples. In the end proformas were analyzed using standard statistical methods (Epi Info/Excel).

**Investigation:** Blood samples (20µl) were collected by prick method from ring finger of individuals using standardised pipette on Whitman filter paper no.1 after recording particulars on each filter paper, these were dried & placed in individual envelopes. Haemoglobin levels were estimated by colorimeter using cyanmethaemoglobin technique.

**III. RESULT AND DISCUSSION**

**Table 1**

Distribution of study population according to mother’s educational qualification and anaemia
Chi sq = 0.18, p value >0.05, df =2

Table 1 shows that where mother was graduate and above there is decrease in the prevalence of the anaemia, but the results were not found to be statistically significant.

**Table 2**
Distribution of study population according to their knowledge about anaemia

<table>
<thead>
<tr>
<th>Source</th>
<th>No.</th>
<th>No. of anaemcics</th>
<th>Non anaemcics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green leafy vegetable</td>
<td>257</td>
<td>146 (57%)</td>
<td>111 (43%)</td>
</tr>
<tr>
<td>Non vegetarian diet</td>
<td>25</td>
<td>11 (44%)</td>
<td>14 (56%)</td>
</tr>
<tr>
<td>Pulses</td>
<td>3</td>
<td>3 (100%)</td>
<td>0</td>
</tr>
<tr>
<td>Fruit</td>
<td>18</td>
<td>8 (44%)</td>
<td>10 (56%)</td>
</tr>
<tr>
<td>Others</td>
<td>16</td>
<td>14 (88%)</td>
<td>2 (12%)</td>
</tr>
<tr>
<td>Do not know</td>
<td>102</td>
<td>53 (52%)</td>
<td>49 (48%)</td>
</tr>
</tbody>
</table>

Chi sq = 0.15, df 1, p value > 0.05.

Table 2 shows there was no significant association between knowledge about anaemia and its occurrence.

**Table 3**
Distribution of study subjects as per their knowledge of the sources of iron rich food.

<table>
<thead>
<tr>
<th>Period of life for increased requirement of iron</th>
<th>Responses</th>
<th>No. of anaemcics</th>
<th>Non anaemcics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Childhood</td>
<td>147</td>
<td>81 (55%)</td>
<td>67 (45%)</td>
</tr>
<tr>
<td>Adolescence</td>
<td>166</td>
<td>95 (57%)</td>
<td>71 (43%)</td>
</tr>
<tr>
<td>Adults</td>
<td>57</td>
<td>34 (60%)</td>
<td>23 (40%)</td>
</tr>
<tr>
<td>Do not know</td>
<td>51</td>
<td>26 (49%)</td>
<td>25 (51%)</td>
</tr>
</tbody>
</table>

Chi sq = 0.19, df = 2, p value > 0.05

Table 4 shows 166 girls knew that the adolescents require maximum amount of iron in their diet but it was not being practiced by them.

**Table 5**
Distribution of study population as per their knowledge of the effect of anaemia on academic performance

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Responses</th>
<th>No. of anaemcics</th>
<th>Non anaemcics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affects academic performance</td>
<td>106</td>
<td>50 (47%)</td>
<td>56 (53%)</td>
</tr>
<tr>
<td>Does not affects academic performance</td>
<td>265</td>
<td>152 (57%)</td>
<td>113 (43%)</td>
</tr>
<tr>
<td>Do not know</td>
<td>50</td>
<td>33 (66%)</td>
<td>17 (34%)</td>
</tr>
</tbody>
</table>

Chi sq = 4.30, df = 1, p value < 0.05

Table 5 shows that girls who had knowledge about the effect of anaemia on academic performance, were less likely to be anaemic.

**Table 6**
Distribution of study population as per their knowledge of more requirement of iron by Boys/girls.

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Response</th>
<th>No. of anaemcics</th>
<th>Non anaemcics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls require more iron</td>
<td>60</td>
<td>40 (50%)</td>
<td>20 (33%)</td>
</tr>
<tr>
<td>Boys require more iron</td>
<td>307</td>
<td>174 (54%)</td>
<td>133 (43%)</td>
</tr>
<tr>
<td>Equal</td>
<td>16</td>
<td>9 (56%)</td>
<td>7 (44%)</td>
</tr>
<tr>
<td>Do not know</td>
<td>38</td>
<td>12 (32%)</td>
<td>26 (68%)</td>
</tr>
</tbody>
</table>

Table 6 shows the percentage of anaemcics in subjects with respect to the answer given. Girls who knew about non-vegetarian food and fruits to be good source of iron were less likely to be anaemic.
Table 6 shows that the prevalence of anaemia was lesser in the girls who knew that they need more iron as compared to the boys.

Table 7

<table>
<thead>
<tr>
<th>Response</th>
<th>No. of anaemics</th>
<th>Non anaemics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Will start taking iron rich diet</td>
<td>36</td>
<td>12 (33%)</td>
</tr>
<tr>
<td>Will do nothing, even if told to be anaemic</td>
<td>40</td>
<td>20 (50%)</td>
</tr>
<tr>
<td>Inappropriate action (Total)</td>
<td>76</td>
<td>32 (42%)</td>
</tr>
<tr>
<td>Will take doctor’s advice if told to be anaemic</td>
<td>345</td>
<td>154 (45%)</td>
</tr>
</tbody>
</table>

Chi sq =0.16, df = 1, p value >0.05

Table 7 shows that right knowledge of the subjects about the action to be taken in the event they are found to be anaemic, was not statistically significant to prevent them from anaemia.

Knowledge, Practice & Attitude regarding anaemia:
Knowledge is one of the factors required to promote health in order for people to control over and to improve their health. As promulgated in the Ottawa charter (WHO, 1986) the others include building healthy public policy, creating a supportive environment, strengthening community action and reorienting health services. In our study, assessment of the subjects, regarding knowledge, practice & attitude in relation to anaemia & its prevention was also taken. It is a known fact that dietary intake of food such as meat, vegetables and fruit rich in iron are important in the prevention of anaemia. Accordingly in our study, it was seen that the girls who had knowledge about sources of iron rich diet, had lesser prevalence of anaemia. (Chi sq = 29.25, p value < 0.01, df 1)

Also prevalence of anaemia was lesser in the girls who knew that they need more iron as compared to the boys. (Chi sq = 12.01, df = 3, p value < 0.01).

In our study prevalence of anaemia was least in the girls who were taking non-vegetarian diet twice weekly, but the results were not statistically significant. Reason for not appreciable effect of non–vegetarian diet on anaemia prevalence, could be too little amount or quite infrequent use of non- veg diet. In our study 371(88%) of the subjects had never taken non vegetarian diet, 14 (3%) girls have taken occasionally (once/twice a year), while 36(9%) take non-vegetarian diet twice weekly. So we can see in our study, the reason for statistically not significant result could be, the very small number of subjects who were taking non vegetarian (i.e. atleast twice weekly and in very little amount).

Parent’s Educational Qualification & anaemia
It was observed that when mother was a graduate and above there is decrease in the prevalence of anaemia, but the result when analysed statistically, was found to be insignificant. The reason for such a finding could be that the mother’s knowledge specific to anaemia would have made significant difference than formal qualification.

DISCUSSION:

In the 1830s, anaemia, hypochromia and lack of iron in the blood were detected by Fowler [1] and Ashwell was able to classify chlorosis as a disease of the blood [2]. In 1832, Pierre Blaud, described the response of chlorosis to his deservedly famous pills (ferrous sulphate plus potassium carbonate). He gave gradually increasing doses, from 2 pills on the first day to 12 pills on day 16. Many observers, including Haden RL, confirmed his findings [3].

Iron deficiency is one of the most common, but not the only cause of anaemia other causes of anaemia include chronic infections, particularly malaria, hereditary haemoglobinopathies and other micronutrient deficiencies, particularly folic acid deficiency. It is worth noting that multiple causes of anaemia can coexist in an individual or in a population and contribute to the severity of the anaemia.

Over half of the pregnant women in world have haemoglobin level indicative of anaemia: 52% in non-industrialized-as compared with 23% in industrialised countries.
In Africa as a whole, one half of all pregnant women are anaemic, as are over 40% of non-pregnant women. Western Africa is the most affected, and southern Africa the least. The prevalence there is estimated to be 56% for pregnant and 47% for non-pregnant women. Southern Africa, on the other hand, has the lowest rates of all the sub-regions of the developing world due, according to some observers, to the widespread use of iron cooking pots by indigenous people. The remaining region of the Africa has a fairly uniform prevalence of between 47% and 54% for pregnant women and 41% and 43% for non-pregnant women.

In a Delhi hospital based comparative study conducted by Ajmani et al [5] in 1972 mean Hb was found to be 4.48± 0.6 and 13.1± 0.4 respectively in anaemic & normal subjects.

Rana et al [6] conducted a study at Hyderabad in Andhra Pradesh by enrolling 697 urban girls in the age group of 9-16 years found mean Hb to be 11.23± 0.18, 11.36± 0.13, and 11.05± 0.17 in the age group <12, 12-13, >13 years respectively.

Another study was conducted at Maharashtra; Chembur, Bombay; in 1990 by Tumbi & Dodd [7]. In the study 80 subjects (apparently healthy and menstruating) were enrolled from low middle income group of a housing society in a suburban area. They found that 60% of the subjects had Hb level <12 g/dl and were anaemic in mild to moderate range.

In 1993, Yegammai & Gandhimathy [8] conducted an urban school based study at Coimbatore in Tamil Nadu. By random sampling 180 subjects were taken for initial screening & 120 out of the 180 – for supplementation trial. About 83% of the girls were anaemic (Hb<11 g/dl). Mean Hb level was 7.9 ±0.3 g/dl. The mean serum iron level of 62.8 to 66.0 µg/dl was found, which was less than the normal value of 70µg/dl.

Kanani et al [9] 1998 enrolled 203, 10-18 years old girls from slums of Vadodra, Gujarat. Hb estimation was done by cyanmethaemoglobin method. Overall 83.0% of the girls were found to be anaemic.

In another school based study by Kanani et al [10] at Vadodra, Gujarat, prevalence of anaemia was 75.0%. A total of 1517 adolescent girls were enrolled and estimation of iron was done by cyanmethaoglobin method.

Another cross- sectional study [11] was done by enrolling 278; 12-18 years old adolescents from rural schools at Faridabad, Haryana. In age group 12-14 years old girls, prevalence of anaemia was 51.5%, while in the age group of 15-16 years old girls anaemia was found to be present in 38.5% of cases.

Chakravarty & Ghosh [12] in 2000 conducted a rural community based study by enrolling 12-19 years old girls. Multistage sampling technique was used. Prevalence of mild and moderate anaemia was high ie 65.8% in boys & 81.3% in girls. In this group, 3.8% boys & 6.0% girls had severe anaemia.

Another study (Rawat et al) [13] at field practice area of LLRM Medical College in Daurala block, Meerut in U.P. studied a cross section of 504 adolescent girls in the age group 10-18 years. They observed that the overall prevalence of anaemia was 34.5% with 19.0%, 14.0% & 1.4% showing mild, moderate, & severe anaemia respectively.

In a community based study [14] conducted at Ahmedabad among girls of school going age (6-180) residing in 15 slums of the city, it was found that majority (81.8%) of girls were anaemic. The overall prevalence of mild, moderate and severe anemia was 55.2%, 26%, and 0.6% respectively. It was significantly higher among girls whose fathers were working as semi-skilled/skilled workers (77%) (P<0.02) and those having BMI more than 18.5 (79.7%). The prevalence of anaemia was observed lower in girls consuming green vegetables (P<0.01).

In the study sponsored by Mother Care project, USAID [15], Raina et al. documented a prevalence of 85.3% (Hb <11 g/dl) in rural Haryana.

In these adolescent girls, the mother to be, who will usher the next generation, pregnancy only serves to aggravate their pre-existing anaemia. Under the circumstances the need to combat anaemia in adolescent girls had been suggested by Nutrition

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Foundation of India [16]. Preventing foetal brain damage due to maternal anaemia in early pregnancy [17] support a strategy that ensures that women have a satisfactory haemoglobin status (11g/dl as recommended by WHO even at the beginning of conception.

IV. CONCLUSION

The study was conducted in the urban & rural field practice areas attached to the Department of Community Medicine, IGMC, Shimla during Jan 2005-2006. A sample of 421 subjects (212 rural and 209 urban) were studied. Out of these 235 (55.34%) girls were found to be anaemic.

Girls who were aware about sources of iron rich diet, adverse effect of anaemia on academic performance and increased requirement of iron by the girls were less likely to be anaemic.

Most of the girls knew about the need for increased amount of iron in the adolescent age group, but still most of them were anaemic, the reason could be that the girls are not actual decision makers in deciding about the meals.

1. So it is recommended that Schools can develop the environment, motivation, service and support necessary to contribute to the integrated promotion of health behaviour, which can be a lifelong asset.
2. Imparting health education, specific to anaemia-prevention, to school students and community in general.
3. Nutrition awareness and education are particularly important given adolescents’ poor knowledge of anemia, diet and health generally and of iron-rich foods specifically.
4. Channels for reaching youth include: Educational settings Health facilities Community outreach, Media and public information.
5. In practice, nutritional education can be addressed within any setting or program that deals with reproductive and other health issues.

V. REFERENCES

**Characterization of Carbon Fiber / Epoxy Composites with Different Fiber Parametric Quantity**

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**ABSTRACT**

Aircrafts and cars are made of composites to lighten their weight. Glass fiber reinforced composites due to their high specific strength and specific stiffness have become attractive structural materials. Room temperature cured epoxy was impregnated with Carbon fiber in order to synthesis composites. Carbon fiber is taken in the 3, 5, 7 % weight in order to suspend on epoxy resin with different fiber lengths such as 1, 2, and 3 cm. The variations of mechanical and thermal properties on Carbon fiber–epoxy composites with different fiber lengths have been studied. Thermal properties such as TGA and DSC are studied to investigate the influence of change in fiber length on Carbon fiber–epoxy composites. Significant improvement in tensile and flexural strengths of Carbon fiber–epoxy composites has been observed by the different lengths of the fiber. The results that by taking epoxy 95 % and carbon fiber 5 % as constant with different fiber lengths were increased the mechanical and thermal properties compared with different fiber content in weight percentage. The lengths of the fiber are influenced on the improvement of tensile, flexural, and morphology properties.

**Keywords**: Carbon fiber/Epoxy, Flexural Test, Tensile test, Tensile Modulus, Thermo Gravimetric Analysis (TGA), Differential Scanning Calorimetric (DSC), Scanning Electron microscope (SEM).

**I. INTRODUCTION**

The use of composites filled with fiber in epoxy system has gained significant importance in the development of thermosetting composites. One of the most important focuses in achieving this goal is to develop a new material, which possesses a strength-to-weight ratio that far exceeds any of the present materials. Epoxy resin remains the most important matrix used in the high-performance transportation systems. When epoxy combines with carbon fibers, it results in advanced composites, which have sound-specific properties such as impact, hardness, tensile, strength, and modulus and properties. The new found properties make this material very attractive for use in aerospace applications. Estimation has it that for every unit of weight reproduction in an aircraft, there is a considerably less consumption of fuel or higher load capacity, and hence materials offer load saving. Due to their resistance to chemicals, the permeability of water, oxygen, and other gases to composites also decreases, making them ideal for building advanced composite fuel tanks for future reusable launch vehicles.

Epoxy resins have played a vital role in polymer matrix materials because of their superior mechanical and adhesive properties. They have been used widely as a matrix to hold the high-performance fiber reinforcement together in composite materials, as well as structural adhesives. Composites are named when the dispersed phase particle size is less than 100 nm, and the reinforcement of polymeric resin with fiber as fillers has resulted in light-weight materials with increased modulus and strength, decreased permeability, less
shrinkage and increased heat resistance even at low friction loading.

But in recent times epoxy resin added with modified fiber as filler finds major applications. The introduction of fiber particles increases the mechanical (tensile strength and modulus), physical (permeability and barrier resistance), and thermal (decomposition and mass loss) properties of the polymer composites. Recent researchers have found that commercial organic fiber could be used to make aerospace epoxy Composites, which possess excellent mechanical strength and low coefficient of thermal expansion with relatively low cost and ease of fabrication. Significant amount of work can be found in the literature on the effect of addition of fiber on the mechanical properties of pure epoxy resin systems.

One of the most important consequences of the incorporation of fiber fillers in molten polymers is the significant change in their viscoelastic properties. The reduction of the filler size down to nano-meter scale can produce substantial differences in the rheology and dynamic of filled polymer in comparison to micron sized particles. The extremely large surface area provided by fiber particles can intensify the effect of particle-particle and/or polymer-particle thermodynamic interactions.

The objective of the present study is to fabricate Composite that contain reinforcing carbon fiber in the epoxy matrix and to evaluate the influence of the fiber fillers on Thermal, Mechanical, Morphology, Chemical resistance and Electrical properties. This research presents the work done on the effect of adding fiber on tensile properties and flexural properties of carbon fiber are incorporated in Epoxy in order to study the variation of Mechanical, Thermal, Morphology properties.

In the present study the tensile, flexural, and chemical resistance properties of carbon fiber/epoxy composites should be evaluated. The Carbon fibers with different proportion in length and content are used as reinforcements in epoxy polymer based matrices. The mathematical models of tensile, flexural, and chemical resistance properties are developed and optimized using statistical package to find the optimum fiber parameters for maximum mechanical properties. The results are to be compared weather the fiber content in weight percentage and the fiber length are influenced on the improvement of tensile, flexural, and chemical resistance properties.

II. METHODS AND MATERIAL

In the present work, epoxy resin (LY-556) thermo setting polymer is used as a matrix, epoxy is the most common thermosetting polymer used as matrix in the polymer composites. It is obtained from Araldite HY-951 Huntsman, Bangalore. Epoxy is a clear liquid with viscosity at 25°C. Epoxies are used by the plastic industry in several ways. Hardener is used as reaction agent. It acts as catalyst. It is added to the resin in 10:1 proportion to get hardener. In the recent work Aradur HY-951 is used as hardener in the Epoxy LY-556. It has a shelf pot life of 2 years when it is stored in a dry place in a temperature range of 18-25°C, while for achieving higher pot life, lid should be closed after using the material. Polyvinyl alcohol (PVA) was used as the mould releasing agent in composite fabrication. The mould cavity is coated with a thin layer of aqueous solution of PVA for the easy removal of the sheet from the mould and for a smooth surface finish.

Table 1: List of raw materials used for micro-composites

<table>
<thead>
<tr>
<th>Description</th>
<th>Raw Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matrix</td>
<td>Epoxy resin (LY-556)</td>
</tr>
<tr>
<td>Hardener</td>
<td>Hardener (HY-951)</td>
</tr>
<tr>
<td>Reinforcing agent</td>
<td>Carbon Fiber</td>
</tr>
<tr>
<td>Mould releasing agent</td>
<td>Polyvinyl alcohol (PVA) / Wax</td>
</tr>
<tr>
<td>Casting</td>
<td>Glass moulds</td>
</tr>
</tbody>
</table>

Composite Manufacturing

There are several methods of making carbon fiber but essentially they consists of first making fibers out of a carbon rich precursor material. The original size and shape of the fiber will remain in the finished carbon fiber, but the interior chemical structure will have been greatly modified through the various heating cycles.

The first steps are carbonizing and stretching precursor fibers, either PAN: Polycrylonitrile, Pitch or Rayon. There are several cycles of heating at varying temperatures excluding oxygen. This process drives off most of other elements (hydrogen and nitrogen mainly) of the starting material leaving carbon behind. It also allows the carbon to gradually crystallize in its characteristic honeycomb way. If you haven't seen it yet, go to my Carbon Research page and look at the video on Carbon fiber structure. it's fabulous. The most important factors determining the physical properties of carbon fiber are degree of carbonization (carbon content,
usually more than 92% by weight) and orientation of the layered carbon planes (the ribbons). Fibers are produced commercially with a wide range of crystalline and amorphous contents variations to modify or favor the various properties. Depending on the starting material and process of carbonization Carbon fiber is modified to suit the end purpose. PAN or polyacrylonitrile is the most common precursor for plastic composites. The main variation of characteristics is strength vs stiffness. By using different heating cycles either can be emphasized. Research is being done to modify other features such as heat and electrical conductivity.

**Synthesis of Carbon Fibre/Epoxy Composites**

In the present work glass moulds are used to prepare carbon fiber reinforced with epoxy composites. A glass mould of (130 x 130 x 0.4) mm$^3$ is used to prepare casting and specimen for tensile test, flexural tests, compressive test, thermal analysis and morphology. Figure-1 represents the glass mould.

![Glass Mould](image)

**Figure 1: Glass Mould**

Moulds are prepared for different castings that are made from resin as per ASTM standards. The pre – calculated amount of Epoxy (resin) is mixed in a suitable beaker.

Carbon fiber is taken with stipulated quantity of resin based on the predetermined ratio and mixed thoroughly with mechanical shear mixing for about 1 hour at ambient temperature conditions. Then the mixer is carried out through a high intensity Ultrasonic for one and half hour with pulse mode (50s on / 25s off). External cooling system is employed to avoid temperature during the Ultrasonic process, by submerging the beaker containing the mixer in an ice and then a pre-calculated amount of hardener was mixed and stirred for 20 min before pouring into the mould bath as shown in figure 2 below.

![Ultrasonic Bath Indicator](image)

**Figure 2: Ultrasonic Bath Indicator**

Once the irradiation is completed, hardener is added to the modified epoxy in the ratio of 10:1 parts by weight. A glass mould with required dimensions is use for making sample as per the ASTM standards and it is coated with mould releasing agent enabling easy removal of the sample.

In this technique carbon fiber is wetted by a thin layer of an epoxy suspension in a mould. Staking of carbon fiber is arranged side by side all over the mould. Stacking of carbon fiber is carefully arranged after pouring some amount of resin against the mould, to keep the poor impregnation at bay.

Left over quantity of mixture is poured over the carbon fiber. Brush and roller are used to impregnate fiber. The closed mould is kept under the pressure for 24 hours at room temperature To ensure complete curing, the composite samples are post cured at 70$^\circ$C for 1 hour and the test specimens of the required size is cut out from the sheet. The removed castings are cut into the samples in accordance with ASTM standards for further testing.

Direct processing technique has been used for the above fiber reinforced composites preparation. A schematic representation of direct processing preparation techniques is presented in the figure 3. This procedure is applied for all the specimens.

![Direct Processing Schematic](image)

**Figure 3: Schematic representations of the direct processing techniques prior to in situ polymerization and synthesis of thermo set composites.**

Characterization encompasses mechanical (tensile, flexural tests), thermal (TGA, DSC tests), Morphology (SEM test). In each case at least three samples are tested and the coefficient intervals (CI), standard error and % change on mean values for the best samples are
tabulated. The following different composites are prepared.

**Practical work specimen Photographs are listed**

Figure 4: Wire extrusion carbon fiber

Figure 5: Specimen

Figure 6: Specimen No 1

Figure 7: Specimen No 2

Figure 8: Specimen No 3

Figure 9: Specimen No 4

**Flexural Load Measurements**

Flexural strength and modulus were tested using an Instron Universal testing machine with a crosshead speed of 2mm/min. The three-point bending test system was used for all samples. In each case, six samples were tested and the average value tabulated. Authors used 50 kN load cell used for testing. Furthermore the sample sizes 100 x 20 x 4 mm were cut in accordance with ASTM D 618.

Figure 10: Specimen of ASTM D618 (No 5)

**Tensile Load Measurements**

Tensile strength was studied using an Instron Universal testing machine supplied by Instron Corporation; a series-9 automated testing machine was used with a crosshead speed of 5 mm/min. Testing samples were prepared in dumb-bell shapes and these dimensions are 100 x 20 x 4mm3 based on the ASTM D 638 standards.
In each case, three samples were tested and the average value tabulated.

Figure 11: Specimen of ASTM D638 (No 6)

THERMAL ANALYSIS

Thermo Gravimetric Analysis (TGA/DSC)

The thermal characteristics of the epoxy modified with carbon fiber are measured using both thermo gravimetric analysis (TGA) and differential scanning calorimetric (DSC-2015 TA Instrument). Thermo gravimetric analysis (TGA) was used to investigate thermal decomposition behavior of the composites. Differential scanning calorimetric (DSC-2015 TA Instrument) was used to study the glass transition temperature (Tg) of the material. Tests were done under nitrogen at a scan rate of 10°C/min in a programmed temperature range of 30 to 600°C. A sample of 5 to 10 mg was used for each run. The weight change was recorded as a function of temperature.

Scanning Electron Microscopy Analysis (SEM)

A JEOL JSM 840A JAPAN scanning electron microscope (SEM) was used to study the morphology of fractured surfaces of composites samples at uniform magnifications. The fractured surfaces were gold-coated initially subjecting it to SEM analysis.

The scanning electron microscope of different cross-sections with uniform magnification (i.e. 300x) of the composition of carbon fiber.

III. RESULT AND DISCUSSION

Mechanical tests

Flexural Test

The results are tabulated at table 2 and table 3. And the graphs are plotted for the specimens. It is shown in figure 43 and figure 44.

In the present work we synthesized two different systems (1) carbon fiber reinforced epoxy with weight proportions of carbon fiber 3%, 5%, 7%, (2) carbon fiber reinforced epoxy with constant weight ratio i.e., Epoxy 95% + Carbon fiber 5% in order to suspend on epoxy resin with different fiber lengths such as 1, 2, and 3 cm. Table 2 shows the experimental measurements of flexural strengths both systems 1 & 2.

<table>
<thead>
<tr>
<th>Name of the sample</th>
<th>Name of the sample</th>
<th>Flexural strength N/mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Different Weight Proportions of Epoxy and Carbon fiber (CF) System 1</td>
<td>Constant Weight of Epoxy (95%) + Carbon fiber (5%) &amp; Different Length of Fiber (cm) System 2</td>
<td>For Weight Proportions System 1</td>
</tr>
<tr>
<td>Epoxy (97%) + CF (3%) specimen 1</td>
<td>1</td>
<td>208.95</td>
</tr>
<tr>
<td>Epoxy (95%) + CF (5%) specimen 2</td>
<td>2</td>
<td>210.12</td>
</tr>
<tr>
<td>Epoxy (93%) + CF (7%) specimen 3</td>
<td>3</td>
<td>209.36</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name of the sample</th>
<th>Name of the sample</th>
<th>Flexural Modulus N/mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Different Weight Proportions of Epoxy and Carbon fiber (CF) System 1</td>
<td>Constant Weight of Epoxy (95%) + Carbon fiber (5%) &amp; Different Length of Fiber (cm) System 2</td>
<td>For Weight Proportions System 1</td>
</tr>
<tr>
<td>Epoxy (97%) + CF (3%) specimen 1</td>
<td>1</td>
<td>1167.2</td>
</tr>
<tr>
<td>Epoxy (95%) + CF (5%) specimen 2</td>
<td>2</td>
<td>1201.5</td>
</tr>
<tr>
<td>Epoxy (93%) + CF (7%) specimen 3</td>
<td>3</td>
<td>1182.9</td>
</tr>
</tbody>
</table>
Flexural strength and Flexural modulus is done on the different specimens. The flexural strength and flexural modulus is calculated by using following formula.

$$F.S = \frac{(3\times F\times L)}{(2\times b\times d^2)} \quad \rightarrow (I)$$

$$F.M = \frac{(L^3\times F)}{(4\times b\times h^3\times d)} \quad \rightarrow (II)$$

- $F$ is the load (force) at the fracture point.
- $L$ is the length of the support span.
- $b$ is width.
- $d$ is thickness.
- $h$ is height.

The results are tabulated at table 2 and table 3. And the graphs are plotted for the specimens. It is shown in figure 43 and figure 44.

In the present work we synthesized two different systems (1) carbon fiber reinforced epoxy with weight proportions of carbon fiber 3%, 5%, 7%, (2) carbon fiber reinforced epoxy with constant weight ratio i.e., Epoxy 95% + Carbon fiber 5% in order to suspend on epoxy resin with different fiber lengths such as 1, 2, and 3 cm. Table 2 shows the experimental measurements of flexural strengths both systems 1 & 2.

It is observed that flexural strength and modulus properties increased up to 5% wt of carbon fiber and 2 cm length of carbon fiber and decreases with further increase in carbon content and length.

Similarly for system2 (Epoxy 95% + Carbon fiber 5%) of different fiber length, experimental measurements of flexural strength properties of the carbon fiber reinforced epoxy composites are shown in table 9. The graphs is obtained the Universal Testing Machine for the obtained values shown in the figure 12 and figure 13.

From the above graphs we can observe that specimen 2 of system 2 i.e. Epoxy (95%) + CF (5%) and 2 cm length of fiber has higher flexural strength and flexural modulus compared to the other specimens in the system 2. Similarly the specimen 2 of system 1 i.e. Epoxy (95%) + CF (5%) specimen 2 has higher flexural strength and flexural modulus compared to the other specimens in the same system. From the Flexural test we came to know that system 2 i.e., for fiber length 2 cm has higher flexural strength and flexural modulus compared to system 1.

**Tensile Test**

In the present work the tensile strength for the different specimens of system1 and system2 were checked in Universal Testing machine and the variations of tensile strength and tensile modulus were tabulated in the table 4 and 5. The graph is obtained from the Universal Testing Machine as shown in the figure 14 and 15.
From the graphs it is observed that system 2 specimen 2 showed highest tensile strength and Tensile modulus compared to system 1.

**Table 4:** Tensile Strength properties of both systems 1 & 2 of carbon fiber reinforced epoxy composites

<table>
<thead>
<tr>
<th>Name of the sample</th>
<th>Tensile Strength N/mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Different Weight Proportions of Epoxy and Carbon fiber (CF) System 1</td>
<td>For Weight Proportions System 1</td>
</tr>
<tr>
<td>Epoxy (97%) + CF (3%) specimen 1</td>
<td>104.92</td>
</tr>
<tr>
<td>Epoxy (95%) + CF (5%) specimen 2</td>
<td>106.89</td>
</tr>
<tr>
<td>Epoxy (93%) + CF (7%) specimen 3</td>
<td>105.53</td>
</tr>
</tbody>
</table>

**Table 5:** Tensile Modulus properties of both systems 1 & 2 of carbon fiber reinforced epoxy composites

<table>
<thead>
<tr>
<th>Name of the sample</th>
<th>Tensile Modulus N/mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Different Weight Proportions of Epoxy and Carbon fiber (CF) System 1</td>
<td>For Weight Proportions System 1</td>
</tr>
<tr>
<td>Epoxy (97%) + CF (3%) specimen 1</td>
<td>1475</td>
</tr>
<tr>
<td>Epoxy (95%) + CF (5%) specimen 2</td>
<td>1639</td>
</tr>
<tr>
<td>Epoxy (93%) + CF (7%) specimen 3</td>
<td>1589</td>
</tr>
</tbody>
</table>

**Thermal Analysis**

**Differential Scanning Calorimetric (DSC)**

Differential Scanning Calorimetric (DSC) analysis is done to the system 1 specimen 2. This has highest flexural strength and flexural modulus. The graph shown in figure 16 has obtained showing the glass transition temperature variation for system 1 specimen 2.
From the above graph figure 16 it is observed that the composite system1 specimen2 properties degrade as the heat flow and temperature increases. The system1 specimen2 has the higher glass transition temperature 215°C.

**Thermo Gravimetric Analysis (TGA)**

Thermo Gravimetric Analysis is done for the specimen 2 in system1 and which has high flexural and tensile strength. The second specimens of system 1 & 2 are maintained up to 250°C and 490°C % Weight loss for both the specimens for temperature variations is obtained in the form of graph as shown in the fig. 17. And fig. 18.

Figure 17: Thermo Gravimetric Analysis for Specimen 2 of System 1.

Figure 18: Thermo Gravimetric Analysis for Specimen 2 of System 2.

From the above figures 17 and 18 is observed that specimen2 of system 2 can resist up to 490°C. The weight loss takes place above 490°C. The specimen2 of system 1 can resist up to 250°C. The weight loss takes place above 250°C. The specimen2 of Carbon Fiber Reinforced Epoxy of fiber length 2 cm has good thermal stability compared to specimen2 of system 1.

**MORPHOLOGY**

**Scanning Electron Microscope (SEM) Analysis**

Scanning Electron Microscope (SEM) Analysis is done for the system1 specimen 3 and system 2 specimen 3 of fiber length 3 cm which has poor flexural strength. The images of fractured surfaces are taken so as to check the interface and homogeneous dispersion of fiber, filler in the matrix. Fig.19 and Fig. 20 shows the images of the fractured surfaces.

Figure 19: SEM image of fractured surface of system1 specimen3.
From the fig. 19 and fig. 20 it is observed that the good interface is obtained for both the specimens. The observation established good miscibility of Epoxy and Homogenous dispersion of carbon fiber in the matrix. The incorporation of 5% carbon fiber & 95% epoxy is this system2 specimen3 and the incorporation of 7% carbon fiber & 93% epoxy is this system1 specimen3.

IV. CONCLUSION

Carbon fiber reinforced epoxy composites were synthesized with different proportions of fiber weight and different lengths of carbon fiber dispersion through in situ polymerization. Flexural strength, flexural modulus, tensile strength and modulus were increased correspondingly up to 5%wt carbon fiber and 95% epoxy i.e., specimen 2 in system 1 and decreases with further addition of fiber content 7% wt. in system 1 and 3 cm length in system 2. Thus it can be concluded that Carbon fiber–epoxy composites can be used for high strength, stiffness, and bending applications in aerospace, automobile, and marine and light weight article applications. Overall studies indicated that the carbon fiber reinforced composites at 2 cm length of fiber with constant epoxy and fiber weight (i.e., system 2 specimen 2) loading are promising candidates for structural applications where high strength and stiffness is indispensable. The present study thus bears testimony to all of these findings. Hence the present study not only discloses that different length of fiber overseen through the polymer with different surface treatment promotes the performance of composites, but that unique tailored properties are improved by changing the weight proportions and length of the carbon fiber on the matrix. This research indicates that the mechanical properties are mainly dependent on the fiber length and unidirectional orientation of polymer composites.

V. REFERENCES


Studies and Research on Operation, Modeling and Simulation of Boilers: A Review

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ABSTRACT

Energy saving is very important for economical and cost effective operation of the facility. In boilers, steam is produced for various process, utility and instrumental applications. It is very important to operate the boiler with proper operating conditions. The parameters like level of feed water, steam temperature and flow of steam need to be optimized. Various studies are carried out on optimization of these parameters by using various software tools. Experimental data can be used to develop models. The present review aims at summarizing the research and studies carried out on various aspects of boilers such as operation, modeling, simulation and optimization.

Keywords: Efficiency, Power, Savings, Heat Recovery, Input, Output

I. INTRODUCTION

Energy and environment are two increasingly important areas in the modern economical and environmental scenario. Saving energy means less requirement, leading to less production and hence less harm to environment. Energy requirement can be minimized by pinch technology [1] Also use of nonconventional energy sources is being explored [2,3,4] The energy sources are depleting and studies are now concentrated on non-conventional energy resources [5,6]. The boilers consume considerable amount of energy for their operation. The boiler operation and its efficiency is very important research area. The boiler efficiency can be maximized by optimizing operating parameters such as water input, air input and temperature. Proper control and instrumentation techniques can avoid excess use of power. The present review summarizes research and studies on boiler operation, simulation, modeling and optimization.

II. STUDIES AND RESEARCH ON BOILERS

Panxiang carried out investigation on boiler combustion process based on the improved RBF neural network [7]. They set the model to single input and single output system as the research object. Then they used the particle swarm optimization algorithm to optimize neural network. They observed that combustion efficiency of the entire system reached 94% They concluded that the accuracy of the system model was significantly better than ordinary neural network. Waste heat recovery from an air conditioning unit was used as a source for performance improvement of a boiler by Jain et.al. [8]. According to them it is high time that we concentrate on waste heat recovery by making significant and concrete efforts. The main objective of their research was to study and analyze the feasibility of retrofitting the waste heat recovery system for hot water generation. Karuppiah et.al. Investigated an embedded based power plant boiler automation using GSM [9]. They proposed a system with one water tank and number of boilers. The valves were controlled by temperature sensors located at each boiler. The water level in main tank was controlled by water level indicator. A GSM mobile system with a PIC microcontroller, GSM modem, sensors and different interfacing circuits was used for the operation.

Chakraborty et.al. Carried out investigation on three-elements boiler drum level control for power plants [10]. According to them, the amount of water entering the
boiler drum must be balanced with the amounts of steam leaving and therefore it is extremely important to have the knowledge of the operating principles, installation requirements, strength and weaknesses of drum water level control system. Mohod et.al. Carried out energy analysis of baby boiler for steaming of raw cashew nut seeds [11]. They observed the variation in steam pressure, temperature and operating time with respect to fuel. They observed that the thermal efficiency of boiler using electricity as a fuel was higher (69.31%) as compared to 4.66% (Wood) and 4.47% (Cashew nut shell). They concluded that the improvement in the biomass combustion efficiency for steam generation could result in less fuel consumption and shorter period.

Sunudas and Prince carried out work related to optimization of boiler blowdown and blowdown heat recovery in textile sector [12]. They found that 1.5% of coal of total coal consumption was wasted in an industry by improper blowdown. By installing the heat recovery system, they were able to recover nearly an 85% of total wasted fuel. Krishnan and Prathyusha utilized soft computing techniques to optimization of main boiler parameters[13]. They optimized the main control parameters of process industries such as level of feed water, steam temperature and flow of steam by using ANFIS with PID controller. An ANFIS system is an adaptive network in which each node performs a particular function with respect to the incoming signals. Parameters are updated according to the given training data and a gradient-descent learning procedure. They used MATLAB software for optimization.

Babu and Das carried out studies on the implementation of condition based maintenance on boiler feed pump critical Machine used in the thermal plant, by adopting vibration spectrum analysis which is a predictive maintenance technology[14]. They observed that due to looseness problem in the main pump bed bolts, the large increase in vibration frequency was observed. In order to reduce the problem, they tightened the main pump bed bolts and checked the impeller casing of the shelter of the main pump for looseness and adjusted it. Kumar et.al. Investigated boiler efficiency through incorporation of additional bank of tubes in the economiser for supercritical steam power cycles in order to economize the operation [15]. They observed that the major efficiency loss of a boiler was caused by the hot stack gases discharging to the atmosphere. Installing an economizer on the boiler was most effective way to optimize the boiler operation. According to them, 2 to 4 percent increase in the efficiency can be achieved by using an economizer.

Hamid et.al. carried out an investigation on automatic detection and analysis of boiler tube leakage system[16]. According to their studies, approximately 60% of boiler outage was due to tube leakages. They used acoustic signal processing methods to detect leaks in pressurized systems of utility and industrial power plants. They obtained specificity of 94% and sensitivity of 92%. Sorensen et.al. studied optimization of boiler heating surfaces and evaporator circuits[17]. They developed a model for optimizing the dynamic performance of boiler. They also included a function for the value of the dynamic performance. Lahane and Khandekar carried out an investigation on mathematical modeling of boiler and heat exchanger pilot plant by system identification procedure[18]. They first acquired data from boiler and heat exchanger set-up and then used it for mathematical modeling. They observed that with slight delay and overshoots, the controller follows the model with less oscillations and the response is very fast. Turzynski carried out an investigation aimed at presentation of the results of experimental research conducted on helical coil biomass boiler with oil as a heating fluid[19]. For studying the characteristics of the device in terms of power, efficiency and oil parameters for moderate/high excess air numbers and fuel flow rates, they used experimental data. They observed that the maximum efficiency of the boiler unit was 83%. It occurred for low air excess numbers and oil flow rates. Also, they found that the air flow gives a significantly wider power control range (up to 5 kW).

III. CONCLUSION

The boiler operation can be optimized by using proper operating conditions. The experimental data can be used for simulation of operating conditions. The studies carried out suggests that the optimization of water flow, temperature and air flow rate can lead to efficient and economical operation. Also it is very important to have proper measuring and control system for accurate control of the operating parameters.
IV. REFERENCES


A Methodological Approach for Cumulative Effects Assessment Assessing Road Transport Sector Sustainability

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ABSTRACT

The study focuses on a technique for sustainability assessment through cumulative effects assessment (CEA) of road transport sector, the performance of which relies on the performances of the factors (stressors) affecting the system. Planning for a system’s sustainability thus depends on the interconnectedness of system stressors and their degree of connectivity. Therefore CEA can be a potential analytical approach for sustainability assessment because it provides an integrated framework with environmental, social or economic considerations drawn from multiple stressors’ connectivity of any complex system. The study aims in conceptualizing the process to assess the degree of connectedness among the stressors affecting transport system through digraph and matrix analysis and conducting economic evaluation of the impacts on the system stakeholders. The innovative idea of the research is to account the synergistic effect of road transport sector (rather than accounting effects separately for different actions), which normally happens in a system when all the stressors prevail together. This approach can provide baseline scenarios to the motorized cities of developing countries (like Dhaka city of Bangladesh) through ‘what-if’ analysis, while opting for least cost (affect) generating system in conjunction with sustainability planning.

Keywords: Cumulative Effect Assessment; Sustainability; Transport Sector; Dhaka City.

I. INTRODUCTION

The road transport sector in the most developing countries (like Dhaka city of Bangladesh) is now challenged with huge population, rapid urbanization, unplanned land use, poor traffic management and massive pollution load. Sustainable transport may become a key tool for dealing with these problems and to provide better ways to cope with future demand in the transportation sector. A sustainable transportation system involves improvements in vehicles, fuels and infrastructure as well as reductions in environmental degradation and economic losses.

Cumulative Effects Assessment (CEA) is a systematic procedure for identifying and evaluating the significance of effects from multiple activities or actions or interventions [12, 19, 37]. Cumulative effect does not mean the simple summation of all the effects, the effects can be more or less than the summation based on the factors or stressors when associated together [12]. According to Frank et al., 2010 [18], cumulative effects are the successive, incremental and combined impacts of one or more activities on society, the economy and the environment. It results from the aggregation and interaction of impacts on a receptor to cause major changes in environmental, social and economic systems. Thus the cumulative effects of any system (or any plan or project) can be stated as the total effects on the resources, ecosystem, or human community due to the activities of that system; as was supported by Cooper, 2004 [12], Therivel and Ross, 2007 [41], Hegmann and Yarranton, 2011 [21]. Over the years, Cumulative Effects Assessment (CEA) has become an increasingly important component of environmental assessment (EA) for different systems and planning strategies (equally within Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) frameworks), which was highlighted in various studies; viz. Cavalcanti and Rovere, 2011 [11] for SEA of

Thus CEA can play the role of an appropriate analytical approach for assessing the performances of any system. Road transport system of a city governs the quality of the city dwellers’ life to a great extent and therefore the system’s performances need to be assessed. In this study, a methodological approach was developed to assess the cumulative effects of the road transport system, which is an innovative approach within the scope of this research. CEA for the transport sector is not a new idea and it has been done to assess the impacts for specific strategies [6]; but the dissimilarity is encompassed in evaluating the transport system’s performance considering it as a host of different interconnected factors and in analysing the connectedness of the factors, which is usually done for ecosystem’s assessment. The study focuses on developing a methodology that can assess the state of a transport system, which consequently supports in analysing its sustainability.

In this study, Dhaka city of Bangladesh was chosen as a representative of many cities of developing countries in order to highlight the factors that regulate the transport sector’s performances and addressing of which (the factors) through management strategies can lead to a least cost inducing transport system. Dhaka’s transport characteristics are discussed as a reference to the responsible set of factors, which might be different for different city’s transport systems. Dhaka’s transport environment is characterized by diverse vehicles using the same road space, traffic congestion, indiscipline and mismanagement, lack in law enforcement, and increasing environmental problems. Huge volume of vehicles, lack of parking facilities, occupancy of footpaths by several vendors, frequent u-turns/intersections and traffic management failures are some of the factors that exaggerate the congestion and pollution (Field Survey 2013; [31, 40]). The road traffic contributes a huge amount of air pollutants to the environment. To a large extent, the main cause of traffic pollution in the city is the number of vehicles on road and their running behaviour. Human exposure is the major apprehension of these pollutants, which initiates hidden costs to society with regard to its effects on human health. Exposure of this pollution to the population is an important sector to deal with and requires an efficient management strategy to ensure the quality of the transportation service while minimizing environmental, health and economic impacts.

The paper tends to focus on developing a methodological approach that is capable of assessing the impacts of the road transport sectors; not developing a strategy to attain total sustainability of this sector, but identifying the major responsible set of factors (stressors) and their degree of relationships. The study aims to provide an approach to scrutinize the stressors or the set of stressors that have synergistic impacts. Thus this paper can facilitate the development of sustainable road transport management strategy for mega cities like the Dhaka city by providing a pathway to attain the least effect incurring solution of the system, with the low cost, higher social acceptability and minimized pollution load from the transport sector.

II. HOW DOES CEA INCORPORATE WITHIN SUSTAINABILITY ASSESSMENT?

The concept “Cumulative Effects” works by the addition or accumulation of effects from different activities. It may result from the accumulation of similar effects or the synergistic interaction of different effects [16]. The magnitude of the combined effects along a pathway can be equal to the sum of the individual effects (additive effect) or can be an increased effect (synergistic effect) [12, 41].

The CEA analysis involves identification of impact sources, affected resources, using a set of key indicators to examine cumulative effects arising from the aggregate of these effects [2]. Since stressors may interact with each other and have combined effects on the system, it is essential to assess the kind of interactions among stressors.

Sustainability is a condition in which economic, social and environmental factors are optimized, taking into account indirect and long-term impacts [43]. The term ‘sustainability’ does not denote threat analysis; sustainability is about systems analysis. Sustainability is a concept that promises economic development,
enhances social equity and protects the natural environment as the economic development strategy can be viable in the long run when social demand and environmental concerns are considered [23, 29, 44].

CEA can be a potential analytical approach for the sustainability assessment since it provides an integrated framework with environmental, social or economic considerations drawn from multiple stressors of any multi-faceted, interconnected, and complex system. CEQ, 1997[13] affirmed that without incorporating cumulative effects into environmental planning and management, it would be impossible to move towards sustainable development. To a large extent, the goal of cumulative effects assessment is to bring in environmental considerations into the planning process at an early stage for determining efficient decisions. Counsell and Hougton, 2001 [14] also explained that the potential direct, indirect and cumulative impacts need to be evaluated in order to integrate sustainable development objectives in the formulation of policies and planning strategies. As like Environmental Impact Assessment (EIA), CEA does not neglect additive and synergistic effects, besides CEA tends to integrate socioeconomic, cultural, and environmental factors in decision-making that allows cumulative effect assessment to be an adequate tool to pursue sustainability assessment [36, 38]. CEA, if done well, predicts and approximates stressors that the system will actually be exposed to, which is equivalent to a sustainability appraisal for that system [33]. As revealed from the literature survey, several studies acknowledged CEA as an important tool for environmental sustainability assessment, and hence in this study, a methodology was developed for conducting CEA with the aim to assess the performance of the transport sector.

III. ROAD TRANSPORTATION SYSTEM IN DHAKA CITY, BANGLADESH

Dhaka city is discussed here as a case study to provide a reference of what the transport systems stressors could be. The stressors were identified for Dhaka city through a detailed field survey conducted in 2013. Being the administrative, commercial and cultural capital of Bangladesh, Dhaka city plays a major role in the socioeconomic development of the country. But the existing transportation system is a major obstruction for the development of the city. Unplanned urbanization, especially poor transportation planning and lower land utilization efficiency has turned the city into a dangerous urban jungle [26, 31].

Dhaka is one of the most crowded and congested cities in the world. Traffic congestion, the major concern of road transportation in this city not only causes increased costs, loss of time and psychological strain, but also creates serious threats to the socioeconomic environment [31]. Alam and Habib, 2003 [3] predicted that by 2020, about 60% of the major roads in Dhaka city would become highly congested with an average speed of less than 5 km/hr during peak hours. According to STP, 2004 [39], a major portion (43%) of all motorized vehicles within this city are car or light vehicles, but in the case of passengers’ services their contribution is relatively very low (only 9.6%). Not only traffic congestion, but inadequate parking facilities, lack of mass transit facilities, poor traffic management, vehicular pollution all tend to worsen Dhaka’s road transport with each day (Field survey 2013; [39]). According to a field survey undertaken during 2013, which was supported by ADB, 2011[1], the main problems of traffic system in Dhaka city include a lack of clear traffic regulations and their poor enforcement and air-noise pollution from old and ill-maintained motorized vehicles.

The major stressors that were identified by assessing the transport system characteristics of Dhaka city (among the 19 identified stressors) include high traffic volume, dominance of private vehicles in the vehicle composition, poor public transport system, traffic congestion, indiscipline driving, traffic mismanagement, lack of law enforcing, pedestrian jay walking, occupied footpaths and road sides, illegal on road car parking and illegal bus stopping on road, air and noise pollution, and so on. These identified stressors act as the input parameters of digraph and matrix analysis for the Cumulative Effects Assessment (CEA) of the transport system; the methodological approach to quantify the cumulative effects is discussed in the following section. The stressor might vary for different urban transport system of different cities, which need to be identified accordingly (like this paper identified for Dhaka city) prior to adopt the approach of CEA discussed in this research.
IV. CUMULATIVE EFFECTS ASSESSMENT: QUANTIFYING EFFECTS FROM ROAD TRANSPORT SECTOR

The purpose of this paper is to conceptualize and illustrate a CEA methodology of road transport sector as an analytical tool for sustainability analysis; where CEA is conducted based on analysing the structure of interactions among the road transport sector stressors and economic evaluation of effects or losses from these stressors. The series of conceptualized methodological steps are discussed briefly in the following sub sections. This study provides an innovative methodological framework of conducting CEA for transport systems, not the results of that CEA, and the framework is conceptualized after testing on Dhaka city’s transport system.

The approach of conducting CEA involves 3 steps, (i) analysing multiple interrelationships among the stressors, (ii) the economic evaluation of the effects and the degree of connectedness among the stressors, and (iii) assessing the cumulative effects. This paper discusses how the steps can be followed to assess the cumulative effects of a road transport sector, and does not provide a result obtained by following the steps. The multiple interrelationships among the stressors are analysed (step 1) to identify the most interconnected stressors that affect the performance of the system simultaneously, and performance of one stressor regulates the performance of its correlated stressors. Therefore, it’s important to identify the interconnected stressors in the first instance. The ‘Digraph theory’ and ‘matrix analysis’ are the approaches, which are usually used for identifying the interactions and interconnectedness among the stressors of a system respectively, especially for the ecosystems [7, 8, 24, 28, 32, 42, 46, 47, 48]; but haven’t been used for CEA of an urban system. Thus, conducting CEA for a road transport system by using both digraph theory and matrix analysis (as one of the core steps) makes it an innovative approach.

A. Analysing Multiple Interrelationships among the Stressors

In order to analyse the multiple interrelationships among stressors, a series of actions are required to undertake- 

a) Identification of the list of stressors (S_i) those have impacts on the road transport sector; Where, S = Stressors of concern and i = Number of Stressors (i =1, 2, 3,…, n).

b) Construction of a digraph [32] in order to use as the basis for analysing the multiple interrelationships among the stressors in S_i. Formally, a digraph is simply a collection of vertices or nodes with directed arcs joining certain pairs of vertices. Digraph of transport sector stressors is to be formed by treating each stressor as a vertex and linking stressors with directed arcs. By constructing a digraph, interactive loops among the stressors are created. An example of constructing a hypothetical digraph is provided in Figure 1. In order to analyse the structure of road transport sector stressors, the digraph is to be created not only based on the direct impacts of one stressor upon another but also based on indirect impacts resulting from a sequence of interactions. The digraph construction was tested for a transport system (to conceptualize the interactions between stressors) by analysing the field survey data, which was conducted in 2013 to identify the stressors of Dhaka city transportation.

Figure 1: A hypothetical digraph of stressors S1, S2, S3, S4, S5 and S6

As an example, Figure 1 denotes that, S3 has direct impacts on S2, and S4; S3 does not directly effect on S5 and S6 but it does so indirectly through a pair of interactions represented by two directed arcs, the first joining S2 to S6 and the second joining S4 to S6.

c) Matrix analysis is to be done based on the constructed digraph of transport system stressors, in order to find the interconnected stressors of the system. The series of steps for matrix analysis, which was provided by Wenger et al., 1999 [46], would lead to identification of the interconnected stressors. The matrix analysis for the constructed hypothetical
diagraph with 6 stressors (showed in Figure 1) is provided below.

i. An adjacency matrix \( (A = a_{ij}) \) (Figure 2) is developed for the stressors as, \( a_{ij} = 1 \), if \( S_i \) has an impact on \( S_j \); and \( a_{ij} = 0 \), if \( S_i \) does not have an impact on \( S_j \).

\[
\begin{array}{ccccccc}
S1 & S2 & S3 & S4 & S5 & S6 \\
S1 & 0 & 1 & 0 & 0 & 0 & 1 \\
S2 & 0 & 0 & 0 & 0 & 0 & 1 \\
S3 & 0 & 1 & 0 & 1 & 0 & 0 \\
S4 & 0 & 0 & 0 & 0 & 1 & 0 \\
S5 & 0 & 0 & 1 & 0 & 0 & 1 \\
S6 & 0 & 1 & 0 & 0 & 0 & 0
\end{array}
\]

Figure 2: Example of adjacency matrix (A) of stressors S1, S2, S3, S4, S5 and S6

ii. The reachability matrix, \( R \) (Figure 3) is computed directly from the adjacency matrix (A), as \( R = B \left[(I+A)^{n-1}\right] \); where, \( I = \) Identity matrix, \( B = \) Boolean function, \( n = \) Number of vertices.

\[
\begin{array}{ccccccc}
S1 & S2 & S3 & S4 & S5 & S6 \\
S1 & 1 & 1 & 1 & 1 & 1 \\
S2 & 0 & 1 & 0 & 0 & 0 & 1 \\
S3 & 0 & 1 & 1 & 1 & 1 \\
S4 & 0 & 1 & 1 & 1 & 1 \\
S5 & 0 & 1 & 1 & 1 & 1 \\
S6 & 0 & 1 & 0 & 0 & 0 & 1
\end{array}
\]

Figure 3: Example of reachability matrix (R) of stressors S1, S2, S3, S4, S5 and S6

iii. Then transpose matrix \( (R^t) \) of reachability matrix (R) is determined (Figure 4).

\[
\begin{array}{ccccccc}
S1 & S2 & S3 & S4 & S5 & S6 \\
S1 & 1 & 0 & 0 & 0 & 0 \\
S2 & 1 & 1 & 1 & 1 & 1 \\
S3 & 1 & 0 & 1 & 1 & 1 \\
S4 & 1 & 0 & 1 & 1 & 1 \\
S5 & 1 & 0 & 1 & 1 & 1 \\
S6 & 1 & 1 & 1 & 1 & 1
\end{array}
\]

Figure 4: Example of transpose matrix \( (R^t) \) of stressors S1, S2, S3, S4, S5 and S6

iv. A matrix of \( RxR^t \) is then developed from the transpose and reachability matrix.

v. The products of \( RxR^t \) matrix portray the different clusters of closely related stressors. These clusters of closely related stressors provide with the interconnected stressors of the system (as shown in Figure 5).

\[
\begin{array}{ccccccc}
S1 & S2 & S3 & S4 & S5 & S6 \\
S1 & 1 & 0 & 0 & 0 & 0 \\
S2 & 0 & 1 & 0 & 0 & 0 \\
S3 & 0 & 0 & 1 & 1 & 1 & 0 \\
S4 & 0 & 0 & 1 & 1 & 1 & 0 \\
S5 & 0 & 0 & 1 & 1 & 1 & 0 \\
S6 & 0 & 1 & 0 & 0 & 0 & 1
\end{array}
\]

Figure 5: Example of a product of matrix (RxR') of stressors S1, S2, S3, S4, S5 and S6

B. Economic Evaluation of the Effects and the Degree of Connectedness

After identifying the interconnected and individual (non-connected) stressors, the next step adopted for the CEA approach was economic evaluation of the effects. The cost associated with each stressor while accumulated would provide the total cost of the system, which is the cumulative cost (or effect) of the system. The economic evaluation of the effects of different stressors (like estimating monetary value of losses resulting from stressors) can be diverse, and the evaluation can be done as per the suitable methodological approach. The paper presents the concept of economic evaluation for conducting CEA and thus the details of the economic evaluation methodology are not provided (as economic evaluation of stressors is itself a big task to perform with sophisticated and varied methodological approaches and requires another dimension of research for that). Several studies have been conducted to economically evaluate the effects associated with transport sector, viz. direct estimation of damages associated with air emissions (Small 1977[45]; Krupnick and Portney 1991[22]; Hall et al. 1992[20]; Small and Kazimi 1995[34]; Maddison et al. 1996[25]), health cost related to air/noise pollution (Azad et al. 2003[5]; Caulfield and Mahony 2007[10]; Chowdhury and Imran 2010[15]; Michiels et al. 2012[27]), air pollution impacts on human health and ecosystem (Preiss and Klotz 2007[30]), external costs (congestion, accident and others) of transport sector (EC 2008[17]). These studies can guide to formulate a suitable methodological structure for economic evaluation of the effects of a transport system depending
on the stressors of concern in that particular transport system.

Analysis of the degree of connectedness among the interrelated stressors, as they they create the synergistic effects, can be done by statistical analytical methods, based on the effects (costs) of the stressors or based on the characteristics of the stressors in the system. The resulting effects of the connected stressors would provide the synergistic effects (or synergistic costs when considered the monetary value) of the stressors.

C. Assessing Cumulative Effects (CE) of Road Transport System

After identifying the interconnected stressors, their degree of interconnectedness and the costs associated with the stressors, the Cumulative Effects (CE) of road transport system can be assessed by using following equation:

\[ CE = CEc = \sum_{i=1}^{n} SEc + \sum_{i=1}^{n} IEc + \sum_{i=1}^{n} IEnm \]

Where,
- \( CE \) = Cumulative Effects
- \( CEc \) = Cumulative costs (monetary value of cumulative effects)
- \( SEc \) = Synergistic Effects of mostly connected stressors (in term of monetary value)
- \( IEc \) = Individual Effects of non-connected stressors (in term of monetary value)
- \( IEnm \) = Individual Effects of non-connected stressors (Non-monetary effects)
- \( n \) = number of individual stressor

\( \text{CEc} = \text{Costs} = \text{Economic, social and environmental effects (including cost of pollution) that are convertible to monetary values in order to bring those effects on the same platform, which enables to account cumulative effects on the same criteria.} \)

Depending on the identified degree of connectedness among the stressors and their positive or negative relationships, the synergistic effects (or costs) of the connected stressors (SEc) would be accounted. The individual effects (IEc and IEnm) would be obtained from the individual stressors. The summation of all the effects thus would provide the cumulative effects of the transport system.

V. CONCLUSION

The planning strategy for sustainable road transport system can be developed through analysing the total circumstances, which can be obtained by a CEA considering all the stressors prevailing in the system. The approach of assessing the stressors’ connectedness developed in this study is an important phase of CEA framework. The obtained stressors relations can support developing different scenarios to illustrate “what-if” relationships, which can act to formulate a generalized linear model for planning strategy of a given system. Developing such model can thus provide the cumulative effects of a given system and the parameters (or set of parameters) responsible for increasing total effects; which can facilitate to identify the focus point to address while planning for road transport sustainability.

VI. REFERENCES


An Investigation of the Amount of Dose Rate Due to Radioactive Count within Sokoto Metropolis

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ABSTRACT

This paper aims to unveil the level of risk to biological system due to ionizing radiation within Sokoto metropolis. It is known to cause cancer and other related ailments. Thirty (30) randomly sampled points were measured with the aid of Dose Rate Meter, Rados [RDS-120]. The energy deposited to biological systems by gamma-ray flux was measured in micro sivert per hour (\(\mu\)Sv/hr). We found a significant total amount of dose rate at 2.95 \(\mu\)Sv/hr with an arithmetic mean of 0.10 \(\mu\)Sv/hr with an annual exposure rate of 864.0 \(\mu\)Sv/yr. This amount which is quite significant above the worldwide effective dose rate of 70 \(\mu\)Sv/yr. This result indicates a radiation hazards contributed by either primordial radionuclides or cosmogenic radionuclides which suggest for mitigation actions and calling for further research.

Keywords: Dose-rate, RDS-120, Sokoto, Gamma-Ray, Cancer

I. INTRODUCTION

Background radiation could be as a result of naturally occurring radiation emitted by soil, ground water, building materials, radioactive substance in the body (especially potassium 40) and cosmic rays from the outer space [1]. Radiations have also been widely applied to various purposes such as agriculture, biology, industry, medicine, and electric power generation [2]. The rocks we see and the soil beneath our buildings are naturally the main sources of radioactivity which is typically four or five times more concentrated indoor than outdoor premises. Building materials, water and Natural gas are additional sources of these menaces [1]. By definition, primordial radionuclides are radioactive sources that have been on earth surface since time immemorial. For the purpose of radiation protection, radiations from uranium-238 and thorium-232 decay series, and potassium-40 are found almost throughout the earth in relative concentrations [3]. Due to the varying concentrations of each type of radioactive sources in different parts of the world, this dose rate which is an energy deposited by gamma-ray flux level varies across the world [4]. The safety and danger continues to vary from one part of the world to another, with the ill effects on humans or nature also varying. In some parts of the globe, high concentrations of radioactive can have detrimental health effects [5], and hence it is of health importance to be able to determine amount and concentration of the background radiation, and to establish the distinction between safe and unsafe levels as well as to determine causes of each type of radiation maladies. The analysis of domestic water shows that the natural radioactivity in them varies over a wide range of significance, mainly depending on the geological make-up of the soil. The radiotoxicity of Uranium isotopes (238U, 234U and 235U) are non-negligible [2]. Furthermore, several radionuclides in the radioactive decay chain taking from 238U and 235U are significantly radiotoxic. The most radiotoxic and most important among them is radium, which is a known carcinogen and exists in several isotopic forms. The predominant radium isotopes in groundwater are 226Ra, an alpha emitter with a half-life of 1600 years, and 228Ra, a beta emitter with a half-life of 5.8 years [6]. The present work is aimed at to measure the dose rate with the aid of Dose Rate Meter, Rados [RDS-120] from CERT, Zaria. Thereby finding the annual dose exposure by an individual from the gamma-ray flux within the typical urban dwelling of Sokoto city.
A. Radiation in Sokoto

The occurrence of oceanic upwelling of North African coast during the upper Cretaceous to Eocene times is well documented. A high organic productivity which resulted in the development of economic phosphate deposits in the Tethyan belt. This belt stretches across the North African and Arabian Plates and is known as the Tethyan Phosphogenic Province [7]. Phosphate deposition in the Sokoto basin was derived from the incursion of phosphate rich water from the Tethys Sea. The Tethys Sea during the late Paleocene covered parts of Libya, Sudan, Niger Republic, Chad and Mali [8,9,10]. The Sokoto phosphate belongs to the Tethyan Phosphogenic Province. The Phosphate was precipitated from sea water during the deposition of the Dange and Gamba Formations. The presence of the oolites indicates the occurrence of accretionary growth phases during the phosphate sedimentation. The calcite found in the phosphate was precipitated from sea water as microsporite. Some of the phosphate was also formed through the process of diagenesis as a partial replacement of carbonate mud by apatite [11,12].

During the regression of the Tethys Sea due to sea level changes, the microsporite was broken up by biological and physiochemical processes. This would have occurred when in a semi-lithified state to be subsequently transported ultrabasinnaly. The bioturbations on the nodules indicates phosphate deposition in shallow water probably within the upper shore face environment. The lack of structural traps from tectonism via differential displacement of faulted blocks hindered economic phosphate accumulations [10].

B. The Study Area

The metropolis of Sokoto, comprising majorly Sokoto-North and South local government areas, while little parts of Wamako, Kware, Bodinga and Dange-Shuni local government areas are found entrapped at the outskate of the metropolis, but constitutes the study area of this research. Sokoto state lies on the Latitude 13.083333°, Longitude 5.25°, and Altitude 895 (feet). It is in the extreme northwest of Nigeria, bordering Niger and Benin Republics. It has an annual average temperature of 33.3°C [13, 14].

C. Radioactive Decay

Radioactive decay is as could be concluded a random process and has been observed to follow the statistical distribution of equation one (1) below [15]. This essentially means that, the rate of decay of radioactive nuclei in any sample depends only on the number of decaying nuclei in the sample. Mathematically this can be written as follows:

\[ \frac{dN}{dt} = -\lambda N \]

or

\[ \frac{dN}{N} = -\lambda dt \]

(1)

Where \( dN \) represents the number of radioactive nuclei in each measured sample points in the time.

where \( dt \cdot \lambda \) is the proportionality constant which is generally referred to in so many literatures.

II. METHODS AND MATERIALS

Sampling and Measurement

The data collection in this project shall be carried out within Sokoto metropolis, outdoor, indoor of homes and enclosed workplaces. A total of 30 sample points were measured and recorded within an interval of 20 minutes for three consecutive times so that the mean value of any measured point will be recorded. Open fields like football pitches, parks, farms and gardens were used for outdoor measurements, whereas houses, churches and mosques were used in indoor inspection to account for both indoor and outdoor presence of the dose rate, three counts of the RDS-120 is ensured for in and outdoor before the mean is taken. To account for fairness between all the sample points, we adopted the random sampling method which gives all the samples in question an equal chance of being chosen with no sample point considered in preference to the other. The instrument is held 3.5 feet above the ground at every sample point due to 5 feet average human height, and the arithmetic mean of the three readings was found by the relationship below.
\[ X = \frac{x_1 + x_2 + x_3 + \ldots + x_n}{n} \]

or

\[ X = \frac{\sum_{i=1}^{n} x_i}{n} \]  

(3)

Where the symbol \( \Sigma \) means adding up set of data in this case set of measurements from all the sample points \( x_1, x_2, x_3, x_4 \) up to \( x_n \) and \( n \) at the denominator remains the total number of samples so added.

### III. RESULTS AND DISCUSSION

Table 1: The Measured Background Radiation for Homes and Workplaces in Sokoto Metropolis. From table 1 below, we could see that sample point number 10 in the serial arrangement has the highest dose rate of 0.13 \( \mu \) Sv/hr in this research followed by sample point with serial number 27 and dose rate 0.12 \( \mu \) Sv/hr respectively. Below is graphical analysis of the table above. Fitted line is physically used to investigate the relationship between two variables: here, radioactive dose rate (\( \mu \) Sv/hr) and the time interval of 20 minutes per of every reading as discussed above. The two conditions have enabled a fitted line plot which displays the as the response on the Y-axis, then a linear model that best describes the relationship was used to visualize the fitted line plot showing that every increase in time of 20 minutes interval paves way for a variation in the reading of another radioactive dose rate (\( \mu \) Sv/hr).

**Table 1:** Measured Background Radiation

<table>
<thead>
<tr>
<th>S/N</th>
<th>Sample Points Identity</th>
<th>Time/minute</th>
<th>Background Radiation (( \mu )Sv/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sok1</td>
<td>20</td>
<td>0.08</td>
</tr>
<tr>
<td>2</td>
<td>Sok2</td>
<td>40</td>
<td>0.10</td>
</tr>
<tr>
<td>3</td>
<td>Sok3</td>
<td>60</td>
<td>0.07</td>
</tr>
<tr>
<td>4</td>
<td>Sok4</td>
<td>80</td>
<td>0.10</td>
</tr>
<tr>
<td>5</td>
<td>Sok5</td>
<td>100</td>
<td>0.08</td>
</tr>
<tr>
<td>6</td>
<td>Sok6</td>
<td>120</td>
<td>0.10</td>
</tr>
<tr>
<td>7</td>
<td>Sok7</td>
<td>140</td>
<td>0.10</td>
</tr>
<tr>
<td>8</td>
<td>Sok8</td>
<td>160</td>
<td>0.10</td>
</tr>
<tr>
<td>9</td>
<td>Sok9</td>
<td>180</td>
<td>0.08</td>
</tr>
<tr>
<td>10</td>
<td>Sok10</td>
<td>200</td>
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</tr>
<tr>
<td>11</td>
<td>Sok11</td>
<td>220</td>
<td>0.10</td>
</tr>
<tr>
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<td>240</td>
<td>0.11</td>
</tr>
<tr>
<td>13</td>
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<td>260</td>
<td>0.10</td>
</tr>
<tr>
<td>14</td>
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<td>280</td>
<td>0.10</td>
</tr>
<tr>
<td>15</td>
<td>Sok15</td>
<td>300</td>
<td>0.11</td>
</tr>
</tbody>
</table>

![Figure 1: A fitted line plot of dose rate in Sokoto](image1)

**Figure 1:** A fitted line plot of dose rate in Sokoto

![Figure 2: A trend plot of dose rate in Sokoto metropolis](image2)

**Figure 2:** A trend plot of dose rate in Sokoto metropolis

### IV. CONCLUSION

The significant annual exposure rate of 864.0 \( \mu \) Sv/yr. of dose rate in every environment is an indication of health implication that either primordial radionuclides or anthropogenic activities giving rise to the dose rate is prominent, one of which commonly causes bone cancer [16] While low dose rate seems to produce insignificant exposure hazards, multiple and cumulative exposure showing the vast variation of the data in this work with increase in time intervals eventually leads to the risk of major cancer as no safe level of prolonged exposure to radiation is established[17, 18].
V. REFERENCES


Bioinformatics Methods for Biochemical Pathways and System Biology Analysis

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ABSTRACT

The analysis of biochemical pathways and system biology has gained significance because of their role in understanding disease and drug discovery. Bioinformatics analysis of the pathways has emerged to understand the genotype-phenotype relationship on a large scale. The techniques integrate the molecular information from the databases with simulation of metabolic networks. These methods also help in representation of genes, proteins and metabolic pathways in combination with dynamic simulated environment. In this paper we reviewed some applicable bioinformatics tools for analytical study of three types of pathways such as metabolic, genetics and signalling pathways along with the information about their principle, work system and their direct access link to the databases and programs. This study helps scientists in fast, economic, high accuracy and large scale based outputs of pathways analysis of their appropriate research involving the biochemical pathways. Bioinformatics tools listed in this paper are named as RegulonDB, WIT,UM-BBD, EcoCyc, MetaCyc, Enzyme and metabolic pathways database, KEGG, KEGG BRITE, Gene network database, Gene path SPAD, STCDB, TRANSPATH Netpath, Signal link2.0.

Keywords: Bioinformatics Tools, Analytical Study, Biochemical Pathways, System Biology

I. INTRODUCTION

A pathway can be defined as a modular section of networking molecules to perform a cellular function. The pathways’s products are different based on the need of the cell; they can be structural or functional responses. The pathways are essential for growth and survival of the organism. Inability to fulfil a cellular function due to failure in functioning of a pathway lead to emergence of the diseases[1]. So the pathways are important key targets for understanding the diseases and drug discovery.[2] A 2-D diagram illustrating interconnection of the protein and non-protein substances usually represent a pathway. As an example a simple pathway like o-> ->o is a graph whose nodes (small circles) correspond to different biomolecules and modes (arrows) represent the nature of molecule – molecule interaction. A pathway network is a network of interconnected pathways deal with a network of cellular function and regulation. [3,2].There are several types of pathways such as metabolic, genetics and cell signaling pathways and different types of codes for their presentation.[1]. Metabolic pathways are agent for metabolism of an organism and involved in generation of essential compounds such as amino acids, lipids, sugar and the energy for their synthesis and their use for building proteins and cellular structures. In metabolic pathway, the metabolite as an initial chemical underwent modification by a chain of chemical reactions which are catalyzed by enzymes in order to fulfill a function. [1,3]. Genetic pathways are also central emphasis in biological systems. Genetic pathways concerned with the regulation of genes. In a simple representation of a genetic pathway, nodes represent genes and phenotypes and arcs stand for direct impact of genes on other genes and phenotypes. In computational analysis of genetic pathway and disease studies related to this pathway, mutations are main tools for definition and classification of genes that participate in a biological mechanism. Determination of the relationship between the genes are then fulfilled using combination of mutations in two or more genes. Genetic networks drawn by generation of
biological mechanism with molecular details which is performed by integration of the relationships between gene pairs. This method of ordering gene function is very fast and economic as compared to the time and cost required to obtain the experimental data. [1]. Cell signaling pathway can be defined as transmission of signals from exterior to interior of the cell using secretion of chemical factors. Inactivation and deficiency in this pathway lead to emerging several disease and cancers, hence, analysis of signaling pathway is a central importance in study of cancers and drug discovery. [3]. There are four types of cell signalling: Hormones secreted in endocrine glands are transported into the bloodstream and can be traveled widely throughout the body. Paracrine signals: are secreted by cells into extracellular medium in nearby cells .Neuronal signals are conducted along axon to distant target cells. Contact-dependent signals involves direct membrane-to-membrane contact of cells with each other. The cells also produce internal signals, e.g. generation of signals for stopping cell division during chromosome duplication and also for starting repair processes or apoptosis. [1,3]. The signaling pathway also called regulatory pathway as the signals and machinery for their processing form a regulatory network. The goal of the network is to control the life process and maintain the equilibrium level for organism to grow and survive. The most important classes of regulatory networks in analysis of signaling pathways are feedback systems (positive and negative feedbacks) and cyclic processes. These classes are essential for proliferation and differentiation processes in multicellular organism .Bioinformatics analysis and computational interpretation of signalling networks help in understanding biological system and related diseases. [3,4].

II. METHODS AND MATERIAL

A. Bioinformatics sources for metabolic pathways analysis:

RegulonDB (http://www.cifn.unam.mx/Computational_Biology/regulondb) is a database for signal transduction pathways and transcription regulatory system in Escherichia coli. This database provide information about organization of operon and their disintegration into transcription units , promoters ,regulatory proteins and their binding sites, ribosomal binding sites terminators .et. RegulonDB contains both documentation and prediction objects. In addition it is linked with Swiss-prot, with microarray databases for analysis and visualization of microarray experiments. [5]

WIT
The WIT (What Is There) (http://wit.mcs.anl.gov/WIT2/) is a comparable computational system for analysis of sequenced genomes and generation of metabolic reconstructions derived from chromosomal sequences and metabolic modules. [6]

UM-BBD
University of Minnesota Biocatalysis/Biodegradation Database (UM-BBD, http://umbbd.ahc.umn.edu/). It includes information about microbial reaction and biodegradation pathways for chemical compounds. It contains database for pathways, reactions, compounds, enzymes, and microorganism entries. [7]

EcoCyc (http://www.ecocyc.org/) is the database for Escherichia coli K-12 MG1655 including its genetic transporters, transcriptional regulation and metabolic pathways. [1].

MetaCyc database: (http://metacyc.org)MetaCyc is a database of experimentally clarified metabolic pathways from variety of different organisms. MetaCyc gathered information from over 2600 different organisms including 2260 pathways. These gathered pathways are of both primary and secondary metabolisms. The database also contains information about metabolites, reactions, enzymes and genes. The purpose of MetaCyc is to list and file the bank of metabolism by stocking a descriptive sample of each experimentally clarified pathway. MetaCyc applications provide online curated database of metabolism , prediction of metabolic pathways from sequenced genomes, reinforcement of metabolic engineering by enzyme database and supporting of metabolomics research via metabolite database. [8]

Enzyme and metabolic pathways database (http://emp.mcs.anl.gov) is a only encyclopedic biochemical data source. The configuration allows various types of tables and stoichiometric matrices to encode metabolic pathways, mechanisms of reactions, rate law and scale of numeric data. [9]

KEGG (http://www.genome.jp/kegg/) stands for Kyoto Encyclopedia of Genes and Genomes is an important pathway database source for study and analysis of high – level functions and efficacies of the biological system, such as the organism, the cell and the ecosystem, from
the information at molecular level. It contains different section such as pathways, reference pathways and ortholog tables [10].

B. Bioinformatics tools for analysis of genetic pathways:

KEGG: as discussed in metabolic pathway part, contain graphical presentation (genome maps) and gene catalogs. [10].

KEGG BRITE
(http://www.genome.jp/kegg/brite_ja.html ) stands for KEGG bimolecular reaction pathways for information transfer and expression .KEGG BRITE is a database of binary relations which is not limited only to molecular interactions but also computes and compares graphs involve genes and proteins. In this collection hierachical text(text)files are created manually .The database consists several sets of pair association including the generalized protein interactions that underlie the KEGG pathway maps, systematic experimental information on protein- protein interactions .[11]

Gene network database
(http://www.genenetwork.org/webqtl/main.py) is a bioinformatics tool for genetic pathways especially for analysis of gene regulatory networks. This database provides information about linkage of DNA sequence variants (polymorphism) to related differences in gene and protein expressions. Data sets of Gene network are made up of large sets of genotypes and phenotypes which are obtained from closely related organisms .This data base is helpful for understanding of mechanism of embryogenesis as regulatory gene networks deal with encoding peptide products, transcription factors and enzymes used in differentiation and morphogenesis.[1]

Gene path (http://magix.fri.uni-lj.si/genepath): is an automated program used for analysis genetic data and detection of genetic networks. This program creates the genetic network either from such constraints or by combination of constraints with a qualitative logic – based algorithm for identification of networks .The body of the program contains following entities: Genetic data, Expert defined pattern, abductive inference engine and network synthesis methods. .[12]

C. Bioinformatics tools for analysis of signalling pathways:

SPAD or Signalling pathway data base (http://www.grt.kyushu-u.ac.jp/spad). This database provides information for signal transduction systems. It is a collective database which assembles information from protein –protein interactions, DNA and DNA and protein sequences. The database consists of four parts based on extracellular signal molecules such as Hormones, Cytokine, Growth factors and stress which are initials of intercellular signal transduction systems. [13].

STCDB
Signal transduction classification database:
(http://www.techfak.uni-bielefeld.de/~mchen/STCDB). This data base contains information about classification of signal transduction in eukaryotic cells. [14]

TRANSPATH
(http://www.biobase.de/pages/products/databases.html) an integrated database on signal transduction and a tool for array analysis. It is a database deal with interpretation of gene regulatory networks that corporate comprehensive information on signal pathway with tools for visual information and analysis. This data base is linked with TRANSFAC ( data base about transcription factors and their DNA binding sites) for the purpose of obtaining signaling transduction from binding of ligand to their targets and their products.[15]

Netpath http://www.netpath is another cell signaling pathway tools for study of signal transduction systems in human. This database contains diagrams of a number of immune signaling pathways and including 1600 reactions. [16].

Signal link 2.0 (http://signalink.org/) is an integrated database system for analysis of signaling pathways. The database includes pathway-specific transcription factors and post translational modifying enzymes, miRNA and scaffolds. [17]

III. RESULT AND DISCUSSION

The role of biochemical pathways and system biology has been highlighted in the study of diseases and drug discovery as they have gained importance in understanding the reasons of disorders and target detection .Bioinformatics tools emerged as alternative methods of study, analysis and drug discovery, for utilization of their benefits such as low cost, rapid process, high accuracy and large scale based studies. [18] For analysis of different multicellular organism's pathways such as metabolic, genetic and cell signalling pathways, bioinformatics tools also have taken a place in
analytical study of the pathways and biology system for the appropriate researcher to take their benefits. Using bioinformatics tools in the pathways analysis will provide the researchers with information on large scale, broad area and subjects involving the pathways. In metabolic pathways analysis, using bioinformatics tools such as RegulonDB, WIT.UM-BBD, EcoCyc, MetaCyc, Enzyme and metabolic pathways database, KEGG by the researchers will provide them with the encyclopaedic information about biochemical products, substrates, catalysing enzymes, amino acids, carbohydrates, lipids and toxic compounds etc. and their metabolic pathways specific diseases related to the failure in their functions. Bioinformatics tools like KEGG, KEGG BRITE, Gene network database, Gene path help the researchers in analysis of genetic pathways and regulatory networks in such a ways that give information about the genes, transcriptional factors, miRNA, genes encode enzymes involved in genetic related diseases. Computational analysis of cell signalling pathways using following tools such as SPAD, STCDB, TRANSPATH Netpath, Signal link 2.0 help in understanding signal transduction and signalling pathways specific transcriptional factors also to obtain information from binding of signal pathways specific ligands to their targets and their products which all help in understanding the diseases and drug discovery deal with the appropriate pathways. So study of the pathways using bioinformatics tools has gained significance in biology field to reach the goal of discovery of novel approaches for better treatment of the diseases. Recently researchers discovered many biomarkers, drug targets such as, CDKs, GPCRs, aquaporins and ion channels related to different types of diseases like cancers but detailed and comprehensive information about their pathways and system biology is required, these bioinformatics tools can be helpful for them to utilize their benefits such as economic process, rapid computation, short time interpretation, high accuracy results and more detailed information due to availability of large scale study. So introduction of available tools to the researchers involved in such studies will help them to use them in their research analysis and take the benefits of such tools. But application of such tools in analysis studies still requires sufficient knowledge of bioinformatics and computational skills. Although these tools are useful and rapid for researchers but still they are not lack of disadvantages such as comprehensive information about all necessary pathways, interpretation tools and other programming related to analysis and detection of other genetic and metabolic parts, so integration of these tools with lab-based techniques will enhance their power and cover disadvantages of the tools.

V. REFERENCES


IV. CONCLUSION

Bioinformatics analysis of biochemical pathways and system biology has gained importance to utilize their benefits such as economic process, rapid computation, short time interpretation, high accuracy results and more detailed information due to availability of large scale study. So introduction of available tools to the researchers involved in such studies will help them to use them in their research analysis and take the benefits of such tools. But application of such tools in analysis studies still requires sufficient knowledge of bioinformatics and computational skills. Although these tools are useful and rapid for researchers but still they are not lack of disadvantages such as comprehensive information about all necessary pathways, interpretation tools and other programming related to analysis and detection of other genetic and metabolic parts, so integration of these tools with lab-based techniques will enhance their power and cover disadvantages of the tools.


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A Simple Hybrid Method for Finding the Root of Nonlinear Equations
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ABSTRACT

In this paper, we proposed a simple modification of McDougall and Wotherspoon [11] method for approximating the root of univariate function. Our modification is based on the approximating the derivative in the corrector step of the proposed McDougall and Wotherspoon Newton like method using secant method. Numerical examples demonstrate the efficiency of the proposed method.

Keywords: Secant method, Predictor-corrector, Nonlinear equations
Mathematics Subject Classification: 65K05, 65H05, 65D32, 34G20

I. INTRODUCTION

Consider a problem for solving nonlinear equation of the form

\[ f(x) = 0, \]  

(1)

where \( f: \mathbb{R} \rightarrow \mathbb{R} \) is continuously differentiable function suppose there is a solution \( x^* \in \mathbb{R} \) for which \( f(x^*) = 0 \). Newton’s method is one of the famous and well known method of solving equation (1)[11] Newton’s method iteratively produces a sequence \( \{x_k\} \) of approximations that converges quadratically to a simple root \( x^* \) from any given initial point \( x_0 \in \mathbb{R} \), in the neighborhood of \( x^* \) via:

\[ x_{k+1} = x_k - \frac{f(x_k)}{f'(x_k)}, \quad k = 0, 1, 2, ... \]  

(2)

where \( q_k = \frac{f(x_k) - f(x_{k-1})}{x_k - x_{k-1}} \).

In an attempt to reduce the computational cost of Newton’s method, secant methods have been introduced [5]. These methods approximate the derivative in Newton’s method using secant line.

Starting with two estimate of the root \( x-1, x_0 \), the iterate formula is given by

\[ x_{k+1} = x_k - q_k^{-1}f(x_k), \quad k = 0, 1, 2, ... \]  

(3)

The convergence rate of secant method is normally superlinear.

Several modifications of Newton method was given in order to reduce its computational cost or to increase its rate of convergence, see, for example, [2, 6, 8, 10, 13, 14] and reference therein. For determining the root of a nonlinear equation, Weerakoon and Fernando [16], suggest an improvement to the iteration of Newton’s method which involves an definite integral of the derivative of the function, and the relevant area is approximated by rectangular rule. Homeier [3], consider a modification of Newton method for finding zero of a univariate function. The modification converges cubically. Per iteration it requires one evaluation of the function and two evaluation of its derivative. Thus, the modification is suitable if the calculation of the derivative has a similar or lower cost than that of the function itself. Ozban [12], present some new variants of Newton method based on harmonic mean and midpoint integration rule. The order of convergence of the proposed method is three. Kou et al. [7], present a new modification of Newton’s method for solving nonlinear equation which converges cubically. The modification requires two function evaluation and one first derivative evaluation. Thus, the new method is preferable if the computational cost of the first derivative is equal or more than those of the function itself. Jayakumar [5], presents a new class of Newton’s method for solving single nonlinear equation. The method is the generalization of Simpson’s integral rule applied on the Newton’s theorem.
Wang [15], present a third-order family of Newton-like iteration method for solving nonlinear equations. These methods avoid computation of second-order derivatives and require one evaluation of the function and two evaluations of the first derivative per iteration. Newton’s method is said to fail in certain cases leading to oscillation, divergence to increasingly large number, or off-shooting away to another root further from the desired domain or off-shooting to an invalid domain where the function may not be defined. Tiruneh et al. [9], argue that a solution is still possible in most of these cases by application of Newton’s method alone without resorting to other methods and with the modified formula based on Newton’s method has better convergence characteristic than the classical Newton’s method. For the root of a nonlinear equation, (1) McDougall and Wotherspoon [11] presents a simple modification to the standard Newton’s method for approximating the root of a univariate function. The modified method converges faster with a convergence order \( 1 + \sqrt{2} \approx 2.4 \) which makes it super quadratic convergence rate compared with quadratic for the standard Newton’s method.

McDougall and Wotherspoon, obtained the following scheme: Given the initial starting point \( x_0 \), for \( k = 0 \), set

\[
x_0^* = x_0
\]

then

\[
x_1 = x_0 - \frac{f(x_0)}{f'(1/2 [x_0 + x_0^*])} = x_0 - \frac{f(x_k)}{f'(x_0)}
\]

followed by \( (\text{for } k \geq 1) \)

\[
x_k^* = x_k - \frac{f(x_k)}{f'(1/2 [x_{k-1} + x_{k-1}^*])}
\]

\[
x_{k+1} = x_k - \frac{f(x_k)}{f'(1/2 [x_k + x_k^*])}
\]

Our aim here is to present a hybrid method for solving nonlinear equations of one variable. This is achieved by avoiding the computation of derivative in the corrector step of the McDougall and Wotherspoon [11].

The rest of this paper is organized as follows. Section 2 is designed for the description and the algorithm of the new method. In section 3 computational experiment of the proposed method compared to the existing classical method is given, and finally the conclusion comes in section 4.

II. METHODS AND MATERIAL

Description of the New Method

In this section, we present our new scheme. Our method is based on approximating the derivative in the corrector step using secant method approach.

Trevor and Simon(2014)[11] suggest a predictor-corrector rule of the form ; given \( x_0 \), for \( k = 0 \)

set

\[
x_0^* = x_0
\]

\[
x_1 = x_0 - \frac{f(x_0)}{f'(1/2 [x_0 + x_0^*])} = x_0 - \frac{f(x_k)}{f'(x_0)}
\]

for \( k \geq 1 \)

\[
x_k^* = x_k - \frac{f(x_k)}{f'(1/2 [x_{k-1} + x_{k-1}^*])}
\]

\[
x_{k+1} = x_k - \frac{f(x_k)}{f'(1/2 [x_k + x_k^*])}
\]

Here, we approximate the derivative in each iteration (not including the first iteration) using secant method. Thus, we obtain the following modified scheme for \( k \geq 0 \)

\[
x_0^* = x_0
\]

\[
x_1 = x_0 - \frac{f(x_0)}{f'(x_0)}
\]

for \( k \geq 1 \)

\[
x_k^* = x_k - \frac{f(x_k)}{f'(1/2 [x_{k-1} + x_{k-1}^*])}
\]

\[
x_{k+1} = x_k - \sigma_k^{-1} f(x_k)
\]

where

\[
\sigma_k = \frac{f(x_k^*) - f(x_k)}{x_k^* - x_k}
\]

Algorithm for the Propose Method

Step 0: Given \( x_0 \in \mathbb{R} \), stopping tolerance \( \epsilon \) for \( k = 0 \) set \( x_0^* = x_0 \)

Step 1: Compute \( f(x_0) \) and \( f'(x_0) \)

Step 2: Compute \( x_1 = x_0 - \frac{f(x_0)}{t'(x_0)} \)

Step 3: Checking the stopping condition, i.e if \( |x_1 - x_0| \leq \epsilon \) stop.

Step 4: For \( k \geq 1 \) compute \( x_k^* = x_k - \frac{f(x_k)}{f'(1/2 [x_{k-1} + x_{k-1}^*])} \)

Step 5: Compute \( x_{k+1} = x_k - \sigma_k^{-1} f(x_k) \), where \( \sigma_k = \frac{f(x_k^*) - f(x_k)}{x_k^* - x_k} \)

Step 6: Check the stopping condition, if \( |x_{k+1} - x_k| \leq \epsilon \) stop.

Step 7: Set \( k = k + 1 \) and goto step 4.
III. RESULT AND DISCUSSION

Numerical Results

Computational test of the method were performed using MATLAB R2010a. All computations were carried out on a PC with Intel COREi3 processor with 4GB of RAM. We compare the performance of McDougall and Wotherspoon method (TSM) and the proposed method (PM) using 20 test functions also considered [11]. The stopping criteria used for these comparisons are $|x_{n+1} - x_n| < \delta$ where $\delta = 1.0 \times 10^{-27}$. For generating complex Mathematical Equation that is third party window. It display math questions in GUI but in backend it generate XML file so that later we can parse the equations and can evaluate.

![Figure 1: Performance profile of TSM and PM methods with respect to number of iterations for problem 1-20](image)

We compare the performance among the tested methods based on the performance profile presented by Dolan and More[1]. For ns solvers and np problems, the performance profile $P : R \rightarrow [0,1]$ is defined as follows: Let $\rho$ and $S$ be the set of problems and set of solvers respectively. For each problem $p \in \rho$ and for each solver $s \in S$ we define $t_{p,s} = \text{(number of iterations required to solve problem } p \text{ by solver } s)$. The performance ratio is given by $r_{p,s} = \frac{t_{p,s}}{t_{p,*}}$, then the performance profile is defined by $P(\tau) = \frac{1}{n_p} \sum_{s \in S} \mathbb{1}_{r_{p,s} \leq \tau}$, $\forall \tau \in R$, where $P(\tau)$ is the probability for solver $s \in S$ that a performance ratio $r_{p,s}$ is within a factor $\tau \in R$ of the best possible ratio.

Using all the twenty functions and their two starting point $x_0$ making a total of 40 test cases. Our method outperformed the method of [11] in most cases, therefore our method is a good improvement to the method of [11].

IV. CONCLUSION

In this paper, we proposed some modification of Newton-like method by using secant method for solving nonlinear equation. The proposed method approximates the derivative in the corrector step in [11]. Numerical result shows that our proposed methods exhibit a good performance.

Finally, we can claim that our proposed method is a good approach for solving nonlinear equations.
fails. At this point we recommend a future research to overcome these drawbacks.

V. REFERENCES

Chemical and Nutritional Evaluation of Biscuit Processed from Cassava and Pigeon Pea Flour

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ABSTRACT

Cassava is an important crop in the tropics. The use of cassava flour and pigeon pea flour in the manufacture of biscuit is uncommon. The chemical and nutritional evaluation of biscuit processed from cassava and pigeon pea flour was investigated.

Commercial and cassava based biscuit were evaluated for chemical and nutritive properties. Sensory evaluation was done by a ten member panel randomly selected from male and female adults. One hundred percent cassava biscuit was significantly higher than other biscuit samples in Hydrocyanide (HCN) at P<0.05. The crude protein and ash content of 30% cassava pigeon pea biscuit was significantly higher than other biscuit samples. Commercial biscuit was higher in crude fat (13.54%), crude fibre (0.85%) and moisture content (4.8%).

Sensory evaluation showed that commercial biscuit, 30% cassava-pigeon pea biscuit and 100% cassava biscuit were not significantly different from each other in colour. Higher scores was given to 30% cassava-pigeon biscuit. The taste, texture, flavour and general acceptability of 100% cassava biscuit and commercial biscuit were not significantly different from each other. Generally, acceptable biscuit was processed from 100% cassava flour and 30% cassava pigeon flour. Thirty percent cassava pigeon biscuit gave better nutrient attributes and sensory scores than commercial biscuit.

Keywords: Biscuit, Cassava Pigeon Pea, Chemical, Nutritional, Sensory

I. INTRODUCTION

Cassava is sometimes classified as a crop for developing countries and for consumption only by rural people, whereas the large crop of cassava grown annually in the tropics is actually consumed in all its forms at nearly all income levels (Ajani and Onwubuya, 2013). It is a very important crop in the tropics where an estimate of a billion people depends on it as a major staple crop. It is an important crop in the farming system because it can be intercropped with many other crops, and yield well in poor soils. Cassava is the fourth most important staple crop in the world after rice, wheat and maize (Onabolu, et. al., 2001).

It is a cheap source of edible carbohydrate that could be processed into different forms of human foods, e.g. fufu, eba, gari, lafun, pupuru, abacha, etc. The cultivation of cassava requires minimal input but the processing is laborious and time consuming. Cassava contains 1% protein, 97% starch, 1% fibre with traces of fat and other minerals (Onabolu, et. al., 2001).

Pigeon pea (Cajanus cajan (L) Millsp) belongs to the family of Cajanicae. It is the only domesticated species well distinguished by the presence of vascular glands on the leaves, calyx and pods (Nwosu, et. al., 2013). Pigeon pea seed is one of the tropical legume seeds which have been highly favourable because of its rich protein composition, energy and mineral content and widespread distribution in the tropics.
However, its nutritive value is masked by the occurrence of anti-nutritional factors. Some of the anti-nutritional factors are known to have negative effect on the haematological parameters, but can easily be removed through processing by heat (Nwosu, et. al., 2013).

Biscuits are an ideal source of food as they possess the following attributes: they are highly palatable and acceptable, they have long storage and good sources of energy, they provide a good source of energy and can easily be modified to suit specific nutritional needs of any target population, and they can be produced in convenient sizes and different forms. Biscuit is therefore one of the popular food sources in any emergency feeding programme (Ubbor and Akobundu, 2009).

There is limited information about the production of biscuit from cassava and pigeon pea flour. Hence this work aims at evaluating the nutritional properties and consumer acceptability of biscuit made from cassava and pigeon pea flour.

II. METHODS AND MATERIAL

Raw materials

The cassava tubers were procured from the Federal College of Agriculture Farm in Ibadan, while the pigeon pea was purchased from Apata Market in Ibadan, Oyo state Nigeria. The variety of cassava tubers was the sweet variety (TMS 20001) and other ingredients such as baking ingredients were also purchased from Apata Market.

Preparation of Cassava and Pigeon pea Flour

The cassava tubers were harvested fresh, peeled manually, washed and grated. The grated mash was packed into perforated sack and pressed using the hydraulic press to drain out water after which it was sun-dried and dry-milled. Pigeon pea was par-boiled in hot water for 5 minutes, peeled, sun-dried and ground using electric blender.

Preparation of Cassava Based Biscuits

Cassava based biscuits were processed from 100% cassava flour, 10%, 20%, 30% cassava/pigeon pea flour using commercial biscuit as control. Biscuit from cassava and cassava pigeon flour were processed by mixing about 100gm of the flour with the following ingredients 0.15g of salt, 15g of sugar, 10g of fat, 0.25g of baking powder, 0.25g of vanilla flavor. About 100ml of water was gradually added while mixing together for 6 minutes to obtain slightly textured dough. The dough was kneaded on a flat rolling board and was manually rolled into sheet and cut into shapes using a suitably shaped tin. The cut pieces of dough were placed into a greased oven tray, baked at 180°C for 20 minutes using the modified method of Eneche (1999).

![Flow Chart of the process of making cassava/pigeon pea biscuit.](image-url)
Determination of Proximate Composition of biscuit samples

The biscuit samples were analysed for moisture, dry matter, crude protein, crude fat, crude fibre and ash using the standard methods of AOAC (1990).

Dry Matter and Moisture Determination

The sample (2g) was weighed into a previously weighed crucible. The crucible plus sample taken was then transferred into the oven set at 100°C to dry to a constant weight for 24 hours overnight. At the end of the 24 hours, the crucible plus sample was removed from the oven and transferred to desiccator, cooled for ten minutes and weighed (AOAC, 1990).

If the weight of empty crucible is Wo
Weight of crucible plus sample is W1
Weight of crucible plus oven dried sample W3

\[
\begin{align*}
\text{% Dry Matter} &= \frac{W_3 - Wo}{W_1 - Wo} \times 100 \\
\text{% Moisture} &= \frac{W_1 - W_3}{W_1 - Wo} \times 100
\end{align*}
\]

Determination of Ash

The sample (2g) was weighed into a porcelain crucible. This was transferred into the muffle furnace set at 550°C and left for about 4 hours. About this time it had turned to white ash. The crucible and its content were cooled to about 100°C in air, then room temperature in a desiccator and weighed (AOAC, 1990).

The percentage ash was calculated from the formula below:

\[
\% \text{ Ash content} = \frac{\text{Weight of ash}}{\text{Original weight of sample}} \times 100
\]

Determination of Crude Protein

The micro-Kjeldahl method for protein determination is employed for protein determination. This is based on three principles:

\[
\begin{align*}
\text{Digestion: } RNH_2 + 2H_2SO_4 \rightarrow (NH_4)_2SO_4 + CO_2 + H_2O \\
\text{Distillation: } (NH_4)_2SO_4 + 2NaOH \rightarrow (NH_3 + H_2O + Na_2SO_4 \\
\text{Absorption: } 3NH_3 + H_2BO_3 \rightarrow (NH_4)_2BO_3 \\
\text{Titration: } (NH_4)_2BO_3 + HCl \rightarrow H_3BO_3 + 3NHCl
\end{align*}
\]

Procedure

The bread sample (0.5g) was weighed into the micro-Kjeldahl flask. To this were added 1 Kjeldahl catalyst tablet and 10ml of conc. H_2SO_4. These were set in the appropriate hole of the digestion block heaters in a fume cupboard. The digestion was left on for 4 hours after which a clear colourless solution was left in the tube. The digest was carefully transferred into 100ml volumetric flask, thoroughly rinsing the digestion tube with distilled water and the volume of the flask made up to the mark with distilled water. 5ml portion of the digest was then pipetted to Kjeldahl apparatus and 5ml of 40% (w/v) NaOH added.

The mixture was then steam distilled and the liberated ammonia collected into a 50ml conical flask containing 10ml of 2% boric acid plus mixed indicator solution. The green colour Isolution was then titrated against 0.01 NHCl solution. At the end point, the green colour turns to wine colour, which indicates that, all the nitrogen trapped as ammonium borate have been removed as ammonium chloride. The percentage nitrogen was calculated by using the formula:

\[
\% N = \text{Titre value} \times \text{atomic mass of nitrogen} \times \text{normality of HCl used} \times 4
\]

The crude protein is determined by multiplying percentage nitrogen by a constant factor of 6.25 (AOAC, 1990).

Crude Fat Determination

The dried sample (1g) was weighed into fat free extraction thimble and plug lightly with cotton wool. The thimble was placed in the extractor and fitted up with reflux condenser and a 250ml soxhlet flask which has been previously dried in the oven, cooled in the desiccator and weighed. The soxhlet flask is then filled to ¾ of it volume with petroleum ether (b.pt. 40 – 60°C) and the soxhlet flask extractor plus condenser set was
placed on the heater. The heater was put on for six hours with constant running water from the tap for condensation of ether vapour. The set is constantly watched for ether leaks and the heat sources is adjusted appropriately for the ether to bril gently. The ether is left to siphon over several times at least 10 – 12 times until it is short of siphoning. It is after this is noticed that any ether content of the extractor is carefully drained into the ether stock bottle. The thimble-containing sample is then removed and dried on a clock glass on the bench top. The extractor flask with condenser is replaced and the distillation continues until the flask is practically dried. The flask which now contains the fat or oil is detached, its exterior cleaned and dried to a constant weight in the oven (AOAC, 1990). If the initial weight of dry soxhlet flask is Wo and the final weight of oven dried flask + oil/fat is W1, percentage fat/oil is obtained by the formula:

\[
\frac{W_1 - W_o}{\text{Weight of sample taken}} \times 100
\]

**Crude Fibre Determination**

The sample (2g) was accurately weighed into the fibre flask and 100ml of 0.25NH₂SO₄ added. The mixture was heated under reflux for 1 hour with the heating mantle. The hot mixture was filtered through a fibre sieve cloth. The filterate obtained was thrown off and the residue was returned to the fibre flask to which 100ml of (0.31NNaOH) was added and heated under reflux for another 1 hour.

The mixture was filtered through a fibre sieve cloth and 10ml of acetone added to dissolve any organic constituent. The residue was washed with about 50ml hot water twice on the sieve cloth before it was finally transferred into the crucible. The crucible and the residue was oven-dried at 105°C overnight to drive off moisture. The oven-dried crucible containing the residue was cooled in a dessicator and later weighed to obtain the weight W₁. The crucible with weight W₁ was transferred to the muffle furnace for ashing at 550°C for 4 hours. The crucible containing white or grey ash (free of carbonaceous material) was cooled in the dessicator and weighed to obtain W₂. The difference W₁ – W₂ gives the weight of fibre (AOAC, 1990). The percentage fibre was obtained by the formula:

\[
\frac{W_1 - W_2}{\text{Weight of sample}} \times 100
\]

**HCN Determination**

0.1gm of the biscuit samples were weighed into a flat bottom plastic bottle with a screw cap lid. 0.5ml of 0.1m phosphate buffer at pH 6 was added in a pipette. A yellow picrate paper attached to a plastic strip immediately in the flat bottom plastic bottle containing samples and buffer, making sure that the picrate paper does not touch the liquid in the bottle. The bottle was immediately closed with the screw capped lid. A blank was also prepared as above into another screw capped bottle.

Linamarin standard stock solutions were also prepared using 10mg linamarin in 10ml, 0.1ml phosphate buffer at pH 6. This was diluted to give concentrations of 25ppm to 100ppm (ie 25, 50, 75, 100). This was used to standardize and calibrate the spectrophotometer. Linamarin paper of 50ppm concentration was treated as sample above and put in a separate screw capped plastic bottle containing phosphate buffer and linamarase enzyme and the bottle was closed immediately.

Linamarin standard stock solutions were also prepared using 10mg linamarin in 10ml, 0.1ml phosphate buffer at pH 6. This was diluted to give concentrations of 25ppm to 100ppm (ie 25, 50, 75, 100). This was used to standardize and calibrate the spectrophotometer. Linamarin paper of 50ppm concentration was treated as sample above and put in a separate screw capped plastic bottle containing phosphate buffer and linamarase enzyme and the bottle was closed immediately.

All bottles containing samples, blank and linamarine standard paper were allowed to stand for 16 – 24 hours at room temperature. At the end of 16 – 24 hours, the bottles were opened, plastic baking sheet if the picrate paper were removed and placed in a test tube. 5ml of distilled water was pipette into the test tube containing the picrate paper and was allowed to stand for 30 minutes with occasional gentle stirring. The absorbance of all solutions in the test tube including linamarin standard solution were measured against blank on spectronic 20 spectrophotometer at a wavelength of 510nm. (Bradbury et al 1999)

The total cyanide content (ppm) or mg/kg = 396 x absorbance.

% Total cyanide content = \( \frac{\text{ppm cyanide}}{10,000} \)
III. RESULT AND DISCUSSION

Chemical Composition of Biscuit Samples

Table 1 describes the chemical composition of biscuit samples. The hydrocyanic acid content (HCN) of biscuit processed solely from cassava flour was significantly higher than other biscuit samples. Although level of HCN (9.70 mg kg⁻¹) is within the safe level (Ashaye et al. 2007). It was also observed that there was a consistent drop in the level of HCN in cassava-pigeon pea biscuit with increase in fortification levels. This trend is as a result of increased presence of pigeon pea flour due to substitution. Pigeon pea flour processed from parboiling is known to be deficient in HCN due to the fact that HCN is heat labile (Onwuka, 2006). HCN of commercial biscuit and 30% cassava-pigeon pea biscuit are not significantly different from each other at P<0.05.

The crude protein content of 100% cassava biscuit was significantly lower than other biscuit samples with 30% cassava-pigeon pea biscuit having a crude protein content of (7.97%). Cassava flour is known to be poor in protein; there was also a gradual increase in the level of % crude protein in cassava-pigeon pea biscuit with increase in fortification. It agreed with the findings of Ubbor and Akobundu, 2009 who asserted that protein content of cassava based composite flours could be elevated through the incorporation of legume flours.

The ash content of 30% cassava-pigeon pea biscuit was higher than other biscuit samples at P<0.05. Ash content also increased with increase in level of fortification. Pigeon pea flour is known to be rich in minerals.

Crude fat which is responsible for maintenance of human health and brain development (Neha and Ramesh 2012) was significantly greater in commercial biscuit (control) than other samples. This could be due to greater content of animal fat used in the preparation of the commercial biscuit. It was also evident that percentage crude fat increased with increasing level of fortification.

The crude fibre and moisture content of commercial biscuit (control) was higher than other biscuit samples at (P<0.05). Gradual increase in crude fibre content of cassava-pigeon pea biscuit with greater measure of pigeon pea flour was also observed. There was however no significant difference in the moisture content percentage in cassava-based biscuits, which was also observed with respect to their dry matter content. The values observed with regards to their moisture content and crude fibre were within the acceptable levels (Oluwamukemi et al 2011, Ogunjobi and Ogunwolu 2010, and Camire et al 2007).

Sensory Evaluation of the Biscuit Samples

Table 2 shows the sensory evaluation of the biscuit samples. There was no significant difference in the colour, taste, texture and general acceptability of 100 percent cassava biscuit and commercial biscuit. This implies this implies that acceptable biscuits can be processed from 100% percent cassava flour. However, 30 percent cassava-pigeon pea biscuit was high in colour, taste, texture, flavor and general acceptability. It is noteworthy that 20 and 30 percent cassava-pigeon pea biscuit were acceptable. This result agreed with the findings of Taiwo (2006) who observed that biscuits processed from cassava and legume flours come out with the good sensory attributes.

Table 1: Chemical composition of biscuit samples

<table>
<thead>
<tr>
<th></th>
<th>HCN (mg kg⁻¹)</th>
<th>Crude Protein (%)</th>
<th>Ash (%)</th>
<th>Crude Fat (%)</th>
<th>Crude Fibre (%)</th>
<th>Moisture Content (%)</th>
<th>Dry Matter (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% Cassava Biscuit</td>
<td>9.70&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.57&lt;sup&gt;d&lt;/sup&gt;</td>
<td>1.53&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.11&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.19&lt;sup&gt;d&lt;/sup&gt;</td>
<td>3.00&lt;sup&gt;b&lt;/sup&gt;</td>
<td>97.00&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>10% Cassava/pigeon pea biscuit</td>
<td>8.32&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.92&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>1.45&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0.14&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.14&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3.50&lt;sup&gt;b&lt;/sup&gt;</td>
<td>96.50&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>20% Cassava/pigeon pea biscuit</td>
<td>2.58&lt;sup&gt;c&lt;/sup&gt;</td>
<td>7.53&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>1.60&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.24&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.24&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3.00&lt;sup&gt;b&lt;/sup&gt;</td>
<td>97.00&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>30% Cassava/pigeon pea biscuit</td>
<td>0.06&lt;sup&gt;d&lt;/sup&gt;</td>
<td>7.97&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.67&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.33&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.47&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.00&lt;sup&gt;b&lt;/sup&gt;</td>
<td>97.00&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Commercial biscuit (Control)</td>
<td>0.02&lt;sup&gt;d&lt;/sup&gt;</td>
<td>7.09&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>1.16&lt;sup&gt;c&lt;/sup&gt;</td>
<td>13.54&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.85&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.81&lt;sup&gt;a&lt;/sup&gt;</td>
<td>95.19&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Means along the same column followed by the same letter are not significantly different from each other (P<0.05)
Table 2: Sensory evaluation of biscuit samples

<table>
<thead>
<tr>
<th></th>
<th>Colour</th>
<th>Taste</th>
<th>Texture</th>
<th>Flavour</th>
<th>General Acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% Cassava Biscuit</td>
<td>8.10^a</td>
<td>8.20^a</td>
<td>7.40^a</td>
<td>7.40^a</td>
<td>8.30^a</td>
</tr>
<tr>
<td>10% Cassava/pigeon pea biscuit</td>
<td>6.00^b</td>
<td>4.40^c</td>
<td>5.20^c</td>
<td>4.80^c</td>
<td>4.70^c</td>
</tr>
<tr>
<td>20% Cassava/pigeon pea biscuit</td>
<td>6.00^b</td>
<td>6.60^b</td>
<td>5.00^bc</td>
<td>6.00^bc</td>
<td>5.80^bc</td>
</tr>
<tr>
<td>30% Cassava/pigeon pea biscuit</td>
<td>8.00^a</td>
<td>7.40^ab</td>
<td>6.80^ab</td>
<td>6.80^ab</td>
<td>7.00^ab</td>
</tr>
<tr>
<td>Commercial biscuit (Control)</td>
<td>8.10^a</td>
<td>8.10^a</td>
<td>7.20^a</td>
<td>8.10^a</td>
<td>8.10^a</td>
</tr>
</tbody>
</table>

Means along the same column followed by the same letter are not significantly different from each other (P<0.05).

IV. CONCLUSION

The result of this research reveals that acceptable biscuits can be processed from 100% cassava flour and 30% cassava- pigeon pea flour. This finding will serve as an alternative for biscuit confectionary industries in Nigeria and other tropical countries in Africa that depends solely on imported and expensive wheat flour for processing. The nutritive value of pigeon pea in the biscuit could improve the nutritional status of children who consumes biscuit as snack food.

V. REFERENCES

Effect of Weaning Age on growth Performance and Feed Conversion Efficiency of Large White Yorkshire (LWY) Piglets under Intensive System of Management in Mizoram

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³College of Veterinary Sciences & Animal Husbandry, Central Agricultural University, Aizawl, Mizoram – 796014, India
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ABSTRACT

The study was for assessment of weaning age on growth performance and feed conversion efficiency of LWY piglets under intensive system of management in Mizoram. The study was conducted on piglets from twelve LWY sows. The sows were selected based on parity, sire mated, litter size and weight, and divided into three homogenized groups with 4 sows in each group (T₁, T₂ and T₃). Piglets of T₁ group were weaned at 28 days, of T₂ at 35 days and of T₃ at 42 days of age. The weaned piglets were reared up to 77th days of age. The animals were reared under intensive system of management following standard feeding and managemental norms. The average body weight of piglets weaned at 28th and 35th day of age were found to be significantly (P<0.05) higher than the body weights of piglets weaned at 42nd day of age. The body weight gain of the early weaned piglets was observed to be higher than the late weaned piglets. The average total body weight gain at 77th day of age was found to be 19.11, 17.72 and 16.60 kg, respectively for piglets weaned at 28th, 35th and 42nd day age. Feed conversion efficiency at 77th day of age was recorded as 2.32±0.16, 2.44±0.19 and 2.48±0.07 indicated that early weaned piglets performed well under the same feeding and managemental situation. From the findings of the study, it was concluded that weaning at 28th day of age may be recommended for LWY piglets under intensive management in Mizoram.

Keywords: Weaning age, LWY piglets, growth, feed conversion efficiency, Mizoram.

I. INTRODUCTION

Pig husbandry ensures livelihood to millions of rural people in India. In recent years, adoption of improved managemental practices has increased the efficiency of pig production throughout the world. Amongst the various improved managemental tools, weaning at an early age is one common practice which helps to improve pig production efficiency.

Weaning at an early age minimizes body weight losses of the sows during lactation, and ensures early rebreeding of the sows increasing the numbers of piglets produced per sow per year [1,2]. Early weaning also reduces expenditure on labour and housing [3]. Weaning of piglets between 10 to 35 days of age is an adopted practice in many developed countries. However, in India, weaning is usually done at 56 days of age.

Considering manifold advantages of early weaning, and the vital roles played by pig husbandry for livelihood and nutritional security, the present study was undertaken to elucidate the effects of weaning age on growth performance and feed conversion efficiency of
Large White Yorkshire (LWY) piglets managed under intensive system in Mizoram.

II. METHODS AND MATERIAL

Ethical approval: Necessary approval has been taken from the Institutional Animal Ethic Committee for conducting the study.

Location of the Study

The study was conducted at the Piggery Unit of the Instructional Livestock Farm Complex (ILFC), College of Veterinary Sciences and Animal Husbandry, Central Agricultural University, Selesih, Aizawl, Mizoram during 2013-2014.

Experimental design

Piglets from 12 LWY sows were utilized for the study. Based on parity, litter size and weight, and sire mated, twelve (12) LWY sows of 2nd and 3rd parity with litters were selected and divided into three homogenized groups of 4 sows in each group (T1, T2 and T3). Piglets of T1 group were weaned at 28 days, of T2 at 35 days and of T3 at 42 days of age. The weaned piglets were reared to 77th days of age.

Management and feeding

The piglets of treatment groups were reared in the creep area of the furrowing pen before weaning. Adequate care was taken to minimize thermal discomfort to young piglets. Strict hygiene was maintained during creep rearing period. Routine management practices like naval cord cutting, teeth clipping, iron injection, etc. were done following standard protocols. After weaning, piglets were shifted to weaner pen fitted with heating device.

Balanced rations [4] were prepared incorporating conventional feed ingredients. Piglets irrespective of groups were provided pre-starter ad libitum during 3rd week of age, starter feed during 4th to 6th week and grower feed from 7th to 11th week of age. Pre-starter and starter ration were fortified with milk powder, sugar, probiotic, zinc oxide, antibiotic, lysine, and methionine.

Data collection

Feed consumption of experimental piglets was recorded individually on daily basis. Body weight records of piglets were made at weekly interval from birth to 11 weeks (77 days) of age. Total expenditure on management and feeding per kg live weight was calculated.

Statistical Analysis

The data generated were statistically analyzed as per Snedecor & Cochran [5].

III. RESULT AND DISCUSSION

Ingredient and nutritional composition of the experimental rations

The rations fed to the piglets, based on age irrespective of treatment groups, are presented in table 1. The nutritional compositions of the rations are presented in table 2. Based on the retail market prices of the feed ingredients, the expenditure on per kg pre-starter, starter and grower ration were calculated as Rs. 52.80, 43.26 and 39.60, respectively.

Feed consumption

The average Daily Feed Intake (ADFI) is presented in Table 3. The ADFI were found to be low during 3rd and 4th weeks of age in all the groups. Post-weaning feed intakes were gradually increased in all groups up to 11th weeks of age. Less feed intake during the early age might be for availability of milk consumption. Post weaning ADFI was higher in late weaned piglets as compared early weaned piglets, but was non-significant (P<0.05) among the groups.

Table 1: Ingredient composition of the rations fed to the piglets before and after weaning

<table>
<thead>
<tr>
<th>Ingredients (kg)</th>
<th>Pre-starter</th>
<th>Starter</th>
<th>Grower</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>48.8</td>
<td>52.8</td>
<td>58.3</td>
</tr>
<tr>
<td>Soy Bean Meal</td>
<td>25</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>Ground Nut Cake</td>
<td>5</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Wheat Bran</td>
<td>2</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Fish meal</td>
<td>8</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Skim milk powder</td>
<td>5</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Sugar</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Soybean oil</td>
<td>2</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>DL_methionine</td>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
</tr>
<tr>
<td>L-Lysine</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Mineral Mixture</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Di-Cal-Phos</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Zinc Oxide</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Tonakind Gold</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>(Probiotic)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agnucin (Antibiotic)</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
</tr>
</tbody>
</table>
The higher post weaning feed consumption as compared to low pre-weaning feed intake in all the groups signified that there might be inhibitory effect of lactation on creep feed consumption of piglets. Kuller et al. [6] demonstrated that both pre and post weaning feed intake were higher for the intermittent suckler than the continuous suckler during lactation. Sulabo et al. [7] on the other hand suggested that limited nutrient supply did not drive piglets to consume more creep feed. Lower feed intake might have contributed to low growth rates for late weaned piglets as compared to early weaned piglets. The present findings are in agreement with the findings of Fraser et al. [8] and Kuller et al. [6].

Growth Performance of Piglets

The average weekly body weights of the piglets before and after weaning are presented in table 4. No significant (P<0.05) differences were observed in body weights of piglets under different weaning regime up to 6 weeks of age. However, it was observed that body weights of piglets weaned early were higher than the late weaned piglets and at 11th week of age, average body weight of piglets weaned at 28th and 35th day of age were found to be significantly (P<0.05) higher than the body weights of piglets weaned at 42nd day of age.

Table 2 : Nutritional composition** (on DM basis) of the rations fed to the piglets before and after weaning

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Pre-starter</th>
<th>Starter</th>
<th>Grower</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Matter (%)</td>
<td>87.61</td>
<td>87.31</td>
<td>87.05</td>
</tr>
<tr>
<td>Energy(DE)(Kcal/kg)</td>
<td>3306</td>
<td>3308</td>
<td>3287</td>
</tr>
<tr>
<td>Crude Protein (%)</td>
<td>21.94</td>
<td>20.03</td>
<td>19.02</td>
</tr>
<tr>
<td>Crude Fibre (%)</td>
<td>3.85</td>
<td>4.21</td>
<td>4.21</td>
</tr>
<tr>
<td>Lysine (%)</td>
<td>1.51</td>
<td>1.31</td>
<td>1.19</td>
</tr>
<tr>
<td>Methionine (%)</td>
<td>0.57</td>
<td>0.50</td>
<td>0.48</td>
</tr>
<tr>
<td>Methionine + Cystine (%)</td>
<td>0.90</td>
<td>0.83</td>
<td>0.80</td>
</tr>
<tr>
<td>Calcium (%)</td>
<td>0.96</td>
<td>0.84</td>
<td>0.81</td>
</tr>
<tr>
<td>Phosphorus (%)</td>
<td>0.74</td>
<td>0.69</td>
<td>0.69</td>
</tr>
<tr>
<td>Ether Extract (%)</td>
<td>5.68</td>
<td>5.71</td>
<td>5.17</td>
</tr>
</tbody>
</table>

** Calculated value.

Table 3 : Average daily feed intake (g) of the piglets under study.

<table>
<thead>
<tr>
<th>Age in week</th>
<th>Treatment group</th>
<th>T-1</th>
<th>T-2</th>
<th>T-3</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>3rd</td>
<td>19.45±2.3</td>
<td>17.29±0.8</td>
<td>21.05±1.81</td>
<td>0.361</td>
<td></td>
</tr>
<tr>
<td>4th</td>
<td>61.22±8.4</td>
<td>51.87±8.2</td>
<td>62.15±5.20</td>
<td>0.579</td>
<td></td>
</tr>
<tr>
<td>5th</td>
<td>178.96±34.07</td>
<td>97.20±8.1</td>
<td>88.46±5.16</td>
<td>0.022</td>
<td></td>
</tr>
<tr>
<td>6th</td>
<td>300.86±21.63</td>
<td>214.08±22.83</td>
<td>128.53±5.01</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>7th</td>
<td>481.10±12.63</td>
<td>349.08±26.53</td>
<td>289.28±31.64</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>8th</td>
<td>645.12±71.40</td>
<td>607.84±10.09</td>
<td>513.6±32.04</td>
<td>0.482</td>
<td></td>
</tr>
<tr>
<td>9th</td>
<td>859.05±14.30</td>
<td>746.05±13.28</td>
<td>656.39±66.41</td>
<td>0.509</td>
<td></td>
</tr>
<tr>
<td>10th</td>
<td>1074.64±27.21</td>
<td>1032.84±83.65</td>
<td>907.87±49.5</td>
<td>0.662</td>
<td></td>
</tr>
<tr>
<td>11th</td>
<td>1369.88±10.64</td>
<td>1357.65±8.3</td>
<td>1253.47±92.11</td>
<td>0.760</td>
<td></td>
</tr>
</tbody>
</table>

Means within each row bearing at least one common superscript do not differ significantly (P < 0.05).

Means within each row bearing at least one common superscript do not differ significantly (P < 0.05).

The average daily gain in body weight (ADG) of piglets under different weaning regime was found to be variable (table 5). However, growth rate of the early weaned piglets was higher than the late weaned piglets. The average total body weight gain at 77th day of age was significantly higher for piglets weaned at 28th day of age than piglets weaned at 35th and 42nd day of age respectively. Similarly, average total body weight gain of piglets weaned at 28th and 35th day of age was found to be higher than piglets weaned at 42nd day of age.
In all the groups, ADG was observed to increase from 1st to 2nd week and thereafter decreased during 3rd and 4th week of age. ADGs were found to increase in 5th week in 35 & 42 days weaning group. During 1st week of post weaning, ADGs in all the groups were reduced. This might be for post weaning growth depression which persisted for one or two weeks after weaning. Similar trends were also reported by Bhatia et al. [3], Mahan [9], Abraham [10], and Phukan [11]. Reduced ADGs during 3rd and 4th week of age might be due to lower milk availability and/or less consumption of pre-starter ration by the piglets. Milk production of sows usually decline after 3rd week of lactation which increases the gap between supply and demand of nutrients for nursing piglets [2]. Digestibility of uncooked feeds was reported to be low in young piglets [12]. The pre-starter rations provided during the experiment were uncooked ones which might contribute to poor intakes and hence decreased growth of young piglets during their early life as also the piglets needs to be adopted to the ration.

**Feed conversion efficiency (FCE)**

The overall FCE was found to be better in early weaned pigs than the late weaned counterpart (table 6). However, there was no statistical (P<0.05) differences among the weaning groups under the study. Better growth rate of early weaned piglets might result better FCE than the lately weaned piglets. The present findings are in confirmation with the results of Rava [13], Abraham [10], Collins et al. [14], Phukon [11], and Suryanarayana and Suresh [15].

**Table 5**: Average daily gain in body weights (g) of the piglets under study

<table>
<thead>
<tr>
<th>Age in week</th>
<th>Treatment group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T-1</td>
<td>T-2</td>
</tr>
<tr>
<td>1st</td>
<td>153.28±6.76&lt;sup&gt;a&lt;/sup&gt;</td>
<td>123.51±7.39&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>2nd</td>
<td>173.59±12.82&lt;sup&gt;a&lt;/sup&gt;b</td>
<td>188.05±11.10&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>3rd</td>
<td>155.00±9.30&lt;sup&gt;a&lt;/sup&gt;b</td>
<td>135.58±7.67&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>4th</td>
<td>113.84±12.30&lt;sup&gt;a&lt;/sup&gt;b</td>
<td>123.96±9.96&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>5th</td>
<td>76.79±7.7&lt;sup&gt;a&lt;/sup&gt;b</td>
<td>155.76±7.54&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>6th</td>
<td>186.70±15.88&lt;sup&gt;a&lt;/sup&gt;b</td>
<td>65.99±14.48&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>7th</td>
<td>257.86±19.54&lt;sup&gt;a&lt;/sup&gt;b</td>
<td>146.45±18.9&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>8th</td>
<td>314.29±19.00&lt;sup&gt;a&lt;/sup&gt;b</td>
<td>302.53±17.9&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>9th</td>
<td>334.91±25&lt;sup&gt;a&lt;/sup&gt;b</td>
<td>355.81±34.1&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>10th</td>
<td>455.09±27.88&lt;sup&gt;a&lt;/sup&gt;b</td>
<td>418.16±20.5&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>11th</td>
<td>496.79±19.99&lt;sup&gt;a&lt;/sup&gt;b</td>
<td>463.46±28.6&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Means within each row bearing at least one common superscript do not differ significantly (P < 0.05)

From the findings of the present study, it was concluded that weaning age of 28th day may be recommended for LWY without any adverse effects on growth performance and feed conversion efficiency when reared under intensive system of management in Mizoram.

**Table 6**: Average feed conversion efficiency of piglets under study

<table>
<thead>
<tr>
<th>Age in week</th>
<th>Treatment group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T-1</td>
<td>T-2</td>
</tr>
<tr>
<td>5th</td>
<td>2.45 ± 0.19&lt;sup&gt;a&lt;/sup&gt;b</td>
<td>-</td>
</tr>
<tr>
<td>6th</td>
<td>1.66 ± 0.26&lt;sup&gt;a&lt;/sup&gt;b</td>
<td>3.26±0.39&lt;sup&gt;a&lt;/sup&gt;b</td>
</tr>
<tr>
<td>7th</td>
<td>1.88±0.16&lt;sup&gt;a&lt;/sup&gt;b</td>
<td>2.32±0.21&lt;sup&gt;a&lt;/sup&gt;b</td>
</tr>
<tr>
<td>8th</td>
<td>2.07±0.19&lt;sup&gt;a&lt;/sup&gt;b</td>
<td>2.05±0.12&lt;sup&gt;a&lt;/sup&gt;b</td>
</tr>
<tr>
<td>9th</td>
<td>2.65±0.48&lt;sup&gt;a&lt;/sup&gt;b</td>
<td>2.08±0.20&lt;sup&gt;a&lt;/sup&gt;b</td>
</tr>
<tr>
<td>10th</td>
<td>2.33±0.25&lt;sup&gt;a&lt;/sup&gt;b</td>
<td>2.50±0.29&lt;sup&gt;a&lt;/sup&gt;b</td>
</tr>
<tr>
<td>11th</td>
<td>3.01±0.19&lt;sup&gt;a&lt;/sup&gt;b</td>
<td>2.96±0.26&lt;sup&gt;a&lt;/sup&gt;b</td>
</tr>
<tr>
<td>Overall</td>
<td>2.32±0.16&lt;sup&gt;a&lt;/sup&gt;b</td>
<td>2.44±0.19&lt;sup&gt;a&lt;/sup&gt;b</td>
</tr>
</tbody>
</table>

Means within each row bearing at least one common superscript do not differ significantly (P < 0.05)

**IV. CONCLUSION**

From the findings of the present study, it was concluded that weaning age of 28th day may be recommended for LWY without any adverse effects on growth performance and feed conversion efficiency when reared under intensive system of management in Mizoram.

**V. ACKNOWLEDGEMENT**

Authors are thankful to the Dean, College of Veterinary Sciences & A.H., Central Agricultural University, Selesih, Aizawl, Mizoram, India for providing financial support and necessary facilities to carry out the study successfully.

**VI. REFERENCES**


Effects of Supplemental Lipoic Acid on Selected Antioxidant and Mineral in Transportation-Stressed Goats

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ABSTRACT

The objective of this study was to assess the effects of supplemental lipoic acid (LA) on body weight, rectal temperature, vitamin C and E, and plasma copper and zinc status in different breeds of Saudi goats subjected to road transportation. Twenty-four apparently healthy goats (12 from each breed, Aardi and Hejazi) were used in experiment. The experiment was conducted, when the ambient temperature was about 16–24°C. The conditions of transport for all goats were identical. Half of goats will be treated intravenously with LA (25 mg per ml) prior transportation, and the rest with placebo. Goats were transported for 12 hours, and blood samples were collected on prior transportation, at unloading, 12 and 24 hrs post transportation. Transportation stress caused a significant reduction in vitamin C, E, and plasma copper and zinc in both breeds, with higher reduction of all measured variables in Hejazi compared to Aardi goats. Supplemental LA reduces the negative impact of transportation. Such finding seems important in animal production and welfare, especially under harsh conditions. In conclusion, further studies are required to extend the work on LA during hot conditions in Saudi Arabia.

Keywords: Goats, Breed; Lipoic acid, Vitamin C, E, Zinc, Copper

I. INTRODUCTION

Transportation is an inevitable husbandry practice which animals unexpectedly encounter in the livestock industry. It has widespread effects on physiological systems in animals, including changes in the cardiovascular, endocrine, immune, central nervous and reproductive systems (Padalino, in press). Many scientific trials focus on the use of antioxidant prior transportation to reduce its impact on welfare and productivity of farm animals. Vitamin E and C are parts of the non-enzymatic body’s antioxidant system, consumed during transportation stress (Minka et al., 2009). Studies are accumulating in search of antioxidant minimizing the negative impact of transportation. For instance, LA is considered as a powerful antioxidant (ultimate antioxidant) owing to its ability to cross biological membranes, scavenging oxygen free radicals, and promoting the regeneration of endogenous antioxidants vitamins such as vitamin E and C (Packer et al., 1997). Therefore, the objective of this study was to assess the effects of supplemental LA on selected vitamins and mineral in different breeds of Saudi goats subjected to transportation.

II. METHODS AND MATERIAL

Twenty-four apparently healthy goats (12 from each breed, Aardi and Hejazi) were used in experiment. The experiment was conducted during the months of November and December, when the ambient temperature was about 16–24°C. The conditions of transport for all goats were identical. Half of goats will be treated with lipoic acid (LA) prior transportation, and the rest were treated with 10 ml normal saline. Twenty-five mgs per ml of Lipoic acid was dissolved as the tromethamol salt and injected intravenously for three consecutive days prior transportation. Goats were transported for 12 hours and blood samples were collected on prior transportation; 0 hr of arrival, 12 hrs post transportation, and 24 hrs post transportation. Vitamin C (Ascorbic acid) was analyzed in plasma on an automated High Performance Liquid Chromatography (HPLC) system (Lykkesfeldt et al., 1995). Vitamin E (alpha tocopherol) was determined in the plasma using HPLC as adapted by Cooper et al. (1997). Plasma copper and zinc concentrations were analyzed via atomic absorption (Model 5100, HGA-600 Graphite Furnace; Perkin-Elmer, USA). The experimental
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protocol consisted of a two-way repeated measure analysis of variance (ANOVA) to determine the effects of sampling time, the difference between treatments, and the interaction between time and treatment.

III. RESULT AND DISCUSSION

The main hypothesis to be tested here is that lipoic acid improves the status of stress biomarkers (vitamin C; E, and copper and zinc) in transportation-stressed goats. During stress conditions such as in this study (transportation), there is an increase demand in antioxidant, and prior supplementation proved effect in counteracting the stress effects.

Transportation causes oxidative stress in buffalo calves (El-Deeb and El-Bahr, 2014). Transported-goats showed higher plasma levels of cortisol, glucose and free fatty acids increased significantly within 15 min of the start of transportation, and these higher levels were maintained throughout transportation (Aoyama et al., 2008). In another study, transported calves showed a decrease growth hormone pulse frequency under abnormal cortisol states (Kadokawa et al., 2013).

Table 1 shows the effects of supplementation with lipoic acid on vitamin C trend post transportation. Significant effects of treatment and breed were observed here. Similar trend was observed in Table 2 for vitamin E. Transportation resulted in the increase in utilization of both vitamins (C and E) in both breeds, and LA restores such decrease by recycling the vitamins.

In line with previous reports, transportation did affect the antioxidant status in different breeds of goats. Similarly, transported lambs on unpaved roads had a significant influence on physiological stress parameters (Miranda-de et al., 2011). There is increasing interest in using Lipoic acid in stress conditions, and this partly due to its antioxidant function; and ability to regenerate and recycling both water- and lipid-soluble antioxidants from their oxidized forms (Packer et al., 1997). Practical uses of LA improved antioxidant status in rats (Akpinar et al., 2008); and prior exercise in horse (Kinnunen et al., 2009).

IV. CONCLUSION

The present study suggests breed-related variations due to stress of transportation, indicating differences in response to stress among different breeds of Saudi goats. Lipoic acid negate the decline in antioxidant (vitamin C and E), and this may be due to its regenerating effects of vitamins under stress conditions, when their utilization is high. Supplementation of lipoic acid may prove effective in counteracting stress of transportation and could be used in more trials in the future with emphasis also with heat stress, prevalent during summer in Saudi Arabia. Due to the increase in goat industry in Saudi Arabia, for their meat, more studies on their welfare should be addressed.

V. REFERENCES


Degradation of Polyester-Based and Vegetable Fiber Polymeric Composites
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ABSTRACT
In recent decades, polymeric materials have been considered to be a cause of environmental problems worldwide. An alternative to address this problem is the use of biodegradable polymers, which are materials that are degraded through the action of microorganisms and that are becoming a new global trend. In this study, composites were prepared using a biodegradable matrix based on polyester and cornstarch (Ecobras™) with vegetable fibers of coconut and corn stover, having two types of polymerization degree, namely, film and injection-molded samples. Degradability studies were conducted in simulated soil, following the ASTM G 160-03 protocol, through the monitoring of mass loss and morphology observations of Ecobras™ free from vegetable fibers and of composites combining film-grade Ecobras™/coconut fiber and injection molding-grade Ecobras™/corn stover, with vegetable fiber contents of 1%, 5% and 10% compared to the polymer matrix. The degradability tests showed that all samples experienced significant mass losses. It was possible to confirm the mass loss and observe the presence of microorganisms attached to the samples after 17 weeks of degradation.

Keywords: Ecobras™, Green Coconut Fiber, Cornstover, Degradation

I. INTRODUCTION
Due to their properties, versatility and price, polymers have many applications in the device market. However, the spread of petrochemical-based polymeric materials increases the use of non-renewable resources and leads to the accumulation of large amounts of non-biodegradable waste. Pollution caused by non-biodegradable polymers has become a global concern. These materials pollute rivers, lakes, and soil, causing a severe negative impact on the environment [1-3].

To reduce the environmental impact, readily degradable materials should be developed from renewable sources [4-5]. An example for minimizing the impact on the environment is the use of natural fibers in biodegradable polymer matrices.

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Ecobras™ is a synthetic polymer based on polyester and cornstarch. Ecobras™ is a biodegradable and compostable plastic produced by BASF and Corn Products that contains 50% vegetable starch from corn and Ecoflex® (polybutylene adipate co-terephthalate (PBAT)). Ecoflex® is, in turn, obtained from the combination of 1,4-butanediol, adipic acid and terephthalic acid. Ecobras™ has an average molecular weight of 66,500 g.mol⁻¹ and is most commonly used in film processing. For use in processing by extrusion or injection molding, a polymer with a higher molecular weight may be necessary. Chain extension provides a simple approach for generating this high molecular weight material, at least for test applications [6-7]. Ecobras™ was developed to possess biodegradability along with good mechanical and processing properties. This material has a significantly lower viscosity than Ecoflex® because the corn starch used in manufacturing Ecobras™ is modified with maleic anhydride, a
plasticizer with a low molecular weight, and when incorporated in the form of granules, the unstructured synthetic polymer matrix causes a reduction in viscosity [8-9].

The objective of the present study is to evaluate the biodegradation of Ecobras™ composites with cornstover and coconut fibers in simulated soil.

II. METHODS AND MATERIAL

1. Preparation of the composites

This study used a matrix of the composite commercial polymer Ecobras™ with two different processing specifications, film-grade Ecobras™ and injection molding-grade Ecobras™, kindly provided by BASF and Corn Products.

The film-grade Ecobras™ samples were processed at a temperature of approximately 115°C for 8 minutes using a rotor speed of 60 rpm, followed by compression using a hydraulic press at 115°C for 10 minutes to form specimens 0.5 mm thick and 30 mm in diameter.

Injection molding-grade Ecobras™ samples were prepared at a processing temperature of 140°C, a rotor speed of 100 rpm and a total mixing time of 8 minutes. The samples were then injected into a semi-industrial molding machine at a temperature of 135°C to obtain specimens 20 mm long, 12 mm wide and 2 mm thick.

The materials used for the formation of film-grade samples were film-grade Ecobras™ free of coconut fiber and film-grade Ecobras™ with coconut fiber provided by Green Coconut Project, Rio de Janeiro, Brazil.

The materials used for injection molding-grade samples were injection molding-grade Ecobras™ free of corn plant material and injection molding-grade Ecobras™ with milled corn stover provided by EMBRAPA Corn and Sorghum, Sete Lagoas/Minas Gerais, Brazil.

For the preparation of the composite, the ratios of polymer (m)/natural fiber (m) for both coconut fiber and corn straw were 99/1, 95/5 and 90/10.

2. Degradation evaluation

The degradation evaluation used was in accordance to ASTM procedures [10]. Samples were removed at 2 to 17 weeks during the degradation tests, and for each week one vessel was prepared with the composite free of fiber, and placed in a chamber at 30±2°C. Each sample was cleaned and weighed to evaluate the mass loss and morphological structure of each sample. The experiments were performed in triplicate.

2.1. Mass loss assessment

All samples were taken from each system according to the period of the simulated soil test. The samples were cleaned and weighed to obtain a constant final mass at the end of the degradation process in simulated soil.

The mass loss percentage was analyzed at 2 to 17 weeks after the withdrawal of samples of composite and of Ecobras™ free of natural fiber from each degradation test in simulated soil.

2.2. Morphological analysis

Samples were dried by critical point CO₂ and metalized by sputtering with a thin layer of gold. The microorganisms were observed by scanning electron microscopy at original magnifications of 1,500 to 10,000 with an accelerating voltage of 15kV.

III. RESULTS AND DISCUSSION

1. Mass loss assessment

The mass losses from Ecobras™ free of natural fiber and from the composite were analyzed at 2 to 17 weeks. There was a significant mass loss from both composites and Ecobras™ free of natural fiber. These mass losses can be attributed to the degradation of Ecobras™ and the biodegradation of the natural fibers. It could be observed that the initial mass loss were high, with each sample exhibiting a significant mass loss in the first two weeks. The high content of starch in the Ecobras™ and its composites could have highly contributed to this initially higher degradation [2,11].

The mean percentages of mass loss of composites and Ecobras™ free from natural fibers are in disagreement
with the literature, which reports that mass loss values decrease over the course of weeks of biodegradation testing [12-14]. In the present work a stabilization of the biodegradation could be observed from the 2nd to the 17th week of test.

Note that as the fiber content increases in the composition of the composite, a decrease in the mass loss of the material is observed in relation to the fiber-free polymer, that can be explained by the presence of natural fibers, which show a decrease in the rate of biodegradation of the natural fiber samples due to hindering the action of microorganisms in the Ecobras™ polymer matrix [11, 15-17].

In comparing the mass loss of the film-grade Ecobras™ and injection molding-grade Ecobras™, it is important to mention that the increase in molecular weight depends strongly on the processing temperature. Thus, samples of injection molding-grade Ecobras™ showed an increase in the difficulty of degrading the material due to its higher molecular weight and thicker specimens than the film-grade Ecobras™ [7].

2. Morphological analysis

In the scanning electron microscopy evaluations of composite samples and Ecobras™ free of natural fibers, it is possible not only to observe the changes in morphology as a result of each sample biodegradation process but also to assess the adherence of the polymer matrix and natural fiber in the composites. It was observed that the surfaces of Ecobras™ samples free of natural fibers before the burial test in simulated soil are smooth, without gaps or holes in the surface of the material. However, over the weeks of degradability testing, the Ecobras™ samples free of natural fibers developed voids or holes in the material surface undergoing a noticeable change in morphology. This is in accordance to the results reported by [18].

Coconut fiber and the corn stover were incorporated into the polymer matrix in all composites. In the samples of polymer matrix with coconut fiber or corn stover, the degradation behavior was very similar to that of the polymer free of natural fibers.

Therefore, it could be observed that in the following weeks, the surface morphology of each material changed during the degradation test. One can also investigate the presence of natural fibers separated from the matrix during the degradation test because the natural fibers were fully engaged in the Ecobras™ polymer matrix throughout the sample processing, but during the simulated soil testing, the coconut fiber and corn stover began to separate from the polymer matrix. This phenomenon was because biodegradation occurs preferentially in the polymer, whereas for the coconut fiber and corn stover, the decoupling matrix requires more time to degrade.

It could be observed the presence of microorganisms both in film-grade Ecobras™ free of coconut fiber and in injection molding-grade Ecobras™ free of corn stover. This result indicated that the material is biodegradable, as described in the literature [19-20].

IV. CONCLUSION

The Ecobras™ and its composites with cornstove and coconut fibers lost more than half of its mass during the period of the test, indicating that the biodegradation process took place, particularly in the first two weeks.

The observation of microbial biofilms on the surface of Ecobras™ and its composites confirm the involvement of microorganisms in the degradation process of these materials. This is also emphasized by the observation of microbial cells at the end of the test, confirming that they are still metabolically active at the expenses of the polymeric materials. Therefore, we can assume that Ecobras™ and its composites are biodegradable.

V. REFERENCES

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Delivery of Malpositioned Fetus by Partial Fetotomy in a Primiparous Cow

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ABSTRACT

Relieving dystocia in a cow by partial fetotomy and applying traction with long obstetrical hook.

Keywords: Fetotomy, Post-Traction, Dystocia, Malpresentation, Repulsion.

I. INTRODUCTION

Deviations of head and neck are common type of abnormal posture in anterior presentations causing dystocia in all species (Roberts, 1971). The incidence of dystocia in cattle is high compared to equines (Morrow, 1986).

Case History and Observation

A three year old cow in first parity with undersized body condition at calving with full term was presented to TVCC, College of Veterinary Science, Rajendranagar, Hyderabad from Goshala with history of onset of labour more than 24 hours. The clinical case was handled by local paraveterinarian for 1-2 hours after beginning of labour. By applying forced traction on forelimbs without observing the position of head and neck. After the complication of the case it is presented to TVCC.

On general examination, the cow appeared dull, depressed and in recumbent posture. Udder engorgement and relaxation of sacrosciatic ligament were prominent. Both forelimbs were protruded out from the vulva. Conjuctival mucous membranes were normal. Vulva was swollen and edematous.

Pervaginal examination revealed a dead fetus in anterior longitudinal presentation, dorso-sacral position with left lateral deviation of head and neck. The cervix was fully dilated and uterine cavity was dry and was devoid of fetal fluids but there is a scope for fetal repulsion. The case was diagnosed as dystocia due to left lateral deviation of head and neck.

II. METHODS AND MATERIAL

TREATMENT

As the birth canal is dry with inflamed vagina, the vagina was lubricated with 1%carboxymethyl cellulose liquid. The lubricant was also infused into uterus with the help of catheter. Both the forelimbs were pulled out of the vulva and partial fetotomy was performed by cutting at the knee joint of both limbs by retaining the first row of carpal bones to radius and ulna (Fig.1). After amputation, obstetrical chain was applied to both the limbs above the knee joint and were repelled into uterus to create the adequate space in the birth canal. Fetal head was located with help of obstetrician hand and obstetrical sharp eye hook was fixed into the long handle is passed into uterus and hook is fixed to the inner canthus of eye orbit and traction was applied. Slowly, the fetal head was brought into birth canal. Both limbs were extended into birth canal by applying slow traction with the help of obstetrical chain.

Once the two limbs and head was pulled upto the level of vulva, traction was applied on two limbs alternatively in downward and backward direction and simultaneously slight traction was applied on fetal head. Thus complete fetus was delivered by traction (fig .2).
Supportive treatment was given to the cow after delivery of the dead foetus by administering Inj. Calcium borogluconate-450ml,I/V; Inj. Rintose -500ml,I/V; Anhistamin-10ml,I/M; Melonex-10ml,I/M and a course of antibiotic Inj.Intacef-2.5g was given I/M for 5 days. The Cow recovered eventually without postpartum complications.

III. RESULT AND DISCUSSION

Underdeveloped pelvis, deviated head and neck were contributing factors for occurrence of the dystocia. Application of the traction on fetal forelimb by the paraveterinarian without observing the fetal head position resulted into complication of the case further. Zaborski(2009) reported that cow body weight and condition, cow pelvic area, calf birth weight are the contributing factors for dystocia. Nix and Spitzer (1998) reported that dystocia was greater in primiparous (17%) than multiparous dams (4%). Higher number of dystocia cases were delivered with fetotomies in cows when compared to buffaloes (Purohit and Mehta, 2006).Peter Jackson (2004) reported percentage of bovine dystocia cases due to feto-pelvic disproportion is 45% and fetal malpresentation is 28% among the total dystocia conditions in dairy cattle. The case was delivered by fetotomy operation because fetotomy is best operation for dead fetus and dam requires less care after fetotomy than cesarean section. Fertility and milk production are likely to be higher after fetotomy than cesarean section. in backend it generate XML file so that later we can parse the equations and can evaluate.

IV. REFERENCES


Investigation on the level of ICT Awareness among Secondary School Teachers in Sokoto State – Nigeria

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ABSTRACT

This research investigates the level of awareness on ICT among secondary school teachers. It focuses on the secondary school teachers in Nigerian context specifically Sokoto metropolis. In undertaking this research, a sample of four hundred (400) questionnaires was distributed to selected secondary school teachers of which 365 copies of the questionnaires were duly answered and returned by the respondents. Hence, these data were analyzed using simple frequencies, percentages and chi-square methods. Conclusively, this research has shown that level ICT penetrating Sokoto state secondary school teachers is growing rapidly. Also majority of secondary schools have ICT facilities. But the level of ICT training to teachers is fair because the difference between trained teachers and untrained teachers is negligible. In addition, very few numbers of teachers are not using ICT facilities in teaching and learning. This is identified to be attributed to lack of proper training on how to use the available ICT facilities and constant power supply. It is recommended that proper training should be continuously given to all staff in all levels on how to use the available ICT facilities. Furthermore, constant power supply should be provided to enable teachers to use these ICT facilities any time required.

Keywords: ICT, Teachers, Investigation, Sokoto State, Education, Secondary School

I. INTRODUCTION

Information Communication Technology (ICT) refers to the set of technologies that are applied in the process of collecting, storing, editing, retrieving, and transfer of information in various forms [1]. The usage of ICTs in Nigeria and in African countries generally is increasing and rapidly growing. However, while there is a great deal of knowledge about how ICTs are being used in developed countries, there is no much information on how ICTs are being introduced into schools in developing countries [2].

The application of ICT enable a powerful learning environment and it transforms the learning and teaching process in which students deal with knowledge in an active, self-directed and constructive way [3]. ICT is not only employed as an instrument, which can be added for existing teaching methods but also seen as an important instrument to support new ways of teaching-learning process. ICT is being integrated into the teaching-learning process in various educational institutions in Nigeria and the world in general.

Even though ICT is somewhat new phenomenon in Nigeria, the use of computers is applied in many areas of human activities, such as medicine, domestic activities, engineering, architecture, and education. It is crucial to investigate how the use of ICT is reflected in the secondary school programs. However, ICT in the educational sector calls for all the stakeholders in the education to be computer literate, if the schools are to survive with the challenges in the society. For the schools to be effective, computer literacy should be established through computer availability, computer utilization, and content competencies in the schools, as
well as through teachers’ effectiveness in the areas of teaching and learning, record keeping, supporting student academic performance, teachers job performance, school discipline and community services.

This research attempts to investigate the level of awareness on ICT among secondary school teachers. It focuses on the secondary school teachers in Nigerian context specifically Sokoto metropolis. A sample of four hundred (400) questionnaires was distributed to selected secondary school teachers of which 365 copies of the questionnaires were duly answered and returned by the respondents. Hence, these data were analyzed using simple frequencies, percentages and chi-square methods.

Background and Literature Survey

Information and Communications Technology (ICT) is often used as a complete synonym for Information Technology (IT). But is a more special term that stresses the role of unified communications and the integration of telecommunication (telephone lines and wireless signals), computers and necessary enterprise software, middle ware, storage, and audio-visual systems, which allow users to access, store, transmit, and manipulate information. Academic researchers had used the expression ICT since the 1980s, but it became well-known after Dennis Stevenson used it in a report to UK government in 1997 and in the revised National curriculum for England, Whales, and Northern Ireland in 2000.

ICT is a computer-based system for information transmission, reception, processing and retrieval which has drastically changed the way we think, the way we live and the environment in which we live [4]. It can be used to access global knowledge and communication with other people [4]. Students that make usage ICTs gain deeper understanding of complex topics and concepts, and are more likely to remember information and use it to solve problems outside the class environment [5]. In addition, students extend and deepen their knowledge, investigation, and inquiry through ICT according to needs and interest when access to information is available on multiple levels.

A lot of researches have been conducted on ICT. Adebowale and Dare [6] investigate the level of awareness of primary and secondary school teachers of Oyo state invited for a capacity building workshop of Nigeria’s educational policy on ICT as well as its possible influence on the use of ICT for classroom teaching and learning. Data collection was done using a self-constructed and validated questionnaire titled: “Teachers awareness of Nigeria’s educational policy on ICT”. The data was analyzed using simple percentage, t-test and ANOVA. This study found that only a small percentage of the respondents possess a high level of awareness of the country’s educational policy on ICT.

Also, Obakhume [7] assess secondary school teachers’ use of ICT in Oyo metropolis of Oyo state. This study examines the availability and usability of Information and communication technology among secondary school teachers in Oyo Metropolis. The Research Design employed is the descriptive survey design. Data collected were analyzed using frequency tables and simple percentage. Results of the study showed that ICT facilities are not available in most of the schools covered. It was also observed most teachers used as the sample for the study, are not competent in the use of ICT.

Another study is conducted by Mingaine [8] to investigate skills challenges in adoption and use ICT in public secondary school, Kenya. The study explored teachers’ skills that influenced the process of adoption and use of ICT in public secondary schools. It adopted a descriptive survey research design. Data collected was analyzed by use of descriptive and inferential statistical techniques after which results were presented in tables. The study findings established that there was limited supply of qualified ICT teachers in Kenya.

In addition, Badau and Sakiyo [9] conducted a study by assessing the competence of ICT of rural and urban secondary school ICT teachers for the implementation of ICT curriculum in North Eastern Nigeria. Data was analyzed through grand mean, standard deviation and percentage. Results reveal that the competence of ICT teachers on policy, curriculum, pedagogy, technology, administration and professional development is low. Obstacles to ICT teachers competences were identified as lack of hardware, software, and financial resources, lack of electricity in most rural schools and insufficient information and experience from teachers in ICT applications.
Further, Ndibalema [10] conducted a research on teachers’ attitudes towards the use of ICT as a pedagogical tool in secondary schools in Tanzania, taking Kondoa District as the case study. The data collection methods involved questionnaire and interview. This study adopted the mixed method approach which considers both quantitative and qualitative as the methodological solutions. It was found that teachers have positive attitudes towards the use of ICT as a pedagogical tool but they did not integrate it in their teaching effectively. Also, low familiarity with ICT usage as a pedagogical tool among teachers was found to be a problem.

II. METHODS AND MATERIAL

Research Design

Taking into Cognicase the research population and topic, descriptive otherwise known as survey research design is adopted. The survey research design enable data to be collected through the use of questionnaires and interview at a point in time without subjecting the variables to any manipulation, control, or experimentation.

The research design was adopted in order to generate enough data to answer the research questions. The research is also designed such that the data collected can easily be quantified, so that it could be reported quantitatively.

Population of the Research

This research comprises some public and private secondary school teachers within Sokoto state Metropolis as its population.

Sample and Sampling Techniques

In undertaking this research, a sample of four hundred (400) questionnaires was distributed to selected secondary school teachers. However, in order to offer an equal opportunity of the entire population stratified random sampling will be used. This will provide an opportunity to choose the teachers that will give a true representation of the population.

Instruments

Questionnaire is used in this research as instruments for collection of data. In this category of research, the usage of questionnaire is necessary since it gives the respondents freedom and greater opportunity to convey themselves with regard to the questions asked. A set of questions are setup to generate data to answer the research questions and problems.

Method of Data Analysis

After data has been collected using questionnaire, it is going to be analyzed using simple frequencies, percentages and chi-square methods.

III. RESULT AND DISCUSSION

Four hundred (400) copies of questionnaires was distributed for this research of which 365 copies of the questionnaires were duly answered and returned by the respondents. Hence, these data were analyzed and presented using tabular, percentage and chi-square methods for easy understanding.

Table 4.1: Sex of the Respondents

<table>
<thead>
<tr>
<th>Sex</th>
<th>Respondents</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>158</td>
<td>43</td>
</tr>
<tr>
<td>Female</td>
<td>207</td>
<td>57</td>
</tr>
<tr>
<td>Total</td>
<td>365</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Questionnaire administered 2015

From table 4.1, it has been observed that 43% of the total respondents are males while the remaining 57% are females. The analysis shows that most of the respondents are females considering the distribution of the sex as shown by the analysis.

Table 4.2: Age Distribution of the Respondents

<table>
<thead>
<tr>
<th>Age</th>
<th>Responses</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-29</td>
<td>105</td>
<td>29</td>
</tr>
<tr>
<td>30-39</td>
<td>177</td>
<td>49</td>
</tr>
<tr>
<td>40-49</td>
<td>71</td>
<td>19</td>
</tr>
<tr>
<td>50 and Above</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>365</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Questionnaire administered 2015
Table 4.2 shows that the majority of the respondents fall between the ages of 30-39 representing 49%, which constituted that most of the respondents are middle-aged people.

Table 4.3: Qualification of the Respondents

<table>
<thead>
<tr>
<th>Qualification</th>
<th>Responses</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCE</td>
<td>101</td>
<td>28</td>
</tr>
<tr>
<td>OND</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>HND</td>
<td>36</td>
<td>10</td>
</tr>
<tr>
<td>B.ED</td>
<td>81</td>
<td>22</td>
</tr>
<tr>
<td>B.SC</td>
<td>61</td>
<td>18</td>
</tr>
<tr>
<td>B.S.C.E.D</td>
<td>56</td>
<td>15</td>
</tr>
<tr>
<td>M.SC</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>M.ED</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>B.A</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>365</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

*Source: Questionnaire administered 2015*

Table 4.3 analyses: 28% of the total population representing 101 respondents are NCE holders, 1% of the total population representing 6 respondents are OND holders, 10% of the total population representing 36 respondents are HND holders, 22% of the total population representing 31 respondents are B. Ed holders, 18% of the total population representing 61 respondents are B. Sc holders, 15% of the total population representing 56 respondents are B.Sc.Ed holders, 2% of the total population representing 9 respondents are M. Sc holders, 1% of the total population representing 5 respondents are M. Ed holders, and 3% of the total population representing 10 respondents are B.A holders. This is clear evident that the highest qualification among the respondents is NCE holders followed by B.Ed holders.

Table 4.4: Teaching Experience of the Respondents

<table>
<thead>
<tr>
<th>Week/Months/Years</th>
<th>Respondents</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Weeks</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>4 Months</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>1-5 Years</td>
<td>140</td>
<td>38</td>
</tr>
<tr>
<td>6-10 Years</td>
<td>134</td>
<td>37</td>
</tr>
<tr>
<td>11-15 years</td>
<td>48</td>
<td>12</td>
</tr>
<tr>
<td>16-20 Years</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>21-25 Years</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>26-30 Years</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>31-35 Years</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

*Source: Questionnaire administered 2015*

Table 4.4 indicated that the majority of the respondents to the questionnaire have teaching experience of 1-5 years, which constituted 38% out of the total population.

Table 4.5: Have you ever heard of IT before?

<table>
<thead>
<tr>
<th>Responses</th>
<th>Respondents</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>340</td>
<td>93</td>
</tr>
<tr>
<td>No</td>
<td>25</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>365</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

*Source: Questionnaire administered 2015*

Table 4.5 indicates that 340 of the respondents (93%) have heard of IT before, while 25 respondents (7%) never heard about IT. This have clearly shows that the level of IT penetrating among teachers is growing rapidly.

Table 4.6: If YES to the above question, how did you hear about it?

<table>
<thead>
<tr>
<th>Responses</th>
<th>Respondents</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media</td>
<td>89</td>
<td>24</td>
</tr>
<tr>
<td>School</td>
<td>199</td>
<td>55</td>
</tr>
<tr>
<td>Friend</td>
<td>33</td>
<td>9</td>
</tr>
<tr>
<td>Books</td>
<td>29</td>
<td>8</td>
</tr>
<tr>
<td>Others</td>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>365</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

*Source: Questionnaire administered 2015*

Table 4.6 indicates that out of the total respondents; 28% heard about IT on Media, 55% heard about IT from School, 9% heard about it from friends, 8% heard about it from Books and 4% heard about IT from other sources. These shows that majority of the respondents heard about IT from school, meaning that they are thought about IT during their schooling.

Table 4.7: Do you know what ICT means?

<table>
<thead>
<tr>
<th>Responses</th>
<th>Respondents</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>320</td>
<td>88</td>
</tr>
<tr>
<td>No</td>
<td>45</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>365</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

*Source: Questionnaire administered 2015*

On response to the question “Do you know what ICT means”, majority of the respondents know what ICT means by 88%.
### Table 4.8: Do you have IT facilities in your school?

<table>
<thead>
<tr>
<th>Responses</th>
<th>Respondents</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>243</td>
<td>67</td>
</tr>
<tr>
<td>No</td>
<td>122</td>
<td>33</td>
</tr>
<tr>
<td>Total</td>
<td>365</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Questionnaire administered 2015

On the responses to the question on the table 4.8, 67% answered Yes that they have ICT facilities in their schools, while the remaining 33% answered No, they don’t have ICT facilities in their schools. Therefore, majority of the respondent have ICT facilities in their schools.

### Table 4.9: Do you use any of the facilities in teaching learning process?

<table>
<thead>
<tr>
<th>Responses</th>
<th>Respondents</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>172</td>
<td>47</td>
</tr>
<tr>
<td>No</td>
<td>193</td>
<td>53</td>
</tr>
<tr>
<td>Total</td>
<td>365</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Questionnaire administered 2015

On the response to question on the table 4.9, 47% answered Yes, that they use ICT facilities in teaching/learning processes, while 53% answered No, they do not use ICT facilities in teaching/learning processes. Therefore high percentages of the respondents are not using of the available ICT facilities in their schools.

### Table 4.10: Have you received any form of training on how to use IT facilities?

<table>
<thead>
<tr>
<th>Responses</th>
<th>Respondents</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>206</td>
<td>56</td>
</tr>
<tr>
<td>No</td>
<td>159</td>
<td>44</td>
</tr>
<tr>
<td>Total</td>
<td>365</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Questionnaire administered 2015

On response to the question on table 4.10, 56% answered Yes, they have received some sort of training for IT, while 44% answered No, they have not received any form training for IT facilities. So, conduct of training is fair because the difference between trained and untrained teachers is negligible.

### Hypothesis Testing

This section test the tentative questions and answers set earlier in the introductory section, with aim of examining the validity and accuracy of the set hypothesis for informed decision making thereof.

Responses from table 4.7 is used to analyze the above hypotheses

<table>
<thead>
<tr>
<th>Responses</th>
<th>Yes</th>
<th>No</th>
<th>Row Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>320</td>
<td>0</td>
<td>320</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>Total</td>
<td>320</td>
<td>45</td>
<td>365</td>
</tr>
</tbody>
</table>

Source: Questionnaire administered 2015

To test the above hypothesis, use the formula:

\[ \chi^2 = \sum \frac{(O - E)^2}{E} \]

Where,

- \( O \) = Observed frequency or data
- \( E \) = Expected frequency or data
- \( \Sigma \) = Addition/Summary Sign

Therefore,

\[ \chi^2 = \frac{RT \times CT}{GT} \]

Where,

- \( RT \) = Row Total
- \( CT \) = Column Total
- \( GT \) = Grand Total

Therefore,

\[ \frac{320 \times 320}{365} = \frac{102,500}{365} = 280 \]

### Table 4.11: Chi-Square Computation

<table>
<thead>
<tr>
<th>Observed</th>
<th>Expected</th>
<th>( \frac{O - E}{E} )</th>
<th>( \frac{(O - E)^2}{E} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>320</td>
<td>280</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>0</td>
<td>40</td>
<td>-</td>
<td>16</td>
</tr>
<tr>
<td>0</td>
<td>40</td>
<td>-</td>
<td>16</td>
</tr>
<tr>
<td>45</td>
<td>5</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>0</td>
<td>40</td>
<td>-</td>
<td>16</td>
</tr>
<tr>
<td>45</td>
<td>5</td>
<td>4</td>
<td>16</td>
</tr>
</tbody>
</table>

Source: Computation by the Researcher 2015

The degree of freedom = D.f. = \( (r - 1) (c - 1) \)
\[ = (5 - 1) (5 - 1) = 4 \times 4 \]
D. f= 16

Level of significance \( \alpha = 0.5 \) (5%)
From the above computation, \( X^2 \) calculated is 405.7 while the critical table (\( X^2 \) tabulated) at d. f. and at 5% level of significance is 26.296.

**Decision Rule**

Since the \( X^2 \) calculated 405.7 is greater than the value of \( X^2 \) tabulated from the critical table which is 26.296 at d. f. and at 5% level of significance, the we reject the null hypothesis (H0) and accept alternative hypothesis that majority of the respondents knows the meaning of ICT and what it stands for.

**Hypothesis Two**

H0: Never heard of IT before.

The responses from table 4.5 below are used to analysed and test the above hypothesis.

<table>
<thead>
<tr>
<th>Responses</th>
<th>Yes</th>
<th>No</th>
<th>Row Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>340</td>
<td>0</td>
<td>340</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>340</td>
<td>25</td>
<td>365</td>
</tr>
</tbody>
</table>

**Source:** Questionnaire administered 2015

Also to test the above hypothesis, use the formula:

\[
X^2 = \sum \frac{O - E}{E}
\]

Where,

\[
O = \text{Observed frequency or data}
\]

\[
E = \text{Expected frequency or data}
\]

\[
\Sigma = \text{Addition/Summary Sign}
\]

Therefore,

\[
E = \frac{RT \times CT}{GT}
\]

Where,

\[
RT = \text{Row Total}
\]

\[
CT = \text{Column Total}
\]

\[
GT = \text{Grand Total}
\]

Therefore,

\[
\frac{340 \times 340}{365} = 115.600 \frac{365}{365} = 317
\]

**Table 4.12: Chi-square Computation**

<table>
<thead>
<tr>
<th>Observed</th>
<th>Expected</th>
<th>( O - E )</th>
<th>( (O - E)^2 )</th>
<th>( (O - E)^2 / E )</th>
</tr>
</thead>
<tbody>
<tr>
<td>340</td>
<td>317</td>
<td>2</td>
<td>52</td>
<td>1.6</td>
</tr>
<tr>
<td>0</td>
<td>23</td>
<td>2</td>
<td>52</td>
<td>9</td>
</tr>
<tr>
<td>0</td>
<td>23</td>
<td>2</td>
<td>52</td>
<td>9</td>
</tr>
</tbody>
</table>

**Source:** Computation by the Researcher 2015

The degree of freedom = d. f. = \((r - 1) (c - 1)\)

\[= (2 - 1)(2 - 1)\]

\[= 1 \times 1\]

D. f. = 1

Level of significance \( \alpha = 0.5 \) (5%)

From the above computation, \( X^2 \) calculated is 312.1 while the critical table (\( X^2 \) tabulated) at d. f. and at 5% level of significance is 3.841.

**Decision Rule**

Since the \( X^2 \) calculated 312.1 is greater than the value of \( X^2 \) tabulated from the critical table which is 3.841 at d. f. and at 5% level of significance, the researcher reject the null hypothesis (H0) and accept alternative hypothesis that the respondent have heard about IT before.

**IV. CONCLUSION AND RECOMMENDATION**

Even though ICT is somewhat new phenomenon in Nigeria, the use of computers is reflected in many areas of human activities, such as medicine, domestic activities, engineering, architecture, and education. It is crucial to investigate how the use of ICT is reflected in the secondary school programs. However, ICT in the educational sector calls for all the stakeholders in the education to be computer literate, if the schools are to survive with the challenges in the society. For the schools to be effective, computer literacy should be demonstrated through computer availability, computer utilization, and content competencies in the schools, as well as through teachers’ effectiveness in the areas of record keeping, supporting student academic performance, teachers job performance, school discipline and community services.

In conclusion, this research has shown that level ICT penetrating Sokoto state secondary school teachers is growing rapidly. Also majority of secondary schools have ICT facilities. But the level of ICT training to teachers is fair because the difference between trained teachers and untrained teachers is negligible. In addition,
very few numbers of teachers are not using ICT facilities in teaching and learning. This is identified to be attributed to lack of proper training on how to use the available ICT facilities and constant power supply.

It is recommended that proper training should be continuously given to all staff in all levels on how to use the available ICT facilities. Furthermore, constant power supply should be provided to enable teachers to use these ICT facilities any time required.

In addition, Government, Companies, Religious groups, NGOs, Social organizations, PTAs etc, should provide the required ICT infrastructure in schools. Teachers should be trained on the use of ICT resources for subject teaching and learning particularly the use of different software packages, CDs, CD ROMs, video tapes on science concepts and processes etc. Computer literacy program should be provided for both pre-service and in service teachers and full integration of ICT resources into education program at teacher preparatory level should be ensured.

V. REFERENCES


Design and Simulation of MEMS-based Z-Axis Capacitive Accelerometer

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1University Institute of Engineering and Technology, Kurukshetra University, Kurukshetra, Haryana, India
2CSIR-Central Electronics Engineering Research Institute, Pilani, Rajasthan, India

ABSTRACT

In this paper, a MEMS-based Z-axis capacitive accelerometer is designed and simulated. An out-of-plane Z-axis accelerometer designed for 8 µm UV-LIGA technology for an acceleration range of ±10g. The operating voltage is 5 V DC. Simulation results show good linear characteristics in the operating range of DC-400 Hz, which is the bandwidth of the accelerometer. The simulations of the device were carried out using CoventorWare®. By using modal analysis in CoventorWare® the resonating frequency of 3.1 kHz is obtained.

Keywords: MEMS, Accelerometer, UV-LIGA, CoventorWare®

I. INTRODUCTION

Accelerometers are used to measure the linear acceleration along its sensitive axis and transduce this inertial force into a measurable electrical signal. Accelerometers can measure tilts, shocks and vibrations [1]. They have a numbers of applications of such inertial sensors. Around 90% of the applications of accelerometers are in automotive industry used in the deployment of air bag systems, 8% in inertial navigation and guidance systems. Some other applications of the accelerometer are biomedical applications, vibrating monitoring, and seismic activities, etc. [2-3].

There are various types of accelerometers based on their fabrication or working principle like piezoresistive, piezoelectric, capacitive, tunnelling, etc. [4]. Since there are various sensing mechanisms with their advantages and limitations, capacitive accelerometers have several advantages such as good DC response, high voltage sensitivity, low noise floor, low drift, low power consumption and low temperature dependency, which make them very attractive for various high performance applications [5].

Accelerometer measure linear acceleration along its sensitive axis. This acceleration can be converted into capacitance change by using capacitive accelerometers. Most of the MEMS capacitive accelerometers are single axis, and the integration of two or three accelerometers is required to measure three-dimensional acceleration [6]. Accelerometer consists of a large proofmass, connected to anchors via suspension beams and a bottom electrode. When there is acceleration, the proofmass deflects from its initial position, gap between proofmass and electrode changes and thereby, capacitance changes. This change in capacitance can be measured by converting it into voltage by using a capacitance to voltage convertor. This output voltage is proportional to acceleration at the input.

II. METHODS AND MATERIAL

Theoretical Background

Accelerometer consists of a square size proofmass, four anchors attached to suspension beams and a bottom electrode. Fig. 1 shows the schematic of the accelerometer. When there is z-axis acceleration, the gap between proofmass and bottom electrode changes and thereby, capacitance changes. This change in capacitance can be measured by converting it into voltage by using a capacitance to voltage convertor. This output voltage is proportional to acceleration at the input.

The sensitivity of the accelerometer is directly proportional to the displacement of the proofmass from its mean position and inversely proportional to the resonant frequency of the structure.
The accelerometer model is same as the second-order spring-mass-damper system as shown in Fig. 2 [7]. When there is an external acceleration, proofmass displaces and the motion of proofmass is opposed by spring and damper. The inertial force is given in equation (1).

\[ \text{m} \dddot{z} + \text{b} \dot{z} + \text{k} z = F_{\text{electrical}} \]  

Where, \( m \) is the mass of the system, \( z \) is the displacement, \( b \) is the damping force coefficient, and \( k \) is the spring constant.

Considering \( z \)-axis as the sensing direction, the equation for the out-of-plane accelerometer is

\[ \text{m} \frac{d^2 z(t)}{dt^2} + \text{b} \frac{dz(t)}{dt} + \text{k} z(t) = \text{ma}(t) \]  

Where \( \text{a}(t) \) is the acceleration on the proofmass. Let, \( \text{C}_1 \) is the original capacitance and \( \text{C}_2 \) is the capacitance after change in the gap between proofmass and bottom electrode. \( \Delta \text{C} \) is the total change in capacitance after deflection as shown in equation (3).

\[
\text{C}_2 = \frac{\varepsilon_0 A}{d-z} = \frac{\varepsilon_0 A}{d} \left( 1 + \frac{z}{d} \right)
\]

\[
\Delta \text{C} = \text{C}_2 - \text{C}_1 = \frac{\varepsilon_0 A}{d} \left( 1 + \frac{z}{d} - 1 \right) = \frac{\varepsilon_0 A}{d} \left( \frac{z}{d} \right)
\]

Total energy in the capacitive structure is calculated by using equation below, and force in the z-direction is calculated by partial differentiation of energy w.r.t. \( z \). After solving, the force is obtained as shown in equation (4).

\[
F = \frac{1}{2} \times \frac{\varepsilon_0 A}{(d-z)^2} V_{dc}^2 \times \frac{1}{2} \frac{\varepsilon_0 A}{(d-z)^2} (2V_{dc}V_{ac})
\]

Where,
- \( d \) = original gap between electrodes
- \( z \) = displacement from mean position
- \( V_{dc} \) = applied dc voltage
- \( V_{ac} \) = applied ac voltage

The design specifications of the accelerometer are given in Table I.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceleration range</td>
<td>±10g</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>DC-400 Hz</td>
</tr>
<tr>
<td>Operating voltage</td>
<td>5 V</td>
</tr>
<tr>
<td>Resonant Frequency</td>
<td>3.1 kHz</td>
</tr>
<tr>
<td>Nominal Capacitance</td>
<td>2 pF</td>
</tr>
</tbody>
</table>

The physical dimensions calculated for the optimized accelerometer design to meet the above specifications are given in Table II.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Size (units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proofmass size</td>
<td>1150 μm × 1150 μm</td>
</tr>
<tr>
<td>Size of perforations</td>
<td>10 μm × 10 μm</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Beam width</td>
<td>8 μm</td>
</tr>
<tr>
<td>Small beam length</td>
<td>50 μm</td>
</tr>
<tr>
<td>Large beam length</td>
<td>400 μm</td>
</tr>
</tbody>
</table>

### III. RESULT AND DISCUSSION

#### A. Simulation Results

Simulations of the accelerometer were carried out by using MEMSCAD tool CoventorWare®. Resonant frequency of the structure was observed using modal analysis in CoventorWare®. By using modal analysis first resonant mode of the structure was in Z-axis, which is the dominant mode of out-of-plane accelerometer, as shown in Fig. 3.1. Second mode was torsional across X-axis, as shown in Fig. 3.2, and third mode was torsional across Y-axis, as shown in Fig. 3.3.

Modal harmonic analysis is done in CoventorWare®. Amplitude response and phase response of the structure are observed. In amplitude response, maximum displacement observed at the resonant frequency of 3.1 kHz as shown in Fig. 3.4. Device behaves linearly between DC to 400 Hz, which is the bandwidth of the accelerometer.

In phase response, phase of the accelerometer is changed by $-\pi/2$ at the resonant frequency as shown in Fig. 3.5.
The structure dimensions were decided optimally based on this analysis and the layout of the structure was generated using L-Edit, layout editor tool from Tanner EDA. Then 3-level masks were designed for the fabrication of the accelerometer.

**B. Proposed Device Fabrication**

The accelerometer device is to be fabricated by using 8 µm UV-LIGA technology [8-9]. The process flow is shown in Fig. 4. It is a three mask process. Gold is used as a seed layer and chromium is used with gold for the adhesion purpose. Copper is used as sacrificial layer which acts as an excellent undercoat for the structural layer which is to be made of nickel material, has a high mechanical strength. The mould for the structural layer, nickel, is made by using SU-8 negative photoresist. Final device thickness will be of 8 µm.

**IV. CONCLUSION**

In this paper, design and simulation of a single axis, out-of-plane capacitive accelerometer using CoventorWare® have been presented for 8 µm UV-LIGA technology. Masks layout for the fabrication of the device has been designed and fabricated. The fabrication flow for the device is also discussed. The device resonating frequency of 3.1 kHz is achieved.

**V. REFERENCES**


Evaluation of Heavy Metals’ Concentrations in Sand Deposits along Heavy Traffic Areas in Port Harcourt Metropolis, Nigeria

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Ignatius Ajuru University of Education, Port Harcourt, Rivers State, Nigeria

ABSTRACT

Roadside sand deposits are common menaces on our roads within the cities of Nigeria, especially as they become air-borne due to heavy human and vehicular traffic as well as natural factors such as wild wind. Ten heavy locations were identified and samples collected and analyzed for 9 heavy metals: Cadmium (Cd), Chromium (Cr), Cobalt (Co), Copper (Cu), Iron (Fe), Manganese (Mn), Lead (Pb) and Zinc (Zn) in Port Harcourt City. Analysis was done using atomic absorption spectrophotometer and data generated were analyzed using descriptive statistics with Microsoft excel 2010. Results from the analyses show that all identified sample points are loaded with significant amounts of all the metals investigated at environmentally unacceptable levels. Iron was identified in triple digits in all sample points. Cadmium and lead were found to be significantly high so are other metals with respect to Who (1984) and FEPA (2003) regulations. These concentrations may be directly translated to the bioavailability of these metals which have very strong toxicological implications of these metals in the environment. Therefore, the present practice of sweeping roadside of sand deposits is obviously not effective especially at the junctions which are hardly attended due the heavy vehicular and human traffic.

Keywords: Heavy Metals, Heavy Traffic, Sand deposits, Port Harcourt

I. INTRODUCTION

Studies involving environmental levels of heavy metals have been extensively carried out by individual researchers and bodies in the different components of the environment all around the globe. Port Harcourt city in this study is comprised of two local government areas (Port Harcourt City and Obio/Akpor). The city is not just one of the many in the world, it is a city according to the 2006 Nigerian census of 1 382 592 people from 235 098 in 1963. This astronomical rise now stands at 1.5 million (Greater Port Harcourt City Development Authority, [1], approximately between 2.7 million and 3.7 million including the greater Port Harcourt areas [2].

Port Harcourt in Nigeria is the hub of the oil and gas and allied industries amidst other servicing economic activities such as food processing, transportation, paint manufacturing, paper and plastic manufacturing, etc. The city like every civilized society hosts corporate professional firm like the legal, accounting, engineering, real estate, medical, hospitality, banks, education (3 universities, 2 health colleges, 1 monotechnic-type college, over 300 public and private primary and secondary schools, a reasonable number of non-formal educational institutions, etc), etc. All of these come with some form of pressures on the city and its environs by of population inflow and congestions and corresponding pollution of same which include metals through the known channels of wear and tear, fossil fuel combustion emissions. This study therefore, aims to analyze the concentrations of some selected metals in some selected locations in the city prone to the challenges of the city status.

In Nigeria, the release of these metals and other pollutants into the environment has been implicated on high population density and industrialization [3] and specifically for roadside sand deposits [4]. Heavy metal concentration on roadside sand samples collected between 50cm-1m distance along Abakaliki–Enugu–Okigwe expressway in south eastern Nigeria was
reported with a mean values of 5205.1 (Fe), 247.97 (Cu), 74.11 (Zn) 100.19 (Pb) and 18.8 (Cd) mg/kg while means values at 100m away from the roadside for Fe, Cu, Zn, Pb and Cd were 4890, 217.86, 64.08, 87.13 and 3.05 mg/kg, respectively [5]. In Adogo, levels of heavy metals in soil and cassava leaves have been reported in roadside soil at ranges from <0.01-0.07±0.01 μg/g for Cd, 0.05±0.02-0.89±0.25 μg/g for Cu, 0.09±0.004-0.18±0.03 μg/g for Ni, 0.06±0.001-0.44±0.16 μg/g for Pb and 0.04±0.003-0.05±0.001μg/g for Zn [6]. Elsewhere in Africa such as in Ghana, Ketu-South District, increasing air pollution levels due to rapid urbanization and growth in vehicular emission was reported in roadside dust samples collected and analyzed for heavy metals which ranged from 0.4-18.2 μg/g for As; 284-9106 μg/g for Cr; 18.4-144.1 μg/g for Cu; 233-1240 μg/g for Mn; 12.3-493.2 μg/g for Ni; 3.1-67.8 μg/g for Pb; and 18.2-406.5 μg/g for Zn [7]. Beyond the shores of Africa such as in England, concentration levels of metals as high as 25.0-1198.0 μg/g for Pb, 56.7-480.0 μg/g for Zn, 0.3-3.8 μg/g for Cd and 15.5-240.0 μg/g for Cu have been reported in roadside soils which were higher than natural background levels reported for British soils [8]. In Nepal, roadside dust samples collected along Kathmandu-Bhaktapur road section of Arniko Highway, Kathmandu valley showed elevated levels of the heavy metals which ranged from 69.09-471.40 mg/kg for Pb, 1.56-6.15 mg/kg for Cd and 0.59-1.89 mg/kg for Hg with the average concentrations 245.36 mg/kg for Pb, 2.89 mg/kg Cd and 1.04 mg/kg Hg for the same elements [9].

II. METHODS AND MATERIAL

A. Sample Collection

10 sample points were purposively selected on the basis of the objective of this study which is the evaluation of concentrations of metals most likely to be released due commercial activities in such busy locations in the city. Grab samples of sand deposits were collected using plastic scrapers along each adjoining roads/streets to a given sampling points (SP) at a sampling distance of 4ft were collected. All samples collected from the designated SPs were combined into a composite sample for that SP. Each composite sample was stored in a tight polythene bag [10]. 10 composite samples were collected from the 10 selected sampling points for this study. The samples were designated as follows: Eleme junction (SP01EJ), Rumuokoro junction (SP02R1), Rumuokwuta junction (SP03R2), Rumuepirikom junction (SP04R3), Agip junction (SP05AJ), Mile3 Park area (SP06M3), Mile1 Market area (SP07M1), Mile1 Flyover (SP08FO), Waterlines junction (SP09WJ) and Rumuola junction (SP10R4).

B. Sample preparation and analysis

Samples were air-dried. 1 g of each of all the dry samples was digested in a 250 mL conical flask using a mixture 10 mL each of 40% HF and 70% HClO₄ in a fume chamber. The resultant clear colourless solution was allowed to cool down, filtered and made up to 100 mL with deionized waster and finally stored in plastic containers in readiness for analysis.

9 metals were analyzed using the 200A model Buck Atomic Absorption Spectrophotometer.

C. Data Analysis

Data generated was subjected to descriptive statistical analysis, mean and standard deviation using Microsoft excel 2007 package.

III. RESULT AND DISCUSSION

A. Results

The result of the study shown in table 1 reveals that all 9 metals are significantly loaded in the roadside sand collections at all the sample points evaluated in this study. Mean concentration of Cd was found to be 0.11±0.03 mg/kg with highest concentration of 0.14 mg/kg and 0.15 mg/kg at SP03R2 and SP07M1 respectively and lowest of 0.08 mg/kg at SP04R3, SP08FO and SP09WJ. Mean concentration of Pb was 1.25±0.71 mg/kg with the highest of 2.64 mg/kg at SP01EJ and lowest of 0.77 mg/kg at SP02R1 and SP10R4. Fe concentration was found in 3 digits with a mean of 305.0±83.8 μg/kg and highest of 463.0 μg/kg at SP07M1 and lowest of 199.0 μg/kg at SP06M3. The results also portray some degree of uniformity in distribution in concentration of the metals especially with Cr and Ni with mean levels approximately between 1.0-2.0 μg/kg respectively whereas Cu, Mn and Zn portray non-uniform distributions with mean levels at
0.50±8.37 mg/kg, 8.32±2.49 mg/kg and 5.03±0.61 mg/kg respectively. The pattern of distribution of these metals is depicted in figure 1 below. Findings of this study are presented in table 1 below.

Table 1: Metals Concentrations in Port Harcourt City (mg/kg)

<table>
<thead>
<tr>
<th>Samples</th>
<th>Cd</th>
<th>Co</th>
<th>Cr</th>
<th>Cu</th>
<th>Fe(x10)</th>
<th>Mn</th>
<th>Ni</th>
<th>Pb</th>
<th>Zn</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP01_EJ</td>
<td>0.10</td>
<td>1.10</td>
<td>0.55</td>
<td>26.91</td>
<td>33.86</td>
<td>11.07</td>
<td>1.76</td>
<td>2.64</td>
<td>4.74</td>
</tr>
<tr>
<td>SP02_R1</td>
<td>0.09</td>
<td>1.03</td>
<td>1.75</td>
<td>0.35</td>
<td>21.45</td>
<td>13.59</td>
<td>1.03</td>
<td>0.77</td>
<td>5.48</td>
</tr>
<tr>
<td>SP03_R2</td>
<td>0.14</td>
<td>1.14</td>
<td>1.80</td>
<td>11.82</td>
<td>30.65</td>
<td>9.25</td>
<td>2.32</td>
<td>0.92</td>
<td>4.96</td>
</tr>
<tr>
<td>SP04_R3</td>
<td>0.08</td>
<td>0.86</td>
<td>1.43</td>
<td>0.51</td>
<td>24.06</td>
<td>6.11</td>
<td>1.64</td>
<td>0.92</td>
<td>6.01</td>
</tr>
<tr>
<td>SP05_AJ</td>
<td>0.10</td>
<td>0.80</td>
<td>1.95</td>
<td>0.05</td>
<td>38.76</td>
<td>8.76</td>
<td>1.50</td>
<td>0.98</td>
<td>5.49</td>
</tr>
<tr>
<td>SP06_M3</td>
<td>0.09</td>
<td>0.65</td>
<td>1.09</td>
<td>0.57</td>
<td>19.90</td>
<td>5.84</td>
<td>1.34</td>
<td>0.92</td>
<td>4.59</td>
</tr>
<tr>
<td>SP07_M1</td>
<td>0.15</td>
<td>0.82</td>
<td>1.18</td>
<td>0.43</td>
<td>46.30</td>
<td>6.58</td>
<td>1.56</td>
<td>1.98</td>
<td>5.68</td>
</tr>
<tr>
<td>SP08_FO</td>
<td>0.08</td>
<td>0.78</td>
<td>1.30</td>
<td>0.46</td>
<td>24.81</td>
<td>8.20</td>
<td>1.30</td>
<td>1.27</td>
<td>4.08</td>
</tr>
<tr>
<td>SP09_WJ</td>
<td>0.08</td>
<td>0.83</td>
<td>1.27</td>
<td>1.83</td>
<td>36.16</td>
<td>7.69</td>
<td>1.32</td>
<td>1.33</td>
<td>4.52</td>
</tr>
<tr>
<td>SP10_R4</td>
<td>0.09</td>
<td>0.66</td>
<td>1.32</td>
<td>0.41</td>
<td>29.08</td>
<td>6.07</td>
<td>1.36</td>
<td>0.77</td>
<td>4.77</td>
</tr>
<tr>
<td>Mean</td>
<td>0.11</td>
<td>0.87</td>
<td>1.36</td>
<td>0.50</td>
<td>30.50</td>
<td>8.32</td>
<td>1.51</td>
<td>1.25</td>
<td>5.03</td>
</tr>
<tr>
<td>SD</td>
<td>0.03</td>
<td>0.17</td>
<td>0.40</td>
<td>8.37</td>
<td>8.38</td>
<td>2.49</td>
<td>0.33</td>
<td>0.71</td>
<td>0.61</td>
</tr>
<tr>
<td>FEPA (2003)</td>
<td>0.003</td>
<td>0.05</td>
<td>0.05</td>
<td>0.50</td>
<td>0.30</td>
<td>0.10</td>
<td>0.02</td>
<td>0.01</td>
<td>0.30</td>
</tr>
<tr>
<td>WHO (1984)</td>
<td>0.003</td>
<td>0.05</td>
<td>0.05</td>
<td>0.50</td>
<td>0.30</td>
<td>0.10</td>
<td>0.02</td>
<td>0.01</td>
<td>0.30</td>
</tr>
</tbody>
</table>

All locations have reasonable levels of all the metals evaluated, enough to provoke curiosity into how much of these and other metals are in the sand deposits along the roads evaluated and how much are airborne in the immediate vicinity and even beyond. These figures depict the very nature of our roads within the metropolis in the present, recent and immediate past.

B. Discussion

From the findings of this study, all metals investigated were found to way beyond environmentally permissible limits. Finding may not be directly unconnected with busy heavy traffic and commercial activities of the selected sample points. These points in the city are beehives of commercial activities which directly relate the heavy vehicular movements associated with these points of the city. The findings also corroborate all known findings in similar studies along the Abaliki-Enugu-Okigwe expressway study [5]; Adogo study in Nigeria [6]; Ketu-South in Ghana study [7]; England study [8]; Nepal roadside dust study [9]. These levels detected are not friendly values especially during the dry season when the likelihood of suspending the soil deposits and other particulate materials in the air.
by moving automobiles is highest. Foodstuffs sold along such affected roads/streets can readily take up these metals; direct inhalation is also a sure possibility.

IV. CONCLUSION

From the detected values of all the metals investigated, heavy traffic areas can be said to be polluted of these land- and air-borne heavy metals pollutants.

Further investigation into the levels of these pollutants and other metals in other areas within the city and the outskirts need to be carried out to ascertain the pollution level and devise remedial measures to check or control emissions, from fuel, corrosion and other sources in such heavy traffic areas.

This study is geared towards establishing the fact that a much more detailed study could be conducted especially, because of the sudden hike in commercial activities in the city which is also a beehive of major industries in the delta region of Nigeria.

V. REFERENCES


Theoretical Framework and Initiation of Scientific Project
“Life Motion of Energy-Element-Informational Unity of the Matter”
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Ukraine, Russia, Kazakhstan, China

ABSTRACT
To provide a scientific answer to the questions “How did life originate?” and “How does life affect the Earth and the Earth affect life?” a concept of the function of energy-element-informational state of physical and biological systems \( f(\text{E}, \text{Э}, \text{I}) \) has been developed. The regularities have been established and simulation of Life as a natural phenomenon, which is organized by moving in space and time energy-element-informational trinity of the Universe, has been run.

Keywords: Life, Motion, Energy, Element, Information, System Model.

I. INTRODUCTION
The U.S. National Research Council has formulated 10 key questions to which geologists and planetary scientists seek answers in the early 21st century. Among others, there are questions * How did life originate? * How does life affect the Earth and the Earth affect life? [1]. Life is one of the forms of existence of the matter that occurs naturally under certain circumstances in the course of its development [2].

Modern science looks at material systems as matters, energy fields, noting that reflection is the universal property of the matter. The role of reflection (information processes) is of special importance for biosystems that actively perceive information from the external environment, transform it, use it for its development, accumulate, store and communicate it to the external environment.

Motion is an essential attribute of the matter. When moving a material system changes its state which is manifested in the change of properties of the system.

To be able to describe changes of the system state (with a complex change in its substance, energy and information) a scientific study of some concept, feature, function of unity of elements, energy and information is required.

Objective:
- To develop the concept of the function of energy-element-informational state of systems;
- To develop an overall picture (model) of the organization of life of the Universe, from nanosystems to the mega-level systems;
- To develop a plan for further multidisciplinary system research within the project "Life".

II. RESULT AND DISCUSSION
Function of Energy-Element-Informational State of Systems
The common (for physical and biological objects) components which together define the structure and properties of systems are:
- A qualitative and quantitative set of elements (Э);
- A qualitative and quantitative set of energies (E);
- A qualitative and quantitative set of information (I);
- Configuration of the energy-element-informational path (S);
- The rate of change of the energy-element-informational state (v)

Physical and biological objects are considered [3-5] as systems of qualitative and quantitative sets of energies \( e_1, e_2, \ldots, e_n = \text{E} \), elements \( \text{Э}_1, \text{Э}_2, \ldots, \text{Э}_n = \text{Э} \) and information \( i_1, \ldots, i_n = \text{I} \).
\(i_2, \ldots, i_n = I\). Function \(f(E, \Theta, I)\) is the characteristic of the energy-element-informational state of the system.

Figure 1 shows the schematic arrangement of hydrogen \(H\), \(p\)-, \(s\)-, \(d\)-, \(f\)- elements depending on the values of the energy-element-informational function \(f(E, \Theta, I)\) of each individual atom of the element as well as properties of systems formed from the atoms of \(H\), \(p\)-, \(s\)-, \(d\)-, \(f\)- elements.

Analysis of the established bonds makes it possible to designate elements that form systems with the lowest values \(f(E, \Theta, I)\): element \(H\) as well as \(p\)- elements of the 2, 3 periods, IV-VI groups (\(H\), C, O, N, P, S, Si – biogenic elements).

Biogenic elements have relatively low values of the atomic mass and atomic radius and high values of electronegativity and the rate of information processes. In the formation of molecules (\(CH_4\), \(NH_3\), \(H_2O\)) a covalent chemical bond is realized by the valence electrons, the atoms tend to \(sp^3\)-hybridization (\(H\) atom gives its single \(1s^1\) electron; \(C\), O, N, P, S, \(p\) electrons).

Due to the intramolecular bond of \(H\) with \(C\), O, N, P, S formation of DNA helical structure is possible (Fig. 2).

Figure 1: Energy-element-informational function \(f(E, \Theta, I)\) and properties of systems of \(H\), \(p\)-, \(s\)-, \(d\)-, \(f\)- elements

As for the establishment of periodic dependence of change of the information properties (I – perception, transformation, accumulation, storing and communication) of atoms and systems they formed, these researches are just only beginning.

A group of physicists from the Max Planck Institute in Germany managed to "record" information about the quantum state of a photon to a single outer-shell electron (the outer shell configuration is \(5s^1\)) of a rubidium atom. The scientists have generated a photon and directed it at a rubidium atom. After the photon interacted with the electron, the researchers studied the behavior of the latter and came to the conclusion that the quantum state of the photon that "had hit" it could be quite accurately judged by the nature of motion of such electron round the atomic orbit. That is, the information has been recorded to the electron and, most importantly, the scientists succeeded in reading it.

It is probable that similar processes of “recording” – “reading” at the atomic level take place in nature, in the
natural environment. For example, interaction of a photon (light – in a narrow sense) and 1s$^1$ electron of a hydrogen atom causes a change in the informational state of the latter (“recording”). The hydrogen atom with a changed informational state, being an active participant of the construction of H$_2$O, DNA molecules, will change the informational state of the “reading” atoms C, O, N, P, S and the whole molecule of H$_2$O, DNA.

Thus, with maintained energy (E), element ($\mathcal{E}$) characteristics, H$_2$O, DNA molecules will have an altered information characteristic (I) and so an altered energy-element-informational state of the system as a whole.


The rate of the system transition from one energy-element-informational state to another is:

$$v = \frac{\Delta f(E, \dot{\mathcal{E}}, I)}{\tau} \quad (1).$$

This equation (1) is a mathematical expression of the essence of matter which is the motion of the energy-element-informational unity.

Using the characteristic of change of $\Delta f(E, \mathcal{E}, I)$ and the equation (1) we can describe the rate of change of state of systems of various space levels, such as nano ($\Delta f(E, \mathcal{E}, I)_{\text{atom}}$, $\mathcal{E}$ – a hydrogen atom 1.67 $10^{-24}$ g; DNA), micro (cell), macro (organism), and mega ($\Delta f(E, \mathcal{E}, I)_{\text{Universe}}$, $\mathcal{E}$ – the Earth 5976 $10^{11}$ kg, the Sun 2 $10^{10}$ kg, the Galaxy $\sim 10^{11}$ of the Sun’s masses).

The way (S) of natural change of the energy-element-informational state of a system located anywhere on the surface of the Earth has a complicated cyclical pattern (Fig. 3) due to the mechanical motion of the Earth around the center of the Galaxy (1), the Sun (2) and its own axis (3). The state of the Earth – the Sun – the Galaxy physical system changes continuously and quite rapidly.

The Galaxy as a whole is moving relative to the background radiation at a speed of 620 km/s. The linear speed of movement of the Solar System around the center of the Galaxy is 220 km/s. The linear speed of movement of the Earth around the Sun is 29.765 km/s.

The linear speed of the Earth’s rotation at the equator is 0.465 km/s.

The equilibrium trajectory of change of the energy-element-informational state of any point on the Earth’s surface the form of which is determined by the trajectory of the mechanical motion of the Earth around the center of the Galaxy (1) the Sun (2) and its own axis (3).

The change of state of the Earth – the Sun – the Galaxy physical system on the “spiral on a spiral, on a spiral” complex trajectory sets the same “mirror” trajectory (Fig. 4) of change of the energy-element-informational state of the system of biogenic elements H, C, O, N, P, S, generates a DNA helix, a cell, an organism [6-8].

The energy-element-informational motion of the Universe “creates” a man like all other biological systems (Fig. 5).
A billion years ago a day lasted just 15 hours. But only blue-green algae or cyanobacteria, inhabiting the Earth at that time, could “see” it. Approximately 530 million years ago the Earth rotated so fast that a day lasted 21 hours. Its current rotation period is 24 hours. The rate of rotation of our planet around its own axis is slowing down.

We might say that the “Dinosaur” biosystem is organized by the Earth – the Sun – the Galaxy physical system at relatively high rotation rates of the Earth around its own axis. Organization of the “Man” biosystem is possible only at lower rotation rates of the Earth.

A “dramatic failure” (for example, sudden change of the speed of the Earth’s rotation at its collision with a large space body) in the natural mechanical motion of the Earth – the Sun – the Galaxy physical system on any part of the “spiral on a spiral, on a spiral” trajectory can cause a disruption of coherence of oscillations of the energy-element-informational functions of biosystem and the Universe and result in the death of all or some of the biological systems existing at the moment of collision and organization of new biosystems meeting new requirements of coherence (Fig. 6).

Model of Life (Energy-Element-Informational)

In the practice of materials science to describe the state of an isolated physical system the scientists use the diagrams (Fig. 7) of element, energy – properties that are discrete in time. In this case it is possible to consider the state-property relationship both in each given point in time and throughout the a-b-d path.
When plotting diagrams of biosystems, the information content should be taken into consideration. A diagram shown in Fig. 8 plotted in E-Э-I coordinates for biogenic elements H,C,O,N,P can serve as a tool for study of the energy-element-informational properties of prior-to-DNA, DNA structures, principles of cell, organism formation.

The model of life (Fig. 9) is part of the energy-element-informational space within which the natural processes of fluctuation of f(E, E, I) relative to the A-A equilibrium line take place. The graph above shows the passage of the f (E, E, I) value through a maximum over td ÷ tc period of time from birth (coming into existence) to death.

Technical definition: Life is motion
\[ v = \frac{\Delta f (E, Y, I)}{\tau} \]
a change of the energy-element-informational function f (E,Э,I)_{of biosystem} in the form of oscillations relative to an equilibrium state; a value of the amplitude of oscillations changes and, throughout the lifetime of the biosystem, passes through a maximum; the biosystem equilibrium state changes in accordance with changes in the equilibrium trajectory of the Earth as it moves in the energy-element-informational space of the Universe following the “spiral on a spiral, on a spiral” path …».

The surface on which the point of diversion of f(E,Э,I) from the equilibrium state limits (rotation figures of Fig.10: ellipsoid, sphere, egg) the energy-element-informational (en-el-info) space in which the Universe organizes life.

Values of time \( \tau_d \div \tau_c \) and volume \( V_f (E,Э,I) \) of existence of a biosystem can serve as a technical quantitative and qualitative characteristic of its life.
Fig. 10. Models of life (ellipse, sphere, egg) and values of quantitative and qualitative characteristic of life (time $\tau_z \div \tau_c$, volume $V_f(E,E,I)$)

Figures in the form of ellipses 1 and 2 have equal volumes $V_{en1} = V_{en2} = R^3$, wherein $(\tau_z \div \tau_c)_1 = 2R$; $(\tau_z \div \tau_c)_2 = R$. The values of volume and time are as follows: within the sphere $V_m = 4,2 R^3$; $\tau_z \div \tau_c = 2 R$; within the egg $V_e = 5,5 R^3$; $\tau_z \div \tau_c = 2,618 R$.

Comparative analysis of time and volume of change of $f(E,E,I)$ in the en-el-info space shows that it is the egg that has an optimal ratio and the largest values of the quantitative and qualitative characteristic of life ($\tau_z \div \tau_c$, $V_f(E,E,I)$).

Fig. 11. The “Golden Egg” of Life

The golden ratio has been recognized a universal law of living systems. Therefore the laws of the golden proportion were used to make mathematical calculations needed to produce a figure of an egg and its geometrical representation. The golden ratio is a proportional division of a line into unequal parts wherein the smaller segment refers to the bigger one as the bigger one to all a : b = b : c. The segments of the golden proportion are expressed as an infinite irrational fraction 0,618... if “c” is taken as 1, $a = 0,382$; ($c : b = b : a = 0,382$; $b = 1,618a)$. Numbers 0,618 and 0,382 are the coefficients of the Fibonacci sequence.

Fig. 12 shows en-el-info models of life of biosystems 1 and 2. Both systems were born (came into existence) at the same time $\tau_z1 = \tau_z2$. The lifetime of system 2 is longer than the lifetime of system 1; $\tau_z2 \div \tau_z1 > \tau_z1 \div \tau_c1$. The volume of “development” of the en-el-info space by system 2 is bigger than that of by system 1; $V_f(E,E,I)2 > V_f(E,E,I)1$.

Fig. 12. Energy-element-informational model (egg) of life of biosystems 1 and 2; $\tau_z$ – time of birth (coming into existence), $\tau_c$ – time of death

Comparative graphical analysis of models 1 and 2 shows that the more vigorously the value of $f(E,E,I)$ increases in the initial period of organization and functioning of the biosystem (from the moment of its birth $\tau_z$ to achieving maximum values of $f(E,E,I)_{1,1}$, $f(E,E,I)_{2,2}$) the larger the value of segment a ($a_2 > a_1$) will be and, as a natural result of the golden ratio principle, the value of length c ($c_2 > c_1$) and volume of life increases.

Man, as a biosystem endowed with brain, being aware of the regularities of natural en-el-info processes, has the ability to artificially influence the amount and quality of his life by purposefully changing the value of $f(E,E,I)$.

The following calculations

1) $a = 22,9$ $b = 37,1$ $c = 60$;
2) $a = 38,2$ $b = 61,8$ $c = 100$. 
made using an egg as a model of life show that if the maximum of increase in the value of \( f(E, E, I) \) is reached at the age of 22.9, then the total length of life is 60 years; if the maximum of increase in the value of \( f(E, E, I) \) is reached at the age of 38.2, then the total length of life will probably reach 100 years.

**The total length of time** of living of a person who purposefully, actively increases the value of his/her energy-element-informational unity \( f(E, E, I) \) of the biosystem, for example, with other conditions being equal, **due to growth of the information content** (studies, education) will be large.

Director of the Institute of Human Brain of RAS S. Medvedev said: Active creative work of the brain increases our lifespan. For example, the process of creation awakens the brain regions important for the person’s emotional activity, including those in hypothalamic structures affecting the endocrine system which is directly connected with the aging processes. Solving of supertasks can cause formation of new connections and generation of new neurons, nerve cells, in the brain of even an elderly person. Length of life of people who throughout their lives have to constantly use their heads is significantly higher compared with those whose brains do not experience any severe stresses. [You Need to Work with Your Head. Komsomolskaya Pravda in Ukraine, January 14-20, 2009.]

Director of the Russian Gerontological Research Center V. Shabalin said: In the Stone Age the average duration of life was 18-20 years. In the Middle Ages it was about 30-40 years. It was only in the late XIX century when the people continued to live to 35 years of age in average, by the end of the XX century the average length of life increased to 70-75 years. That is only in the last century - incredibly fast! - we have begun to live twice as long. **We are that information base** that allows our descendants to move up to a higher level. [The Smart Will Live Up to 150 Years Old and the Lazy Will Become Extinct. Komsomolskaya Pravda in Ukraine. October 9-15, 2009.]

**Multidisciplinary System Research**

The established and described above laws made it possible to present a qualitative picture of organization of life of the Universe (Fig. 13).

**Figure 13.** Cyclic change of the function of state \( f(E, E, I) \) of the Universe and biosystems 1-5, aligning their equilibrium according to the change of energy-element-informational characteristics of the Universe

Figure 13 shows the cyclic change of energy-element-informational characteristics of the environment occurring during the time that is commensurable with the duration of the existence of successive generations of biosystems. In this case we should talk about alignment of the equilibrium state in each of the generations with a gradual transition from the energy-element-informational properties inherent in system 1 to the energy-element-informational properties inherent in systems 2, 3, 4 and 5 by means of alternation of generations in harmony with changing characteristics of the environment.

A variety of shapes and properties of the wildlife systems is attributable to the variety of possible options for energy-element (H, C, O, N, P, S, Si)-informational conjugations formed and functioning under various constantly changing energy-element-informational conditions of the environment.

We may say that a qualitative picture of life has been drawn. To perform systemic work on quantitative specification of the picture of life it is necessary to unite the efforts of physicists, chemists, materials scientists, biologists, computer scientists, planetary scientists and astronomers within the multidisciplinary project "Life. Motion of Energy-Element-Informational Unity of the Matter".
Foremost objectives of the Project:
- study of patterns of change of the energy-element-informational unity in the periodic table;
- plotting of discrete diagrams of energy-element-informational state-property of helical structures on the basis of elements H, C, O, N, P, S, Si (prior-to-DNA structures; physical systems)
- establishment of laws of the process of change of the energy-element-informational state and hence the properties of systems on the basis of biogenic elements H, C, O, N, P, S, Si (helical DNA structure, cell, organism, biosystems);
- modeling, mathematical specification of the equation of Life, a natural energy-element-informational cyclic process of formation, development and evolution of spiral structures of H, p-elements in the past, present and future lifetime of the Universe.

III. CONCLUSION

1. The important role of information as an integral part (along with the matter and energy) of the characteristics of systems, qualitative and quantitative indicators of which should be considered to fully cognize and describe the properties of material systems, biological systems in particular, has been shown.

2. A concept of the energy-element-informational function of state \( f(E,\mathcal{I}) \) of the matter (nano–mega level) has been developed (the same for both physical and biological systems).

3. The regularities of Life have been established and a possibility of modeling of Life as a natural phenomenon organized by moving in space and time energy-element-informational triunity of the Universe has been opened.

IV. REFERENCES


Environmental and Public Health Risks Associated with Antibiotic Resistance Genes (ARGs) Spread in Environment: A Comprehensive Review

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ABSTRACT

Currently, the use of life saving antibiotics is growing up rapidly due to its multi-effectiveness for curing from bacterial infected diseases. If same antibiotics are frequently consumed, then it kills – susceptible bacteria but leaves resistance gene. Thus, some bacteria obtain resistance capacity against some antibiotics called antibiotic resistance bacteria (ARBs). Consequently, uncontrolled production and unmonitored consumption of antibiotics is responsible for – antibiotic resistance genes (ARGs) spread in environment. Hence, it is considered as emerging contaminants posing a potential worldwide human health risk, but mass people aren’t concerned about it hereto. Therefore, we conducted this review to explore the already performed researches on this topic and their gaps. It revealed that researchers have already detected – wastewater, surface water, wastewater treatment plant, sludge, landfill leachate, soil, animal washed lagoon, and animal farm as reservoir of ARGs. China is the largest producer and consumers of antibiotics, followed by U.S. in the world wherein (46.1%) are used in livestock’s industries. Consequently, intensive animal husbandry is declared as-hotspot of ARGs. But, little knowledge is known about the associated risks with ARGs. However, 149 unique ARGs are detected from swine farm in China by researchers. Still, there is no universal technology to remove or kill ARGs from such sources but – advanced technologies are performing better.

Keywords: Antibiotics; Resistance; ARBs; ARGs; Environment; Health; Contamination.

I. INTRODUCTION

Antibiotic drugs have reduced the burden of common infectious diseases and have become essential for many medical interventions [133, 65]. It is a class of naturally occurring and synthetic chemical compounds with antimicrobial activity that are widely used – in human and veterinary medicine. They are applied in the treatment and prevention of bacterial infection which may either kill or inhibit the growth of bacteria. In contrast, antibiotic resistant pathogens have emerged and spread amidst – human and animal populations [34, 55, 28]. The increasing incidence of resistance to a wide range of antibiotic agents, by a variety of organisms is a major concern facing modern medicine. Therefore, a major problem has been arisen due to infectious diseases caused by resistant bacteria that are related to – high mortality and healthcare costs [16]. On the other hand, antibiotic Resistance (AR) is a natural phenomenon and it occurs when an antibiotic has lost its ability to effectively control or kill bacterial growth [134]. Genetically, AR spreads through two ways of – bacteria populations, such as, new generations inherit and bacteria share or exchange sections of genetic material with other bacteria [11]. When an antibiotic is used, bacteria that can resist that antibiotic have a greater chance of survival than those are – ‘susceptible.’ These bacteria are known as Antibiotic resistant bacteria (ARB) which can’t be controlled or killed by antibiotics; rather they can survive and even – multiply in the presence of an antibiotic viz. Staphylococcus aureus [75]. Besides, some resistance occurs without human action, as bacteria can produce and use antibiotics against other bacteria. However, bacteria may also become resistant in
two ways, such as, by a genetic mutation and by acquiring resistance from another bacterium [106]. Consequently, antibiotic resistance genes (ARGs) are emerging contaminants posing a potential worldwide – human health risk. Wastewater, intensive animal husbandry and animal manure are believed to be a major contributor of ARGs into environment. Hence, swine farms are declared as – hotspots for pervasive and abundant ARGs in China [17].

However, antibiotics revolutionized in medicine in the 20th century, and together with vaccination led to the near eradication of diseases, such as, tuberculosis in the developed world. Since, World War II, many more antibiotics isolated from – fungi and bacteria, which have been used to treat a wide range of human and animal infections [69, 136, 6]. An increase in the frequency of antibiotic resistance in bacteria, since the 1950s has been observed for all major classes of antibiotics used to treat a wide variety of diseases [101, 28]. But the loss of efficacy of antibiotics against common pathogens, has not only led to a shift towards more – expensive antibiotic drugs in high-income countries, but also to increased morbidity and mortality in low-income and middle-income countries [41]. To predict risk of antibiotics, identification of spatial and temporal trends in antibiotic consumption is important to understand the epidemiology of AR [37]. The quantity of antibiotic drug consumption is – a major driver of AR and variations across the country, wherein its consumption varied significantly with season in many countries. It was found that between 2000 and 2010, consumption of antibiotic drugs increased by (36%) while in Brazil, Russia, India, China, and South Africa accounted for (76%) of this increase [10]. Besides, Alexander Fleming famously warned that the ignorant may someday misuse his – life-saving discovery penicillin and select for resistant bacteria. According to Van-Boeckel et al. [126], the proliferation of ignorance is only poised to increase. Based on global datasets of veterinary antibiotic use, it was estimated that from 2010 to 2030 antibiotic use in food-animal production will increase by (67%) [98]. On the contrary, it is well known that multiple human-made chemicals, when entering into environment, will disperse over much wider distances and persist for much longer than initially anticipated and envisioned. The production, use and disposal of the different chemicals employed in common – households, agriculture, industry, and for medical purposes are expected to grow rather than stabilize, while the long-term effects of chemical pollution of surface and groundwater’s are largely unknown. Micro-pollutants are sometimes also referred to as micro-constituents or pharmaceutical and personal care products (PCPs) [102]. Anyhow, through different ways antibiotics and ARGs are spreading in environment, for example – water, soil, and food which ultimately entering into human body unconsciously. Globally, the antibiotics production and application in diverse fields are rapidly accelerating, especially in China, USA, EU, India, Russia and Brazil [124, 19, 66, 10]. But its long term environmental impacts and associated health risks are still unknown to mass people due to its – silent emerging approach. Though several studies have already been done in limited countries but little knowledge is informed herto. Hence, the absence of sufficient studies on ARGs has redoubled the problems. Therefore, we conducted this study to explore and gather all related published data as well as to detect research gaps so that it can facilitate future researchers to perform further study.

II. REVIEW FINDINGS

Global Scenario of Antibiotics Consumption

Life-saving antibiotic drugs have become inevitable for medical interventions, meanwhile, antibiotic-resistant pathogens have emerged and spread worldwide [65, 66, 133]. Currently, such pathogens have become a global problem because it has increased the cost of life saving antibiotics [87, 44]. The emergence of drug-resistant bacterial strains is due to the selection pressure imposed by use of antibiotics. Identification of spatial and temporal trends in antibiotic consumption is important to understand the epidemiology of antibiotic resistance [113, 80]. The annual usage of antibiotics has been estimated to be between 100,000 and 200,000 tons globally, with more than 25 000 tons used each year in China [139]. Large volume of antibiotic drug consumption is a major driver of antibiotic resistance in the environment. Besides, growing up antibiotic resistance capacity among bacteria depends on the – volumes and patterns of antibiotic consumption [79, 89]. According to sales data of 71 countries, the consumption of standard units of antibiotics between 2000 and 2010 increased by (36%) wherein Brazil, Russia, India, China,
and South Africa accounted for (76%) of this increase [10, 41, 37, 23]. In most countries, antibiotic consumption varied significantly based on season. There was seen increased consumption of carbapenems (45%) and polymixins (13%), two last-resort classes of antibiotic drugs. The rise of antibiotic consumption and the increase in use of last-resort antibiotic drugs raises serious – public health concern [10, 42, 50]. Further, it is seen that large quantity of antibiotics are consumed in China, U.S., and India wherein major volume is used only in animal farms [32, 35].

**Historical Origin of AR, ARBs and ARGs**

Antibiotics have revolutionized medicine in many respects, and countless lives have been saved, their discovery was a turning point in human history. Regrettably, the use of these wonder drugs has been accompanied by the rapid appearance of resistant strains [68, 67]. Accidentally, antibiotic (Penicillin) was discovered by Alexander Fleming in 1929, and by the 1940s, penicillin was available for medical use and was successfully used to treat infections in soldiers during World War II [28, 24, 5]. In 1967 the first penicillin-resistant *Streptococcus pneumoniae* was observed in Australia, and seven years later, in the U.S. another case of penicillin-resistant *S. pneumoniae* was observed in a patient with pneumococcal meningitis [24, 31]. Antibiotic resistance by other organisms reflects the same trend observed between *S. pneumoniae* and penicillin. The increase in resistance among these organisms clearly indicates a change in the frequency of antibiotic resistance genes [112, 121]. However, microbes, their genes, interaction and horizontal transfer for creating resistance genes are shown in (figure 1).

![Fig. 1](a) Microbes, their genes, populations and interactions, and (b) Role of horizontal gene transfer in the creation of resistance genes and their dissemination [26].

The chronological development of antibiotics and its resistance in the world is presented in (figure 2). Here, the dark ages – the preantibiotic era, primordial – the advent of chemotherapy, golden – the halcyon years when most of the antibiotics used today were discovered, the lean years – the low point of new antibiotic discovery and development, pharmacologic – attempts were made to understand and improve the use of antibiotics by dosing and administration, biochemical – knowledge of the biochemical actions of antibiotics and resistance mechanisms led to chemical modification studies to avoid resistance, target – mode of action and genetic studies led to efforts to design new compounds, genomic/HTS – genome sequencing methodology was used to predict essential targets for incorporation into high-throughput screening assays, disenchantment – with the failure of the enormous investment in genome-based methods, many companies discontinued their discovery programs [112, 28, 4, 24]. Currently, numerous ARBs are spread in diverse environment, such as – water, wastewater, soil and animal manure. Consequently, the global initiatives to advance the sustainability of urban water infrastructure through adopting measures, for example – water reuse is facing problems because wastewater effluents are enriched in antibiotics, ARBs, and ARGs. Thus, water environment act as a source and pathway for the spread of antibiotic resistance [100, 15, 24]. Wherein, the dispersal of ‘foreign genes’ into the environment occur through – ‘horizontal gene transfer’ and ‘vertical gene flow’ by seed dispersal, pollen flow considered as major concern. There is substantial public concern about a potential spread of ARGs from transgenic plants into the soil and intestinal bacteria [26, 128]. On the other hand, the causes of antibiotic resistance are complex and include human behaviour at many levels of society [65]. However, the increasing levels of multi-drug resistance in human pathogenic bacteria are compromising our ability to treat infectious disease [116]. Besides, ARGs are biologically transmitted from microorganism to microorganism in particular micro-environments where dense microbial communities are often exposed to an intensive use of antibiotics [108, 100].

![Fig. 2](The ages of antibiotic discovery and development of its resistance in the world [28].)
Animal Farm and Wastewater: Heaven of ARGs

Antibiotics are produced by pharmaceutical industries while consumed by healthcare facilities (hospitals), veterinary, and animal farm (industry). Then, consumers discharge their daily generated wastes into water bodies or soil that are enriched – with antibiotics, ARBs and ARGs [97]. Indeed, the expansion of the ARG reservoir in the environment has been caused by antibiotic use in humans and animals [61]. Hence, many researchers have already detected animal farm and animal wastewater as heaven of ARGs [49, 127, 91]. The study by Van Boeckel et al. [126] is the first to estimate global use of antibiotics in livestock production, and to disaggregate that global figure into estimates for each of 228 countries and the scenario of antibiotic use in animal farm is shown in (figure 3). It was found that abattoir wastewater contained high levels of Escherichia coli and Enterococcus spp. wherein Salmonella spp. was not detected but Citrobacter freundii and Shigella spp in Uganda [119, 2, 135]. Currently, concerns about potential threats of antibiotics to humans and wildlife, has been highlighted. Antibiotics are commonly applied to animals to prevent diseases and promote growth making livestock agriculture a major source of – antibiotic pollution [102, 3]. So, the largest consumers of antibiotics in the world are human being and veterinary or animal farms. Therefore, intensive animal husbandry is believed to be a major contributor to the increased environmental burden of ARGs [148, 137, 117]. Through human and animal wastewater and excreta consumed antibiotics get mixed with surface water and sediment. By the way, both surface water and soil are becoming contaminated day-to-day [58, 70]. Despite of large volume of antibiotics are consumed in China, little information is available regarding the corresponding ARGs associated with animal farms. By using high-capacity qPCR arrays, 149 unique resistance genes are detected from – animal farms in China. Diverse, abundant, and potentially mobile ARGs in farm samples suggest that unmonitored use of antibiotics and metals is causing the emergence and release of ARGs to the environment [129, 148, 11, 102]. Additionally, dairy lagoon water acts as reservoir of large quantity of ARGs that comes from animal farms. It was found that aerobic versus anaerobic treatment had no effect on tet(W), with an overall pattern of increase in the presence of antibiotics followed by decrease to initial levels. But tet(O) responded differently under aerobic versus anaerobic treatment as well as sul(I) and sul (II) showed similar patterns [93, 39, 77]. The lowest concentrations of both tet and sul ARGs were found in the lagoons of chicken layer operation, in contrast, sul ARGs were detected highest in the – swine lagoons [77]. Anyhow, plasmids a mobilized agent carries ARGs from source to different environment. Incompatibility testing and PCR analysis clearly revealed at least two different types of IncQ-like plasmids. Both types of IncQ plasmids were detected in manure, sewage, and farm soil [115, 21]. In case of treatment, a chlorine dose close to breakpoint is required to achieve complete removal of antibiotics, leading to high consumption of free chlorine in most of the wastewaters [102, 93, 1].

Surface Water and Municipal Wastewater: Carriers of ARGs

Since, life is fully dependent on water, so the protection of aquatic environments and water resources is crucial for – sustainability of human being. But water being universal solvent, it gets mixed with numerous impurities that makes water polluted; one of such pollutants is ARGs [102, 76]. The point sources of such ARGs are human being and animal, after consuming antibiotics, they release them into surface water and wastewater through excreta and feces [64, 131]. As example – five groups of antibiotics were investigated in the surface water of Yangtze Estuary over four seasons and detected 20 antibiotics without sulfamerazine. It was found that frequencies and concentrations of antibiotics depend on several factors, such as, flow conditions (seasonal), temperature and location (discharge and sewage outfall) [143, 150]. Similarly, it was found that high concentrations of antibiotics are related to urban and agricultural activities in Cache La Poudre River [92]. In Cache la Poudre (Poudre) and South Platte Rivers of Colorado, eight sites were classified as primarily WWTP-influenced based on discriminant analysis of ARG detection frequencies. By contrast, tet(W) phyloptype and phylogenetics of site Poudre River-4,
located 4 km downstream of a WWTP, was also
categorized and found to be significantly different
from the animal feeding operation (AFO) lagoons.
Generally, a good correspondence was found between
classification of the impacted river sites and the
surrounding landscape [118, 142, 140]. Further, the
water environment may represent – a key dissemination
pathway of resistance elements to and from humans.
Riverine sul1 is correlated with upstream capacities of
animal feeding operations and wastewater treatment
plants [99, 107]. Wherein tetracycline resistance genes
were not detected by quantitative PCR in many samples
but sul1 and sul2 were present at relatively high
concentrations in all (38) samples collected from Haihe
River, China. The highest ARG concentrations detected
were in sediment samples collected during the summer,
indicating that sediments are an important ARG
reservoir than water in – Haihe River [72, 26]. Besides,
hospital and municipal sewage are important sources of
ARGs for the receiving freshwater bodies. Consequently,
in freshwater lake sediments in the vicinity of a point
source of treated wastewater wherein total and relative
abundance of ARGs were identified in close proximity
of the sewage discharge point and decreased
exponentially with distance [25, 57].

**Municipal WWTPs: Reservoir of ARGs**

![Fig. 4: (a) Schematic diagram depicting the major antimicrobial resistance mechanisms and (b) Illustration showing bacterial floc in STP; potential genetic events (italics) and influences (bold) leading to antibiotic resistance amongst environmental bacteria [55].](image)

Wastewater treatment plants (WWTPs) serve a vital role
for protection of human and environmental health and
may represent a critical control point for the global
spread of antibiotic resistance [64]. While the effluent of
WWTPs is treated with a variety of antimicrobial
methods, bacteria and the genetic material that is able to
pass on antibiotic resistance to environmental
populations (details figure 4) are not completely
destroyed [74, 7]. Because, it receives direct input of
antibiotics as well as resistant fecal and other
commensal bacteria, while activated sludge can harbor
bacteria resistant to clinically important antibiotics,
including ciprofloxacin and vancomycin [84]. A unique
aspect of ARGs as contaminants is that biological
treatment steps may actually result in a selective
increase of ARBs and ARGs [71, 77]. ARGs have been
observed to persist in effluents of a variety of full-scale
WWTPs at levels well above those typical of aquatic
environments, even following mixed-media filtration
and disinfection [60, 64]. It was found that mesophilic
anaerobic digestion at both 10 and 20 day solids
retention times (SRTs) significantly reduced sulI, sulII,
tet(C), tet(G), and tet(X) with longer SRT exhibiting a
greater extent of removal, however, tet(W), erm(B) and
erm(F) genes increased relative to the feed. Thermophilic anaerobic digesters performed similarly to
each other and provided more effective reduction of
erm(B), erm(F), tet(O), and tet(W) compared to
mesophilic digestion [73, 105]. Besides, water quality
indicators and bacterial AR were examined at locations
impacted by confined AFOs and compared them to
nearby reference sites. Sites near confined AFO farms
had poor water quality, while water quality remained
relatively good downstream of WWTP. Out of a total of
830 environmental bacterial isolates, (77.1%) were
resistant to only ampicillin, while (21.2%) were resistant
to combinations of other antibiotics [132, 9].

**MSW and Landfill Leachate: Breeding House of
ARGs**

Although antibiotic use in clinical settings is regulated,
the disposal of antibiotics related to household use and
PCPs is less discriminate, usually being disposed with
other solid wastes [130, 100]. Thus, landfills are often
receptacles of antibiotics and, in turn, possible
incubators for the selection of resistant bacteria and
ARGs via HGT and other mechanisms due to long term exposures within – landfill ecosystems [122]. As such, waste antibiotics and resultant ARGs may pass from MSW into mobile leachates and then into surrounding environments [43, 122], although relative leachate levels and relationships over space and time across MSW networks have not been assessed in great detail [52, 33]. Emerging contaminants (ECs) are compounds that recently have been shown to occur widely in the environment and identified as being a potential environmental or public health risk, but yet adequate data do not exist to determine their risk. However, ECs viz. pharmaceuticals, PCPs, surfactants, plasticizers, fire retardants, pesticides and nanomaterials’s source, fate and transport in landfill leachate and adjacent environments [103]. Lately, 20 antibiotics and six ARGs were detected in MSW leachates from two Shanghai transfer stations (TS) and one landfill reservoir (LR) in April and July 2014. Antibiotic levels were higher in TS than LR leachates. However, ARG abundances did not correlate with detected antibiotic levels, except for tetW and tetQ with TC levels. In contrast, most measured ARGs did significantly correlate with heavy metal levels (p < 0.05), especially with Cd and Cr [138, 22, 29].

Soil and Animal Manure: Potential Harbour of ARGs

Several studies have examined the effect of manure application on antibiotic resistance in soil from various perspectives [110, 13]. Effects of swine manure application on sul1, sul2, ermF, ermB, tet(Q), and tet(X) abundance have been studied in detail in soil, while newer metagenomic approaches have revealed increases in a variety of ARGs [49, 54, 149]. Increases in ARG abundance in soil have been associated with manure spiked with antibiotics; livestock fed antibiotics compared to those not fed antibiotics, the presence of metals [53, 62]. However, manure application does not universally increase ARGs in soils [38, 141, 47]. Cultured microorganisms have been commonly focused in attempts to isolate ARGs or to identify antimicrobial compounds. Although this strategy has been successful in many cases, most of the microbial diversity and related antimicrobial molecules have been completely lost [16]. Before and after application of dairy manure slurry and a dry stack mixture of equine, bovine, and ovine manure showed that growth of bacterial hosts containing ARGs or horizontal gene transfer immediately following slurry application with respect to ermF, sul1, and sul2 and following a lag for dry-stack-amended soils [36, 19]. Besides, soil bacteria are a reservoir of ARGs with greater genetic diversity than previously accounted for, and that the diversity can be surveyed by a culture-independent method [104]. The fate of added microorganisms can also be related to the fate of their DNA or any DNA found within soil or groundwater. The genes were located on a plasmid pLEP01, which was either introduced into the soil columns directly as a mixture of supercoiled and open circular forms or after linearization by restriction enzymes [96, 109, 40]. Both cattle slurry (CS) and CS digestate are a considerable ARG, especially sulphonamide resistance encoding sul1. Mineral or organic fertilizers amendment significantly affects ARG concentration and proportion in bacterial community in grass land soil. While, ARG concentration levels are significantly different corresponding to different fertilization treatments [86, 63]. It is estimated that approximately (75%) of antibiotics are not absorbed by animals and are excreted in waste. Antibiotic resistance selection occurs among gastrointestinal bacteria, which are also excreted in manure and stored in waste holding systems [19]. Veterinary antibiotics used in animal husbandry are assumed to contribute to an increased antibiotic resistance amongst bacteria in manure. Bacteria carrying transferable ARs, antibiotics, metabolites and nutrients are inevitably brought into soil when manure is used as fertilizer [48, 88, 54].

Organic Agriculture Increase Antibiotic Resistance in Soil

Microbial resistance to antibiotics is on the rise, in part because of inappropriate use of antibiotics in human medicine but also because of practices in the agricultural industry. The resistant bacteria from agricultural environments may be transmitted to humans (shown in figure 5), in whom they cause disease that cannot be treated by conventional antibiotics [56, 148]. If genes for antibiotic resistance are linked to genes for the desirable trait, researchers can single out plant cells that have been transformed successfully by exposing all cells to an antibiotic. This means, however, that some new varieties of plants with desirable traits, such as insect resistance or herbicide tolerance, may also carry a new gene for antibiotic resistance [20, 46, 137]. Both animals and humans may excrete up to (95%) of antibiotics in an unaltered state. While, some antibiotic removal has been observed in WWTPs and in agricultural waste treatment
systems, none of the systems are designed to remove antibiotics [45, 59]. ARG diversity, abundance and antibiotic molecule exposure are, however, not systematically linked, and many other factors can contribute to resistance gene emergence, selection and dissemination in the environment. Soil is a heterogeneous habitat and represents a broad spectrum of different ecological niches [85, 95]. The use of antibiotics in agriculture is routinely described as a major contributor to the clinical problem of resistant disease in human medicine. While a link is plausible, there are no data conclusively showing the magnitude of the threat emerging from agriculture [18, 8, 53]. Environmental bacteria which contain ARGs identical to those in enteric bacteria have acquired the genes by ‘horizontal transfer’. On-farm the fate and impacts of estrogenic hormones in field soils receiving swine manure is being evaluated on 3 farms in SW Ontario wherein the persistence, pathways, and rate-controlling parameters of estradiol breakdown are being determined in agricultural soils [123, 146]. Streptomycin is used in several countries, the use of oxytetracycline, oxolinic acid and gentamicin is limited to only a few countries. Antibiotics are applied when disease risk is high. However, antibiotics have been indispensable for crop protection in the U.S. for more than 50 years without any reports of adverse effects on health or persistent impacts on the environment [117, 49].

**Treatment and Disinfection of ARGs in Wastewater**

Disinfection of wastewater may present an opportunity to limit release of ARGs to the environment and ultimately reduce the risk of spreading to pathogens and contributing to drug resistant infections in humans (details in figure 6) [78, 12]. UV disinfection is of particular interest because UV radiation is directly absorbed by DNA and thus has the potential to impart ARG damage [125, 30]. UV disinfection is commonly employed for seasonal disinfection, is thought to be limited in production of disinfection byproducts, is relatively noncorrosive to water treatment and delivery systems, and does not leave a residue, which could be damaging to receiving environments [7, 60, 81]. In a study, free chlorine was applied to oxidize antibiotics and to disinfect lagoon bacteria as well. Results indicate that aeration substantially improves lagoon functionality, thereby adding both organic and ammonia removal. Ammonia present in the wastewaters plays a critical role in antibiotics decomposition and bacterial inactivation due to its rapid competition for free chlorine to form monochloramine. Generally, a chlorine dose close to breakpoint is required to achieve complete removal of antibiotics [102, 145]. However, UV disinfection technology as the potential way to damage four ARGs, mec(A), van(A), tet(A), and amp(C), both in extracellular form and present within a host ARBs: methicillin-resistant Staphylococcus aureus (MRSA), vancomycin resistant Enterococcus faecium (VRE), Escherichia coli SMS-3-5, and Pseudomonas aeruginosa 01, respectively. In general, damage of ARGs required much greater UV doses than ARB inactivation. Overall, the results indicate that UV is limited in its potential to damage ARGs [78, 51]. Among chlorination, ultraviolet (UV) irradiation and sequential UV/chlorination treatment on the inactivation of ARGs, a positive correlation was observed between the removal of ARGs and chlorine dosage, as well as contact time. Greater free chlorine (FC) dosage leads to higher removal for all the genes. Wherein, NH3–N concentration was found to lead to lower removal of ARGs at the same chlorine dosage [147, 114, 83]. Significant removal of ARGs was achieved by membranes of 100 kDa and smaller, and presence of wastewater colloids resulted in enhanced removal by 10 kDa and 1 kDa membranes. ARG removal was observed to correlate significantly with the corresponding protein, polysaccharide, and total organic carbon colloidal fractions. Therefore, advanced membrane treatment technology is promising for managing public health risks of ARGs in wastewater effluents [12, 14]. There is widespread speculation that WWTPs and aquatic environments in general maybe a breeding ground for ARBs. The presence of antibiotics in WWTPs facilitates the acquisition and proliferation of resistance characteristics amongst bacteria in that environment [55, 120, 82].
Modern world can’t be thought a single day without use of – antibiotics for human being and animal. But the ever growing unmonitored and uncontrolled consumption of antibiotics as well as heavy metals is responsible for growing resistance capacity among different bacteria, ultimate result of which is spread of ARBs and ARGs in environment. A large volume of antibiotics is used only in animal farms of China, U.S., India, Russia and Brazil. Thus, human and animal consumed antibiotics and ARs are dispersing into different environment through – wastewater, animal manure, organic fertilizer, soil, and solid wastes. However, in China swine farms are considered as hotspots of ARGs. But mass people are not aware about such silent emerging contamination worldwide, therefore, it is creating global problems for environment and public health. However, the causes of ARGs spread are detected but still it is no well-established technique to inactivate or remove ARGs from such reservoirs. In contrast, it is found that conventional wastewater treatment technologies aren’t sufficient to remove ARGs from water but – high dose of free chlorine, UV ozonation and advanced membrane treatment technologies can remove more ARGs from wastewater.

IV. ACKNOWLEDGEMENT

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Comparison of Different Parameters of Four Selected Industrial Effluents in Chittagong Metropolitan, Bangladesh

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ABSTRACT

A study was executed at Nasirabad Industrial Area, Chittagong to compare important parameters of industrial effluents viz. physical, chemical and heavy metals from four types of industries such as steel, textile, chemical and garments. For sample collection three points were selected from each industry – discharging, mixing and universal points. Then all collected samples were analysed by using pH electrode, DO electrode, sension 156 portable multi-parameter meter, and spectrophotometer etc. It revealed that effluents from garment industry were awfully polluted, they exposed the lowest DO value (1.0 mg/L) and highest TDS (512 mg/L), EC (1135 mho/cm) and BOD (76.66 mg/L), COD (326 mg/L), Chromium (0.283 mg/L), Zinc (0.041 mg/L) and Lead (0.69 mg/L). Most of the cases the second point showed surpassing effluents accumulated. Comparatively, steel industry was found less contaminated as-well-as in all industries universal points wherein all parameters showed the values is under standard level due to natural assimilative capacity.

Keywords: Industrial effluent, parameters, pH, TDS, BOD, COD, EC, and Heavy metals.

I. INTRODUCTION

Bangladesh is a developing country and currently its economy is growing fast along with industrial expansion. Therefore, there are total 30 industrial estates in Bangladesh wherein the Bangladesh Export Processing Zones Authority (BEPZA) was established to setup and operate export processing zones in Bangladesh under the Bangladesh Export Processing Zones Authority Act, 1980. Later, the Chittagong Export Processing Zone (CEPZ) was established in 1983, following the Dhaka Export Processing Zone (DEPZ) was created in June 1993 [18]. After the creation of Pakistan in 1947, much trade was diverted to Chittagong from Calcutta, and the port was considerably improved [8]. Further, international trade of any country mainly depends on sea ports facilities wherein the chief sea port of Bangladesh is situated in Chittagong through which about more than (80%) exports and imports are accomplished annually. Hence, it is the prime zone for new industrial establishments and expansion of old ones too.

Consequently, a few industrial zones have already been established in Chittagong. About (40%) of the heavy industries of the country are located in Chittagong wherein small industrial parks are namely Nasirabad, Kalurghat, Patenga, Bhatiary etc. Unfortunately, what makes it so useful, such as economic growth, also makes it problematic when these industries discharge untreated effluents into water bodies which contain verities of hazardous and toxic components [3, 19] and they are liable to contaminate our surrounding environment. Dearth-of proper technology and fund along with skilled technician, this tough task is performed through rough and conventional way.

Industrial effluents (IEs) are unavoidable by-products of industrial activities. With the growth of industries, IEs are also producing in large volume wherein most of the IEs are directly thrown away into the adjacent water bodies’ paradigm river, lake, stream, lagoon etc. and contaminate surface water sources [11]. Besides, characteristics of IEs vary widely from one factory to
another viz. wet processing of textiles, steels, paper, fertilizers, cements, and pharmaceuticals generate a large volume of IEs with a great deal of inorganic and organic chemicals, detergents, soaps, oils, corrosive substances and other impurities which effects in temperature, BOD and COD load of water [9]. The most significant physical features of IEs is its total solids (TS) content, which is composed of floating matter, matter on suspension, colloidal matter, and objects in solution wherein chemical and physical appearances are formed by dissolved ingredients. Then biological features are identified by the presence of bacteria, and algae [15]. There are manifold components of IEs – organic substances and synthetic combinations. As example: NH₃ pollutant is discharged from urea fertilizer plants and the maximum absorption limit is 100-400 ppm [2]. Then chromium waste is released primarily from tanneries and the threshold limit is 0.1 ppm. In addition, phenols are common pollutants in the chemical industries and the acceptable limit in potable water is 0.0002 ppm. Color may be of burden when the diffusion factor of the receiving water is low and light penetration is minimized, affecting plant growth. Miniature industries viz. metal, machine tools, tannery and textile colouring plants are more responsible for environmental deterioration and pollution [8].

Bangladesh, basically an agricultural country and experienced its industrialization very beginning of the fifties based on primarily agricultural raw materials and the expansion of the industrial sector has been very crawling due to the start-of industrialization process. Afterwards, the rest industries which are more harmful for environment like tanneries, textile, pulp and paper, oil refineries, paint, fertilizer manufacturing industries etc. were established gradually. These industries consume a gigantic volume of water in their manufacturing channel and discharge hazardous effluents without pre-treatment [10] where most of the industries are located on the river banks and therefore IEs flow directly in the vicinity of water bodies. However, industrial advancement is the crying demand for economic development but rapid and unplanned industrial growth is responsible for committing manifold mistakes. Therefore, Bangladesh has the advantage of being a comparatively late starter, can learn from the mistakes done of first world countries and avoid those technologies consume more energy and resource [1]. A wide variety of pollutants are present in IEs which are coming out from verities of factories containing oil, greases, plastic, metallic wastes, suspended solids, phenols, toxins, acids, and salts, dyes, cyanides, DDT etc. myriad of which are not readily susceptible to degradation and thus antecedents drastically pollution troubles [11]. As a result, environmental toxicities are occurred due to indiscriminate industrial growth and discharge of untreated wastewater into natural aquatic resources especially in river or canal flow which finally reach to the sea. Then the pollutants in sea may become dispersed by turbulence and oceans currents or concentrated in the food chain which may result in the loss of species diversity. Moreover, the pollution in inland water bodies is sometimes so serious that they are not fit even for irrigation [7].

But reviewing all published literatures, its stark clear that test of different parameters of IEs in commercial city of Bangladesh is not sufficient and informative. In Chittagong, there are many types of industries amidst; the extreme polluting ones are tanneries, pulp and paper, fertilizer, chemicals etc. [8]. Wherein, Nasirabad Industrial area is enclosed by various sorts of factories among them bigger types are iron and steel mills, textile and dyeing, garments, chemical industries, packaging etc. which together are 142 units. Therefore, we conducted this study with the motto of investigating current wastewater quality and to compare among different parameters from four types of selected factories.

II. METHODS AND MATERIAL

Sample Collection and Preservation
Four types of effluent discharging factories were selected from Nasirabad Industrial Area for modelling which are steel, textiles, chemical, and garments. From each category of industry 3 units were selected randomly due to barricade to enter into factories to conduct investigation. Then, we pointed out three points for each unit paradigm discharging point (before mixing), mixing point (with nature and similar sort of industry) and universal point (where diverse types of effluents get mixed and far away). For the vision of accurate assessment of effluent qualities, the fragments were assembled with intensive care. There was no way to separate effluents with respect to their origins, so three samples were collected from little distance. For taking samples plastics bottles were first washed thoroughly with soda water and distilled water before collecting the sample to confirm that it is absolutely free from any undesirable materials or micro-organisms. Then samples
were stored plastic bottle and filled the whole volume of the container and a cap was locked enough so that no air space can be remained inside the bottle. The clustered water segments were then carefully brought and preserved in refrigerator for analysis in the laboratory of Chittagong WASA.

**Required Apparatus and Reagents**

Required apparatus are DO and pH electrode, sension156 Portable Multi-parameter Meter, 250 ml beaker, pipette, stirrer, and spectrophotometer. On the other hand, reagents are distilled water; seed (mixed micro-organisms solution solution), Na2O3, H2SO4, Potassium, Dichromate, Hg2SO4, Ag2SO4, KHP, standard buffer solution, Potassium 1, Chromo Ver 3, Cu Ver 1, Zinco Ver 5 buffer powder pillow, and Chloroform.

**Analytical Procedure for Sample Analysis**

The analytical work was accomplished quickly after collection of samples to certify better results. The assembled fragments were analysed in the laboratory to detect pH, TDS, DO, BOD, COD, EC, Cl⁻ and heavy metals (Pb, Cd, Cr, Cu, Zn) in Chittagong WASA and Institute of Forestry and Environmental Sciences, University of Chittagong lab by adopting required apparatus and reagents. For determining actual value of each parameters, we adopted individual process suchlike pH test of effluent was conducted by practicing pH electrode and sension 156 Portable Multi-parameter Meter. TDS was determined by utilizing buffer solution at ambient temperature. Wherein after standardization the electrode was washed with distilled water and then about 50 ml of water was taken in a clean beaker and electrode was completely submerged in the sample. After stirring gently for sometimes the TDS meter gave a stable TDS reading in mg/L unit.

Dissolved Oxygen (DO) was determined using the DO electrode and sension 156 Portable Multi-parameter Meter. DO electrode was set by sliding the switch on the top of the meter. Then the electrode was immersed into the solution to be tested. After, the electrode was stirred gently and waited for the reading to stabilize. Similarly, BOD test was carried out by diluting the sample with de-ionized water saturated with oxygen, inoculating it with a fixed aliquot of seed, measuring the DO and sealing the sample. The sample was kept at 200 °C in the dark to prevent photosynthesis for five days, and the DO was measured again. BOD was calculated by using the following formula:

\[ \text{BOD (for diluted sample)} = \text{Initial DO} - \text{Final DO} \times \text{Dilution Factor} \]

Then for detection COD 0.4g HgSO4 was placed in reflux flask. Then 20 ml of sample was diluted with 20 ml of distilled water. 10 ml standard K2Cr2O7 was added slowly followed by 30 ml H2SO4 which already contained silver sulphate. This slow addition along with swirling prevents loss of volatile materials such as fatty acids in the sample. Then it was mixed well with glass beads. After, the flask was connected to a condenser and refluxed for 2 hours and then cooled and washed down with condensers with small quantity of distilled water. After that the flask was removed and added with about 80 ml distilled water. Then cooled and titrated against standard ferrous ammonium sulphate using ferrion as indicator. Color changed sharply from green blue to wine red. In the reflux flask, a reagent blank reading under identical condition was taken simultaneously with sample water and finally COD was calculated. In contrast, Electric Conductivity (EC) was identified by using the conductivity electrode and sension156 Portable Multi-parameter Meter and following almost similar steps as DO test.

Spectrophotometer (model- HACH: DR/4000V) was adopted to determine the volume of heavy metals (Cr, Zn, Pb, Cu and Cd) in the effluent water. At first 25 ml of sample was filtered by filter paper and HACH programme was on. The stored program for hexavalent chromium was selected by pressing 1560 then ‘Enter’ was pressed and displayed “HACH PROGRAM: 1560 Chromium, Hex.” Then a cell of sample was filled with 10 ml of filtered sample and one ‘Chroma Ver 3’ reagent powder pillow was added to the sample cell. After it was swirled to mix and ‘START TIMER’ was pressed then 8-minute reaction period began. Another sample cell was filled with 10 ml of sample (the blank) and when the timer beeped, and then the blank was placed into the cell holder. The light shield was closed and the zero key was pressed and displayed ‘0.000 mg/l Cr6+’. Similarly, other heavy metals were identified but Wagtech International Series (As Test Kit) operational manual was adopted to calculate the volume of As in the effluents.

**Data Analysis**

The analytical data of various parameters were carefully recorded and then compiled in MS-excel sheet. Latter, we made re-arrangement of the assembled data for the convenience of analysis and achieving expected outputs. Then we consulted with the experts about our graft
results. Finally, all the data were converted into Minitab software format and was analysed by using both Minitab, Microsoft Excel program (2007) and SigmaPlot12.

III. RESULT AND DISCUSSION

Total Dissolved Solids (TDS)
The experiment reveals that the level of TDS did not vary significantly (p < 0.05) amidst different types of factories but there lies symbolic variations among the sampling stations. The maximum TDS (512 mg/L) was observed in the second post of garments industries and the under most (226 mg/L) was in discharge point of chemical factories (figure 1). In the third position TDS obtained 336.66 mg/L. However, TDS of all categories of industry remained the standard value (2100 mg/L). TDS are the total mineral content of the water, primarily salts, carbonates and metals. High TDS greater than 1000 mg/L is commonly objectionable or causes offensive taste [18]. A maximum concentration of dissolved solids escalates the density of water, affects osmoregulation of fresh water organisms and reduces solubility of gases and utility of water for drinking, irrigational and industrial purposes. Moreover, high TDS can result in corrosion of metal equipment and also permit algae bloom [6].

Acidity or alkalinity measurement (pH)
The highest pH (6.0) was hoarded from the acquittal station of garment industry and the slightest pH from the second terminal of chemical and the second point of steel industry. Third station of sample values overtook curtailed standard level; otherwise other industries remain within standard equivalent (6.0 to 9.0). The investigation disclosed that the degree of pH did not vary significantly (p < 0.05) amidst diverse groups of factories but there lies meaningful variations betwixt the segmenting posts. The effluents of chemical industries are acidic in nature probably due-to the practice of unsimilar chemicals paradigm HCl, H2SO4, Ca(OCl)Cl etc. [8]. Acids or alkalis fabricate the inheriting stream ill-suited for the vegetation of fish and other aquatic lives and brought-about austere hindrances. In contrary, the unpleasant feature of foul-tasting water, minor pH assessments usually have few negative health effects. Acidic but potable water can incite humourless troubles, however, through the leaching of heavy metals from plumbing channels. The non-profit ‘Water Systems Council’ warns that these toxic metals can include substances such-as lead. The ‘New York State Department of Health’ explains that lead exposure can divert to a host of neurological and reproductive problems. Ingestion of lead-tainted water is one way adults can become exposed to this toxin. Aquatic wildlife also suffers from the effects of pH extremes [13].

Electric Conductivity (EC)
It was revealed that electric conductivity (EC) was highest (1135 mho/cm) in the second position of garments whereas lowest (456 mho/cm) in second position of chemical industries (figure 3). Among the three positions of sampling points steel and chemical industries showed lower concentration. In the garments and steel industries EC gave higher value in the second position but reduced in textile and chemical industries. From third point, we observed that EC of steel and chemical industries increased (670 mho/cm). However, EC of all categories of industries remained within the standard value (1200 mho/cm). The study revealed that the level of EC did not vary significantly (p < 0.05) among different categories of industries but there lies significant variations among the sampling points. Wherein the EC of the water depends on the water temperature: the higher the temperature, the higher the EC would be. The EC of water increases by 2-3% for an increase of 1 degree Celsius of water temperature. Many EC meters nowadays automatically standardize the readings to 25°C. The same EC values can be measured in low quality water and in high quality irrigation water.
Dissolved Oxygen (DO)

The study revealed that DO value was not varying significantly among different categories of industries but there lies significant variations among the sampling point except steel industry. DO reading of all categories of industries was below the level of standard value. DO levels of chemical industries in its discharge point is lowest (1.0 mg/L) and highest value (3.21 mg/L) obtained from second point of steel effluents (Figure 4). Among the three points of sample third point is nearer to optimum level. In third point DO concentration increased and reached nearer to optimum level. Low DO concentrations in fresh water aquatic systems indicate high pollution level in water. Lower DO level in the effluents may be due to presence of chemically oxidized and biodegradable organic compounds in effluents. These organic compounds are readily degraded in aqueous medium by soil and microorganism present in the sewage. During this process, DO in the stream is used up. When the DO is reduced below a certain limit, aquatic life is affected adversely. Many organic chemicals may be used by microorganisms in watercourse as sources of energy and chemicals necessary for growth. When DO is used faster than it will be replenished, its concentration in water bodies decreases. Reduction of DO less than perhaps 3-5 mg/L can cause an adverse impact on fish that need a relatively high oxygen concentration to meet their metabolic needs. A further increase in oxygen demand would result in an even lower DO and progressively worse conditions for fish and other aquatic lives. The absence of DO would result in the growth of microorganisms that produce by-products that cause foul odors in the water and its surroundings [12]. (Table 1) showed that each garments industries discharged effluents which either untreated or not properly treated. Standard value of DO varies from 4.5-8 mg/L, but we didn’t see any industry discharging nearer to optimum level, moreover DO level Sirina garment obtained below 1.5 mg/L which is very alarming. Further, (table III) showed that each steel industry except Bayezid discharged effluents which either untreated or not properly treated. Effluents from Bayezid steel properly treated as its DO reading was 4.8 mg/L which is nearer to standard value. But (table 3) showed that chemical industry discharged same untreated or not properly treated effluents wherein we didn’t observe any industry discharging nearer to optimum level; moreover DO level elite paint marked below 1.5 mg/L. Additionally, (table 4) showed that among all chemical industries only Chowdhury textile discharged treated effluents. Similarly, we didn’t observe any industry discharging closer to optimum level without Chowdhury textile.

Biological Oxygen Demand (BOD)

The study revealed that the level of BOD was not varying significantly among different categories of industries but there lies significant variations among the sampling point. However, chemical industries showed highly significant variation. From the experiment the highest BOD (76.66 mg/L) was found in first point of chemical industry and the lowest (32.33 mg/L) was found in second point of steel industry. In every points BOD level of garments and chemical industry exceeds standard value (50 mg/L) (Figure 5). Whereas in the second position of textile and steel industry is on optimum level. Higher BOD level indicates more bacterial activities and in these cases bacteria rob the available DO necessary to survive by the other aquatic organisms like fishes. Many organic chemicals may be used by micro-organisms in watercourse as sources for energy and chemicals for necessary growth which may cause breakdown of organic constituents to simpler compounds and often ultimately to inorganic ashes and gases. These biochemical reactions result in utilization of oxygen dissolved in the water imposing a high BOD [12]. The BOD test serves an important function in stream pollution-control activities. It is a bioassay procedure that measures the amount of oxygen...
consumed by living organisms while they are utilizing the organic matter present in waste, under conditions similar in nature. BOD indicates the amount of organic matter present in water. Therefore, a low BOD is an indicator of good quality water, while a high BOD indicates polluted water. DO is consumed by bacteria when large amounts of organic matter from sewage or other discharges are present in the water. Fish kills and an invasion and growth of certain types of weeds can cause dramatic changes in a stream or other body of water. Energy is derived from the oxidation process. (Table 2) showed that each steel industry except Bayezid discharged effluents which either untreated or not properly treated. Effluents from Bayezid steel properly treated as its BOD reading is nearer to standard value (50 mg/L). Whereas Saleh steel discharged huge amount untreated waste. Here, BOD crossed the standard limit and so effluents are needed to be treated.

**Chemical Oxygen Demand (COD)**

The highest COD equivalent (326.66 mg/L) was noticed in the chemical industry at releasing point and the lowest (220 mg/L) was found in second position of both textile and steel industries. It was also seen that in the two stations COD level of all factories exceeded the standard level (200 mg/L) (figure 6). Meanwhile, third point represented a COD value of 163.33 mg/L lies below the standard level. The COD test reflects an indication of the impact of discharged water on aquatic life by means of DO depleting nature. Effluents from steel, textile, chemical and garments industry contain various volumes of chemicals which are adopted by micro-organisms for their metabolic process and accelerate high COD demand. The study showed that the level of COD did not differ significantly (p < 0.05) among dissimilar types of industries but there lies symbolic variations among the sampling station. High COD levels shrink the quantity of DO available for aquatic organisms. Low (generally under 3 mg/L) DO or hypoxia causes reduced cell functioning, disrupt circulatory fluid balance in aquatic species and can result in death of individual organisms. Hypoxic water can also release pollutants stored in the sediment. In case of tannery industry, soluble COD varies from 0.46 for raw effluents to 0.54 for chemical treatment effluents [14]. Further, COD test is useful in pin-pointing toxic condition and presence of biological resistant substances. The COD test is important to monitor and control the discharge of effluents and for assessing treatment plant performance [20]. (Table 2) showed that each steel industry except Bayezid discharged effluents which either untreated or not properly treated. Effluents from Bayezid steel properly treated as its COD reading is nearer to standard value (200 mg/L). Wherein Saleh steel discharged huge amount untreated waste. Here, COD crossed the standard limit and effluents needed to be treated.

**Chloride (Cl–)**

Similarly, it was observed that volume of chloride is the apical (500.00 mg/L) in the second position of textile industry and the lowest (132.66 mg/L) in emitting point of garment industry (figure 7). In the third station, Chloride level is 121.66 mg/L which is the slightest than others. The study reveals that the value of Chloride did not deviate significantly (p < 0.05) betwixt different tiers of industries but there lies important variations among the sampling points. However, level of chloride in effluents of all categories was within the standard value (600 mg/L).
Chromium (Cr)

In case of Chromium, the maximum level (0.283 mg/L) of Cr was detected in steel industry in the second station. And the value (0.11 mg/L) was found in garment factory at its discharge point. In the third position, Cr concentration obtained 0.03 mg/L (figure 8). The investigation represented that the degree of Cr did not vary significantly (p < 0.05) between different groups of industries but there places momentous variations among the sampling stations. Else, steel and chemical industries utilize chromium for various objectives. This element is carcinogenic which may cause severe effect on aquatic lives [5] but our finding of Cr releasing is not so serious.

Fig. 8: Normal Cr levels in industrial effluents.

Zinc (Zn)

The supreme level (0.041 mg/L) of Zinc was found in garment industry in it’s the second point and the lowest value (0.013 mg/L) was detected in the second point of chemical factory (figure 9). No concentration of zinc observed in the third position. The analysis shows that the level of Zinc did not alter significantly (p < 0.05) in the midst of verities categories of industries but there remain meaningful variations among the sampling point. Zinc is an important dietary element, but concentrations above 5 mg/L can impart an unpleasant taste to water. Exposure to gigantic amounts of Zinc can befall stomach cramps and anaemia, and also shrink good cholesterol. In marine waters, aquatic species suffer acute effects from Zinc at 90 μg/L. Adverse effects of dissolved Zinc, including altered behaviour, blood and serum chemistry, impaired reproduction, and reduced augmentation, occur to salmon at very low levels (5.6 μg/L in freshwater). In mammals, ingesting huge volume of Zinc can cause infertility and underweight offspring [17]. (Table 1) heavy metal concentration obtained from this study is not satisfactory wherein Sirina garments and design apperals discharging a significant concentration of heavy metal, though the value is minute. Standard value of zinc is 5 mg/L wherein zinc concentration is not alarming among all heavy metals. Besides, (table 3) showed that chemical industry discharged untreated or not properly treated effluents. Heavy metal concentration obtained from this experiment is not satisfactory. Report showed that zinc absent in Al-karim paint. Further, (table 4) showed that among all chemical industries only Chowdhury textile discharged treated effluents. Clifton group discharged high concentrated heavy metal.

Fig. 9: Average Zn levels in industrial effluents.

Lead (Pb)

In case of lead the topmost level (0.69 mg/L) was shown in chemical industry at acquittal point and the under most level (0.016 mg/L) was found in the second post of textile factory. In the third station lead absorption was 0.16 mg/L (figure 10). Lead concentration of all tiers in every point exceeds the standard equivalent (0.1mg/L). The studied disclosed that the degree of Lead did not differ significantly (p < 0.05) among various categories of industries but there was found indicative variations among the sampling stations. Unlike other trace elements, lead is neither essential nor beneficial for living organisms. Organic compounds are generally more toxic than inorganic lead compounds. Adverse effects of lead in water on aquatic species occur at congregations of (1.0 - 5.1) ug/L and include shortened survival, impaired reproduction and abridged enlargement [16]. From (table 1), heavy metal concentration obtained from this study is not satisfactory wherein Sirina garments and design apperals discharging a significant concentration of heavy metal, though the value is minute. However, (table 3) showed that chemical industry discharged untreated or not properly treated effluents. Report showed that lead in elite paint crossed standard value. Contrary, (table 4) showed that among all chemical industries only Chowdhury textile discharged treated effluents. Clifton group discharged high concentrated heavy metal, lead exceed standard level (0.1 mg/L).
Cadmium (Cd)
The maximum level (0.09 mg/L) of cadmium was noticed in chemical factory at acquittal point and the lowest level (0.03 mg/L) was found in the second post of textile industry. In the third station cadmium consolidation was 0.006 mg/L (figure 11). Two positions of steel and two points of chemical industry exceed its optimum level (0.05mg/L). Nevertheless, all other stations of the preferred stations observed value are below under standard level. From (table 1), heavy metal concentration obtained from this study is not satisfactory. Report showed that cadmium absent in jakmur fashions and their effluents free from heavy metal. But Sirina garments and design apperals discharging a significant concentration of heavy metal, though the value is minute (standard value of cadmium 0.05mg/L). Besides, (table 3) showed that chemical industry discharged untreated or not properly treated effluents. Heavy metal concentration obtained from this research is not satisfactory. Report showed that cadmium absent in Al-karim paint. But in case of elite paint cadmium crossed standard value (0.05mg/L). Moreover, (table 4) showed that among all chemical industries only Chowdhury textile discharged treated effluents. Heavy metal concentration obtained from this study is not satisfactory. Clifton group discharged high concentrated heavy metal but cadmium remains below than standard in different positions (standard value of cadmium 0.05mg/L).

Arsenic (As)
The apical value (0.23mg/L) of arsenic was noticed in chemical factory at discharge station and no absorption (0.0mg/L) of arsenic observed in sample of textile industries. In the third point arsenic concentration was in an average of 0.003 mg/L (figure 12). Two positions of chemical industry exceed its optimum level (0.2 mg/L). Then the rest studied points of other factories remain under standard equivalent. Contrary, since 2006, the American state of New Jersey has enforced an arsenic drinking water standard or maximum contaminant level (MCL) of 5 μg l−1 instead of the federal MCL of 10 μg l−1 [4].

Copper (Cu)
The study shows that the level of Copper did not vary significantly (p < 0.05) among different categories of industries but there lies significant variations among the sampling point. The highest level (0.09mg/L of copper was found in textile industry at discharge point and no concentration (0.003mg/L) of copper found in textile industry (figure 13). In third point copper concentration was nil. Two points of chemical, two points of textile and one point of steel industry exceed its optimum level (0.05mg/L).
# TABLE 1
## COMPARATIVE ANALYSIS OF EFFLUENT PARAMETERS OF DIFFERENT GARMENTS

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<td>COD (mg/L)</td>
<td>BOD (mg/L)</td>
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</tbody>
</table>

DP = Discharge point (Sample taken before mixture); MP = Mixed point (Sample taken from drain)

# TABLE 2
## COMPARATIVE ANALYSIS OF EFFLUENT PARAMETERS OF DIFFERENT STEEL INDUSTRIES

<table>
<thead>
<tr>
<th>Industry</th>
<th>Collection point</th>
<th>Parameters</th>
<th>Chemical</th>
<th>Heavy metal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>DO (mg/L)</td>
<td>COD (mg/L)</td>
<td>BOD (mg/L)</td>
</tr>
<tr>
<td>Saleh Steel</td>
<td>DP</td>
<td>2</td>
<td>320</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>MP</td>
<td>2</td>
<td>320</td>
<td>55</td>
</tr>
<tr>
<td>Bayezid Steel</td>
<td>DP</td>
<td>4.8</td>
<td>195</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>MP</td>
<td>4.8</td>
<td>180</td>
<td>35</td>
</tr>
<tr>
<td>BSRM Steel</td>
<td>DP</td>
<td>3.0</td>
<td>220</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>MP</td>
<td>3.5</td>
<td>180</td>
<td>40</td>
</tr>
</tbody>
</table>

# TABLE 3
## COMPARATIVE ANALYSIS EFFLUENTS PARAMETERS OF DIFFERENT CHEMICAL INDUSTRIES

<table>
<thead>
<tr>
<th>Name</th>
<th>Collection point</th>
<th>Parameters</th>
<th>Chemical</th>
<th>Heavy metal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>DO (mg/L)</td>
<td>COD (mg/L)</td>
<td>BOD (mg/L)</td>
</tr>
<tr>
<td>Al Karim Paint</td>
<td>DP</td>
<td>2.0</td>
<td>320</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>MP</td>
<td>3.0</td>
<td>50</td>
<td>220</td>
</tr>
<tr>
<td>Eastern Chemical</td>
<td>DP</td>
<td>2.5</td>
<td>320</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>MP</td>
<td>2.1</td>
<td>320</td>
<td>55</td>
</tr>
<tr>
<td>Elite Paint</td>
<td>DP</td>
<td>1.5</td>
<td>350</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>MP</td>
<td>2.0</td>
<td>320</td>
<td>50</td>
</tr>
<tr>
<td>Name</td>
<td>Collection point</td>
<td>Chemical Parameters</td>
<td>Heavy metal Parameters</td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>------------------</td>
<td>---------------------</td>
<td>------------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DO (mg/L)</td>
<td>COD (mg/L)</td>
<td>BOD (mg/L)</td>
</tr>
<tr>
<td>Chowdhury</td>
<td>DP</td>
<td>2.5</td>
<td>250</td>
<td>65</td>
</tr>
<tr>
<td>Textile</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MP</td>
<td>3.5</td>
<td>200</td>
<td>36</td>
</tr>
<tr>
<td>KDS</td>
<td>DP</td>
<td>2.2</td>
<td>220</td>
<td>55</td>
</tr>
<tr>
<td>Textile</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MP</td>
<td>2.2</td>
<td>230</td>
<td>50</td>
</tr>
<tr>
<td>Clifton Group</td>
<td>DP</td>
<td>2</td>
<td>70</td>
<td>270</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MP</td>
<td>2.5</td>
<td>55</td>
<td>240</td>
</tr>
</tbody>
</table>

### IV. CONCLUSION

Effluents discharge from industry is an unavoidable by-product of industrial activities which deteriorate environmental at alarming rate and may bring a great dilemma in future. This study represents that amidst manifold categories of factories at Nasirabad, effluents from four types viz. textile, garments, chemical and steel industries were highly adulterated which may be absence of any ETPs in the industrial parks. Among four types of factories garments showed maximum level of pollution while steel industries revealed little concentration than others. Effluents from garments industries are getting mixed with drain water and polluting water system of nearby areas. Similarly, chemical industries and textile industries are also higher polluters. Contrary, steel industries are comparatively less polluters. Finally, based on field experiences and literature review, we suggest concerning authority should come forward to establish industrial parks and common ETP to minimize hazardous substances releasing from different industrial units into environment through effluents.

### V. ACKNOWLEDGEMENT

This research work was done as MSc Thesis for Environmental Science degree from University of Chittagong and we would like to express our deepest thank to those persons and organizations that cordially supported us to make it fruitful.

### VI. REFERENCES


A One Factor Model Affects the Risk Level of Viet Nam Hardware Industry During and After the Global Crisis 2007-2011

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Banking University, HCMC – GSIM, International University of Japan, Japan

ABSTRACT

Using a one factor model, this paperwork estimates the impacts of the size of firms’ competitors in the hardware industry on the market risk level, measured by equity and asset beta, of 22 listed companies in this category. This study identified that the risk dispersion level in this sample study could be minimized in case the competitor size doubles (measured by equity beta var of 0.678). Besides, the empirical research findings show us that asset beta min value decreases from 0.054 to 0.030 when the size of competitor doubles. Last but not least, most of beta values are acceptable. Ultimately, this paper illustrates calculated results that might give proper recommendations to relevant governments and institutions in re-evaluating their policies during and after the financial crisis 2007-2011.

Keywords: Risk Management, Competitive Firm Size, Market Risk, Asset and Equity Beta, Hardware Industry

I. INTRODUCTION

Studies reveal that competition has affected business risk and return. Eugene F., and French, Kenneth R., (2004) also indicated in the three factor model that “value” and “size” are significant components which can affect stock returns. They also mentioned that a stock’s return not only depends on a market beta, but also on market capitalization beta. The market beta is used in the three factor model, developed by Fama and French, which is the successor to the CAPM model by Sharpe, Treynor and Lintner. Pagano and Mao (2007) stated that An intermediated market can therefore remain viable in the face of competition from a possibly faster, non-intermediated market as long as the specialist can generate revenue for the above services that covers his/her costs associated with asymmetric information, order processing, and inventory management. As Luis E. Peirero (2010) pointed, the task of estimating cost of equity in emerging markets is more difficult because of problems such as collecting data in short periods.

Together with financial system development and the economic growth, throughout many recent years, Viet Nam hardware industry is considered as one of active economic sectors, which has some positive effects for the economy. Additionally, financial risk and reactions has become an issue after the global crisis 2007-2009 which has some certain impacts on the whole Viet nam economy, and specifically, the Viet Nam hardware industry. Hence, this research paper analyzes market risk under a one factor model of these listed firms during this period. The purpose of this study is to find out how much market risk for this industry in changing contexts of competitors.

Therefore, this paperwork will explain not only the relationship between risk and competitor size, but also presents how much risk for the hardware industry in each competitor scenario. It finds out competition or competitor size definitely has certain effects on market risk of listed hardware firms.

This paper is organized as follow. The research issues and literature review will be covered in next sessions 2 and 3, for a short summary. Then, methodology and conceptual theories are introduced in session 4 and 5. Session 6 describes the data in empirical analysis. Session 7 presents empirical results and findings. Next, session 8 covers the analytical results. Then, session 9
will conclude with some policy suggestions. This paper also supports readers with references, exhibits and relevant web sources.

II. METHODS AND MATERIAL

Research Issues

For the estimating of impacts of a one factor model: the size of competitor on beta for listed hardware industry companies in Viet Nam stock exchange, research issues will be mentioned as following:

Issue 1: Whether the risk level of hardware industry firms under the different changing scenarios of the size of competitor increase or decrease so much.

Issue 2: Whether the disperse distribution of beta values become large in the different changing scenarios of the size of competitor in the hardware industry.

Issue 3: What is the relationship between competitor size and risk minimization?

3. Literature review

Black (1976) proposes the leverage effect to explain the negative correlation between equity returns and return volatilities. Diamond and Dybvig (1983) said banks can also help reduce liquidity risk and therefore enable long-term investment. Next, Kim et all (2002) noted that the nature of competitive interaction in an industry is important in assessing the effect of corporate product strategies on shareholder value. Jimenez et all (2005) pointed As market power is the primary source of franchise value, reduced competition in banking markets has been seen as promoting banking stability.

Chen et all (2013) supported regulators’ suspicions that over-reliance on short-term funding and insufficient collateral compounded the effects of dangerously high leverage and resulted in undercapitalization and excessive risk exposure for Lehman Brothers. The model reinforces the importance of the relationship between capital structure and risk management. Then, Alcock et all (2013) found evidence that leverage cannot be viewed as a long-term strategy to enhance performance, but in the short term, managers do seem to add significantly to fund excess returns by effectively timing leverage choices to the expected future market environment. And Gunaratha (2013) revealed that in different industries in Sri Lanka, the degree of financial leverage has a significant positive correlation with financial risk.

4. Conceptual theories

The impact of competition or the size of competitor on the economy and business

In a competitive hardware market, there are many firms offering the similar products and services and this helps customers select a variety of qualified goods that meet their demand. Competitors could affect price and customer service policies; hence, affect revenues and profits of a typical company. Sources of competition include, but not limit to, training. Increasing training can help competition raising productivity.

Different kinds of market contain various types of risks. And different organizational structure can offer various competition degrees.

5. Methodology

In this study, analytical research method is used, philosophical method is used and especially, scenario analysis method is used. Analytical data is from the situation of listed hardware material industry firms in VN stock exchange and applied current tax rate is 25%. Risk here is assumed understood as fluctuations and volatility of beta which is sometimes higher than 1 or more or lower than that. We use historical and real data on the HNX and HOSE stock exchange in the period 2007-2011 for estimating risk. This is a part of our quantitative analysis method used combined with financial analytical method.
Scenario analysis method is applied in three (3) cases of changing size of competitors under changing competitive strategy. We estimate how much risk in case the firm selects competitor with doubling size, smaller size and approximate size. And beta results can be used for CAPM model to estimate WACC or cost of capital if readers want to go to further steps. In later sessions, we will explain the relationship between competitor size and beta. When we mention the competitor selecting strategy, we stand from the point of view of firm management, although the calculated results can be used for various stakeholders including investors. In the below table 1, 2, 3 and others, the symbols such as “VTC” will represent for stock code of each listed firm on the stock exchange. Finally, we use the results to suggest policy for both these enterprises, relevant organizations and government.

III. RESULTS AND DISCUSSION

6. General Data Analysis

The research sample has total 22 listed firms in the hardware industry market with the live data from the stock exchange.

Firstly, we estimate equity and asset beta values of these firms, as well as the risk dispersion. Secondly, we change the competitor size from approximate size to doubling size and slightly smaller size to see the sensitivity of beta values. We figure out that in 3 cases, asset beta mean values are estimated at 0.441, 0.393 and 0.430 which are negatively correlated with the size of competitors. Also in 3 scenarios, we find out equity beta mean values (0.748, 0.678 and 0.728) are also negatively correlated with the competitive firm size. Various competitors selected definitely have certain effects on asset and equity beta values.

7. Empirical Research Findings and Discussion

In the below section, data used are from total 22 listed hardware industry companies on VN stock exchange (HOSE and HNX mainly). In the scenario 1, current financial leverage degree is kept as in the 2011 financial statements which is used to calculate market risk (beta) whereas competitor size is kept as current, then changed from double size to slightly smaller size. Then, two (2) FL scenarios are changed up to 30% and down to 20%, compared to the current FL degree. In short, the below table 1 shows three scenarios used for analyzing the risk level of these listed firms. Market risk (beta) under the impact of tax rate, includes: 1) equity beta; and 2) asset beta.

Table 1 – Analyzing market risk under three (3) scenarios (Made by Author)

| Competitor size as current | Scenario 1 |
| Competitor size slightly smaller | Scenario 2 |
| Competitor size double | Scenario 3 |

7.1 Scenario 1: current financial leverage and competitor size kept as current In this case, all beta values of 22 listed firms on VN hardware industry market as following:

Table 2 – Market risk of listed companies on VN hardware industry market under one factor model (case 1) (source: VN stock exchange 2012)

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Company stock code</th>
<th>Equity beta</th>
<th>Asset beta (assumed debt beta = 0)</th>
<th>Note</th>
<th>Financial leverage (F.S reports)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CMT</td>
<td>0.665</td>
<td>0.326</td>
<td></td>
<td>51,1%</td>
</tr>
<tr>
<td>2</td>
<td>SVT</td>
<td>0.860</td>
<td>0.651</td>
<td>TLC as comparable</td>
<td>24.2%</td>
</tr>
<tr>
<td>3</td>
<td>VIE</td>
<td>0.283</td>
<td>0.054</td>
<td>UNI as comparable</td>
<td>81.0%</td>
</tr>
<tr>
<td>4</td>
<td>HPT</td>
<td>0.238</td>
<td>0.063</td>
<td>TST as comparable</td>
<td>73.7%</td>
</tr>
<tr>
<td>5</td>
<td>NIS</td>
<td>0.347</td>
<td>0.165</td>
<td>VTC as comparable</td>
<td>52.5%</td>
</tr>
<tr>
<td>6</td>
<td>TST</td>
<td>0.739</td>
<td>0.236</td>
<td></td>
<td>68.1%</td>
</tr>
<tr>
<td>7</td>
<td>ST8</td>
<td>0.891</td>
<td>0.682</td>
<td></td>
<td>23.5%</td>
</tr>
<tr>
<td>8</td>
<td>TAG</td>
<td>0.632</td>
<td>0.411</td>
<td></td>
<td>35.0%</td>
</tr>
<tr>
<td>9</td>
<td>POT</td>
<td>1.046</td>
<td>0.533</td>
<td></td>
<td>49.0%</td>
</tr>
<tr>
<td>10</td>
<td>CKV</td>
<td>0.604</td>
<td>0.221</td>
<td></td>
<td>63.5%</td>
</tr>
<tr>
<td>11</td>
<td>ONE</td>
<td>0.551</td>
<td>0.217</td>
<td>UNI as comparable</td>
<td>60.6%</td>
</tr>
<tr>
<td>12</td>
<td>PMT</td>
<td>1.234</td>
<td>1.056</td>
<td></td>
<td>14.4%</td>
</tr>
<tr>
<td>13</td>
<td>SMT</td>
<td>0.934</td>
<td>0.654</td>
<td>PMT as comparable</td>
<td>30.0%</td>
</tr>
<tr>
<td>14</td>
<td>UNI</td>
<td>1.186</td>
<td>0.732</td>
<td></td>
<td>38.3%</td>
</tr>
<tr>
<td>15</td>
<td>TLC</td>
<td>1.066</td>
<td>0.770</td>
<td></td>
<td>27.8%</td>
</tr>
</tbody>
</table>
7.2. Scenario 2: competitor size double
All beta values of total 22 listed firms on VN hardware industry market as below:

Table 3 – Market risks of listed hardware industry firms under one factor model (case 2) (source: VN stock exchange 2012)

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Company stock code</th>
<th>Equity beta</th>
<th>Asset beta (assume debt beta = 0)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CMT</td>
<td>0.665</td>
<td>0.326</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>SVT</td>
<td>0.212</td>
<td>0.161</td>
<td>VIE as comparable</td>
</tr>
<tr>
<td>3</td>
<td>VIE</td>
<td>0.263</td>
<td>0.050</td>
<td>LTC as comparable</td>
</tr>
<tr>
<td>4</td>
<td>HPT</td>
<td>0.113</td>
<td>0.030</td>
<td>ITD as comparable</td>
</tr>
<tr>
<td>5</td>
<td>NIS</td>
<td>0.487</td>
<td>0.231</td>
<td>ST8 as comparable</td>
</tr>
<tr>
<td>6</td>
<td>TST</td>
<td>0.739</td>
<td>0.236</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>ST8</td>
<td>0.891</td>
<td>0.682</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>TAG</td>
<td>0.632</td>
<td>0.411</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>POT</td>
<td>1.046</td>
<td>0.533</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>CKV</td>
<td>0.604</td>
<td>0.221</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>ONE</td>
<td>0.551</td>
<td>0.217</td>
<td>UNI as comparable</td>
</tr>
<tr>
<td>12</td>
<td>PMT</td>
<td>1.191</td>
<td>1.019</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>SMT</td>
<td>0.826</td>
<td>0.578</td>
<td>HTP as comparable</td>
</tr>
<tr>
<td>14</td>
<td>UNI</td>
<td>1.186</td>
<td>0.732</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>TLC</td>
<td>1.066</td>
<td>0.770</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>KST</td>
<td>0.405</td>
<td>0.230</td>
<td>VTC as comparable</td>
</tr>
<tr>
<td>17</td>
<td>VAT</td>
<td>1.168</td>
<td>0.551</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>VTC</td>
<td>0.635</td>
<td>0.431</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>ELC</td>
<td>0.200</td>
<td>0.100</td>
<td>ITD as comparable</td>
</tr>
<tr>
<td>20</td>
<td>SAM</td>
<td>1.191</td>
<td>1.069</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>LTC</td>
<td>1.102</td>
<td>0.329</td>
<td>DTL as comparable</td>
</tr>
<tr>
<td>22</td>
<td>ITD</td>
<td>0.351</td>
<td>0.132</td>
<td>BVG as comparable</td>
</tr>
</tbody>
</table>

All three above tables and data show that values of equity and asset beta in the three cases of changing competitor size have certain fluctuation.

8. Comparing statistical results in 3 scenarios of changing leverage:
Table 5 - Statistical results (FL in case 1) (source: VN stock exchange 2012)
Table 6 – Statistical results (FL in case 2) (source: VN stock exchange 2012)

<table>
<thead>
<tr>
<th>Statistic results</th>
<th>Equity beta</th>
<th>Asset beta (assume debt beta = 0)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX</td>
<td>1,234</td>
<td>1,069</td>
<td>0,165</td>
</tr>
<tr>
<td>MIN</td>
<td>0,200</td>
<td>0,054</td>
<td>0,147</td>
</tr>
<tr>
<td>MEAN</td>
<td>0,748</td>
<td>0,441</td>
<td>0,307</td>
</tr>
<tr>
<td>VAR</td>
<td>0,1085</td>
<td>0,0893</td>
<td>0,019</td>
</tr>
</tbody>
</table>

Note: Sample size 22 firms

Table 7- Statistical results (FL in case 3) (source: VN stock exchange 2012)

<table>
<thead>
<tr>
<th>Statistic results</th>
<th>Equity beta</th>
<th>Asset beta (assume debt beta = 0)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX</td>
<td>1,191</td>
<td>1,069</td>
<td>0,1217</td>
</tr>
<tr>
<td>MIN</td>
<td>0,113</td>
<td>0,030</td>
<td>0,0833</td>
</tr>
<tr>
<td>MEAN</td>
<td>0,678</td>
<td>0,393</td>
<td>0,2846</td>
</tr>
<tr>
<td>VAR</td>
<td>0,1392</td>
<td>0,0903</td>
<td>0,0489</td>
</tr>
</tbody>
</table>

Note: Sample size: 22

Based on the calculated results, we find out:

First of all, Equity beta mean values in all 3 scenarios are acceptable (< 0.8) and asset beta mean values are also small (< 0.5). In the case of reported leverage in 2011, equity beta max is 1,234 which is somewhat acceptable. If competitor size doubles, equity beta min decreases from 0,200 to 0,113. Finally, when competitor size is slightly smaller, asset beta min decreases from 0,054 to 0,025.

The below chart 1 shows us : when competitive firm size decreases slightly, average equity beta value decrease slightly (0,728) compared to that at the initial selected competitor (0,748). Next, average asset beta decreases little (to 0,430). However, in case the competitor size doubles, the risk level decreases (equity beta mean value is estimated at: 0,678), and the equity beta var value (0,139) is little higher than that in case competitor size as current (0,108).

Furthermore, the entire efforts among many different government bodies need to be coordinated.

In conclusion, the government has to consider the impacts on the mobility of capital in the markets when it changes the macro policies and the legal system and regulation for developing the hardware market. The Ministry of Finance continues to increase the effectiveness of fiscal policies and tax policies which are needed to combine with other macro policies at the same time. The State Bank of Viet Nam continues to increase the effectiveness of capital providing channels for hardware companies as we could note that in this study when competitive firm size doubles, the risk level decreases (equity beta mean value is estimated at: 0,678), and the equity beta var value (0,139) is little higher than that in case competitor size as current (0,108).

Finally, this paper suggests implications for further research and policy suggestion for the Viet Nam government and relevant organizations, economists and investors from current market conditions (for example, they can do research on tax effects on the market risk of these firms).
V. ACKNOWLEDGEMENTS

I would like to take this opportunity to express my warm thanks to Board of Editors and Colleagues at Citibank – HCMC, SCB and BIDV-HCMC, Dr. Chen and Dr. Yu Hai-Chin at Chung Yuan Christian University for class lectures, also Dr Chet Borucki, Dr Jay and my ex-Corporate Governance sensei, Dr. Shingo Takahashi at International University of Japan. My sincere thanks are for the editorial office, for their work during my research. Also, my warm thanks are for Dr. Ngo Huong, Dr. Ho Dieu, Dr. Ly H. Anh, Dr Nguyen V. Phuc and my lecturers at Banking University – HCMC, Viet Nam for their help.

Lastly, thank you very much for my family, colleagues, and brother in assisting convenient conditions for my research paper.

VI. REFERENCES


Exhibit

Exhibit 1 – Inflation, GDP growth and macrroeconomics factors
(source: Viet Nam commercial banks and economic statistical bureau)

<table>
<thead>
<tr>
<th>Year</th>
<th>Inflation</th>
<th>GDP</th>
<th>USD/VND rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>18%</td>
<td>5,89%</td>
<td>20.670</td>
</tr>
<tr>
<td>2010</td>
<td>11,75% (Estimated at Dec 2010)</td>
<td>6,5% (expected)</td>
<td>19.495</td>
</tr>
<tr>
<td>2009</td>
<td>6,88%</td>
<td>5,2%</td>
<td>17.000</td>
</tr>
<tr>
<td>2008</td>
<td>22%</td>
<td>6,23%</td>
<td>17.700</td>
</tr>
<tr>
<td>2007</td>
<td>12,63%</td>
<td>8,44%</td>
<td>16.132</td>
</tr>
<tr>
<td>2006</td>
<td>6,6%</td>
<td>8,17%</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>8,4%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note approximately

Exhibit 2 – Comparing statistical results of equity beta var and mean in three (3) scenarios of changing competitor size in the commercial electric industry
(source: VN stock exchange 2012)
Mitigation of Security Attack in Android Application using Pin Tool
A Review
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ABSTRACT

The popularity and adoption of smartphones has greatly stimulated the spread of mobile malware, especially on the popular platforms such as Android. In light of their rapid growth, there is a pressing need to develop effective solutions. In the past few years, mobile devices (smartphones, PDAs) have seen both their computational power and their data connectivity rise to a level nearly equivalent to that available on small desktop computers, while becoming ubiquitous. On the downside, these mobile devices are now an extremely attractive target for large-scale security attacks. Mobile device middleware is thus experiencing an increased focus on attempts to mitigate potential security compromises. In particular, Android incorporates by design many well-known security features such as privilege separation. In this thesis the Android security model and some potential weaknesses of the model is described. Thesis provides taxonomy of attacks to the platform demonstrated by real attacks that in the end guarantee privileged access to the device and mitigation technique for the same attack would be proposed. The result analysis and testing would be done on mitigation technique.

Keywords: Dynamic Analysis, Runtime, Binary Instrumentation, Pin, Pin tool, Intel, Just-in-time compiler, security attack, android   Attack.

I. INTRODUCTION

(1) Pin and Pin Tool

Instrumentation

Instrumentation is a simple technique for inserting any extra line of code into an application to observe its behavior. It can be performed at various stages – inside the source code, at compile time, post link time, or even at run time. Source Code Instrumentation is a way to instrument source programs and Binary Instrumentation is to instrument binary executable directly Static binary instrumentation (SBI) occurs before the program is run phase, a phase in which we can rewrite executable code or object code. Dynamic binary instrumentation (DBI) is done at run time.

<table>
<thead>
<tr>
<th>Program Analysis</th>
<th>Type of program analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static Category</td>
<td>Dynamic Category</td>
</tr>
<tr>
<td>Source Type</td>
<td>Static source analysis</td>
</tr>
<tr>
<td>Binary Type</td>
<td>Static binary analysis</td>
</tr>
</tbody>
</table>

Table (1). Types of Program Analysis

Static Analysis and Dynamic Analysis:

Static analysis is the process of analyzing the source code or machine code of the program without need of running it Dynamic analysis is the process of analyzing program as it executes or at the runtime.

Source Analysis and Binary Analysis:

Source analysis is the process of analyzing programs at the level of source code. Source analysis are generally done for the points of programming language constructs such as expressions, statements, functions, and variables.
**Binary analysis** is the process of analyzing programs at the level of machine code, that stored either as object code (pre-linking) or executable code (post-linking). In this category, we have analysis that are performed at the level of executable intermediate representations, such as byte-codes, that runs on a particular virtual machine. Binary analysis are generally done for the points machine entities, such as registers, memory locations, procedures, and instructions.

**A Pin**

Pin has been the framework of choice for researchers working on program analysis and related tools. It can be used for several purposes, but mostly for program analysis (memory allocation analysis, error detection, performance profiling, etc...) and for architectural study (processor and cache simulation, trace collection, etc…). PIN is a dynamic binary instrumentation engine or framework. Pin is used for the instrumentation of software programs. It supports many platforms like Windows, Linux, Mac OS and Android executable for IA-32, and Intel(R) 64[4]. The Pin allows a programmer to insert any arbitrary code (written in C or C++) at arbitrary places in the executable (run time of any program). The code is added dynamically while the executable (program) is in the running phase. The input to this compiler is not byte code, but a regular executable. Pin dynamically re-compiles the application during execution. The Pin kit includes many tools (they can be found at: pin-w-x-y-android/source/tools). The tools are provided as source files. Pin provides the framework and API.

**Pin Architecture:**

![Pin Architecture](image)

**Figure 1. Pin Architecture [1]**

Pin consists of a virtual machine (VM), a code cache, and an instrumentation API invoked by Pin tools. The VM consists of a just-in-time compiler (JIT), an emulator, and a dispatcher. After Pin control of the application, the VM coordinates its components to execute the application. The JIT compiles and instruments application code, which is then launched by the dispatcher. The compiled code is stored in the code cache. The emulator interprets instructions that cannot be executed directly. It is used for system calls which require special handling from the VM. (E.g. system calls)

**Pin Tool**

Pin tool is the instrumentation program. Pin tools run on Pin to perform meaningful tasks. The inscount pin tool is used to find out the number of instructions in the running program.

Instrumentation consists of two components:

1. A mechanism that decides where and what code is inserted
2. The code to execute at insertion points

These two components are instrumentation and analysis code.

**(2) Android**

Android is a powerful Operating System supporting a large number of applications in Smart Phones. These applications make life more comfortable and advanced for the users. Hardware’s that support Android is mainly based on ARM architecture platform. Android comes with an Android market which is an online software store. It was developed by Google. It allows Android users to select, and download applications developed by third party developers and use them. There are around 2.0 lack+ games, application and widgets available on the market for users. Android applications are written in java programming language. Android is available as open source for developers to develop applications which can be further used for selling in android market. There are around 200000 applications developed for android with over 3 billion+ downloads.

Android relies on Linux version 2.6 for core system services such as security, memory management, process management, network stack, and driver model. For software development, Android provides Android SDK
(Software development kit). Read more about open source software.

Android uses Following Tools:
Eclipse, ADT Plugins, SDK toolkit, AVD toolkit.

Android Architecture

![Android Architecture](image)

**Figure 2.** Android Architecture [3]

Android Activity Lifecycle

![Android Activity Lifecycle](image)

**Figure 3.** Android Activity Lifecycle [2]

(3) Mitigation

Mitigation is the effort to reduce loss life and property by Lessing the impact of disasters.

![Attack classes](image)

**Figure 4.** Attack classes

No Physical Access

Attack circumstances where it is impossible to gain physical access to a user’s device. Then the attacker must get the user to perform actions on the attacker’s behalf. Such remote attacks commonly rely heavily on social engineering [5]. To achieve the appropriate initial access to the user’s device an attacker must get some malicious software running on the device. To run code remotely on a user’s device, the attacker typically must convince the user to either download a malicious application or access malicious content via one of the applications already installed on the device. If the attacker can exploit vulnerability on the user’s device, then this access may be used further to gain privileged access.

Physical Access with ADB Enabled

If the attacker finds a device left unattended, yet obstructed via a password or screen lock, the attacker may be able to exploit the device through the Android Developer Bridge.

Physical Access without ADB Enabled

If the attacker finds an obstructed Android device left unattended, but is unable to use the ADB service, the attacker may still gain privileged access via recovery boot.

Physical Access on Unobstructed Device

In some cases the attacker may actually have access to a device without a password protected screen lock. Such a situation allows the attacker to actually leverage any
other attack method since the attacker can choose to install applications, visit malicious websites, enable ADB on the device, etc.

Reduce the Patch Cycle Length

Attackers exploit some flaw in the operating system to gain root privileges. Reducing the patch cycle length would mitigate these threats with greater effectiveness. Zero-day exploits would still be possible, however the common lingering threat will be reduced. While Google has already demonstrated willingness to act quickly with out of band patch releases in reaction to certain attacks (e.g., [6]), reducing complete patch cycles is a more difficult problem. Indeed, manufacturers make changes to the Android source to create a competitive advantage. A fundamental separation between the core of Android and manufacturer modifications should be established.

Privileged Applications

To mitigate application attacks that take advantage of Android’s permission model many solutions have been proposed. Propose lightweight application certification comparing the requested permissions of an application to a set of security rules. If the application does not pass any of the security rules, then possible malicious activity is brought to the attention of the user.

For example, Google could validate that certain software vendors create security software and grant applications created by these vendors additional API functionality. Applications signed by such a vendor could, for example, have read access to the file system in order to facilitate anti-virus scanning beyond limited scope typically granted to applications. Such a configuration would allow users to install security related applications without having to first root their device. Because privileged applications will have unrestricted access to the device, these applications should be certified by some governing entity before they can be downloaded. This certification process could also help mitigate some weaknesses of an unmoderated market. With access to trusted security tools, users would be able to monitor untrusted applications and provide appropriate feedback.

Authenticated Downloads:

Once an attacker has physical access to a device, adding malicious applications becomes simple and quick by posing as the legitimate user and downloading them from the Android Market. To ensure downloads are made only by the user, the market should require authentication before every transaction, similar to the model currently used by the iPhone.

Authenticated ADB:

Because of the power given through the ADB, it should not be accessible to unauthorized users. Android should require the device to be unlocked before ADB can be used. Any legitimate user should be able to unlock the device and once the connection is made, the session could be maintained by preventing the screen from locking while it is connected via USB. With ADB authentication, the attacker no longer has a backdoor to bypass the lock mechanism’s authentication process, mitigating the ADB attack against obstructed devices.

Trusted Platform Module:

To secure a device in a managed model scenario a root of trust must be established. Using a Trusted Platform Module (TPM) provides a ground truth on which device security could be built, providing authentication of device state. Using a TPM would mitigate the recovery image attack, which relies on the ability to change the
boot image. Assuming signed byte code and authentication of the boot image, updates running unauthorized code would become extremely difficult.

II. LITERATURE REVIEW


In this Paper, They have described that robust and powerful software instrumentation tools are essential for program analysis tasks such as profiling, performance evaluation, and bug detection tool writer to analyze an application at the instruction level without the need for detailed knowledge of the underlying instruction set. The API is designed to be architecture independent whenever possible, making Pin tools source compatible across different architectures. Pin uses dynamic compilation to instrument executable while they are running. For efficiency, Pin uses several techniques, including in lining, register reallocation, liveness analysis, and instruction scheduling to optimize instrumentation. This fully automated approach delivers significantly better instrumentation performance than similar tools.

(2) Paper title: Behavioral Analysis of Android Applications Using Automated Instrumentation

They describe that Google's Android operating system has become one the most popular operating system for hand-held devices. Due to its ubiquitous use, open source nature and wide-spread popularity, it has become the target of recent mobile malware. In this paper, they present efforts on effective security inspection mechanisms for identification of malicious applications for Android mobile applications. To achieve that, they developed a comprehensive software inspection framework. Moreover, to identify potential software reliability flaws and to trigger malware, they develop a transparent instrumentation system for automating user interactions with an Android application that does not require source code. Additionally, for run-time behavior analysis of an application, they monitor the I/O system calls generated by application under monitoring to the underlying Linux kernel.

(3) Paper title: All Your Droid Are Belong to Us: A Survey of Current Android Attacks

Mobile devices (smartphones, PDAs) have seen both their computational power and their data connectivity rise to a level nearly equivalent to that available on small desktop computers, while becoming ubiquitous. Mobile device middleware is thus experiencing an increased focus on attempts to mitigate potential security compromises. The Android security model also creates several new security sensitive concepts such as Android’s application permission system and the unmoderated Android market. In this paper we look to Android as a specific instance of mobile computing. We first discuss the Android security model and some potential weaknesses of the model. We then provide a taxonomy of attacks to the platform demonstrated By real attacks that in the end guarantee privileged access to the device. Where possible, we also propose mitigations for the identified vulnerabilities.

(4) Paper title: Analysis and Research of System Security Based on Android

In this paper, it has analysis Android system's security mechanisms with widely used in mobile platforms. It has separately introduced its system architecture, security mechanism and safety problems. Through it has analysis Android security mechanisms and its components, it has set to the Android security, safety mechanism side, system security and data security. It has promoted system security to system permission. At the same time it analysis the Android security risks, it has deeply researched the attack based on Linux kernel. It has proposed security mechanisms based on SELinux policy theory to ensure system security on application program framework layer. Not only from the Linux kernel layer, it uses Android's security framework to ensure system security from the application layer intrusion, so it is essential to research and develop the method to protect the Android framework. This work will be the reference base to the Android further security analysis.


In this paper they have presented patch droid, a System to patch security vulnerabilities on legacy android Android devices, Patch droid uses dynamic
instrumentation techniques to patch vulnerabilities in memory, and uses a path distribution service so that patches only have to be created once and can be deployed on every devices. Because patches are injected directly into the processes, Patch droid does not need to flash or modify system partitions or binaries, making it universally deployable even on tightly controlled devices.

(6) Paper title: Dissecting Android Malware: Characterization and Evolution

In this paper, we focus on the Android platform and aim to systematize or characterize existing Android malware. Particularly, with more than one year effort, we have managed to collect more than 1,200 malware samples that cover the majority of existing Android malware families, ranging from their debut in August 2010 to recent ones in October 2011. In addition, we systematically characterize them from various aspects, including their installation methods, activation mechanisms as well as the nature of carried malicious payloads. The characterization and a subsequent evolution-based study of representative families reveal that they are evolving rapidly to circumvent the detection from existing mobile anti-virus software. Based on the evaluation with four representative mobile security software, our experiments show that the best case detects 79.6% of them while the worst case detects only 20.2% in our dataset. These results clearly call for the need to better develop next-generation anti-mobile-malware solutions.

III. METHODS AND MATERIAL

![Figure 6. Mitigation of security attack in android application using pin tool](image)

Step 1:
- Installation of Windows, Android sdk and AVD
- Implement intel PIN framework on system
- Compiling and Running miscount pin tool
- Attaching miscount pin tool to a running process and see the output at runtime.
- Study of the functions of PIN API given in the manual
- Modifying the miscount pin tool so that it can trace and list all the instructions
- Identifying which instructions are of read and write type

Figure 7. Instruction count in this android application

![Figure 7. Instruction count in this android application](image)

Figure 8. For Example: attack

IV. CONCLUSION

We have presented a method of mitigation of security attack in Android Applications using Pin tool which allows the user to instrument an Android Application. Instrumented code alters the behaviour of the original application thus the attacker can’t find the right way to inject his own code into the running Application. Android applications obtained from untrusted sources can be instrumented to enforce some sort of policies to prevent application from doing data leaks of confidential information. Moreover instrumentation can also be used as a protecting weapon. So here we have used pin tool to mitigation of security attack in android application.

We have described about the Pin, an Intel framework that provides portable, transparent, easy-to-use, robust and efficient dynamic binary instrumentation. It supports various architectures like IA32, EM64T, Itanium R, and ARM.
After describing the PIN tools and the pin tool kit, we have described the pin tool used for counting the instructions known as inscount. The code as well as the screenshot when it was attached to a running application is also shown. After that we have modified and extended the functionality of this pin tool to change the arguments to get trace the instructions.

Pin tool works as a dynamic binary instrumentation engine. It always detects vulnerabilities or malicious activities during the execution process of application. It provides run time monitoring and profiling for vulnerability analysis.

V. FUTURE WORK

In future instrumentation the android application to perform various attacks dynamically can be carried out. We need to develop various drives classes that can perform various kinds of activities. Thus with the help of instrumentation we can develop a whole new era of android application with fully featured profilers, debuggers and tools for controlling the applications at runtime.

In future on an android application, the attack will be performed. Using pin tool, its mitigation will also be provided. Mainly privileged types of attack will be done and mitigation technique will be developed to protect application from any attack.

VI. REFERENCES

http://jon.oberheide.org/blog/2010/06/25/remote-kill-and-install-on-google-android/
Studies on the Pathogenicity of Pebrine Spores Isolated from Ichneumon Fly (Xanthopimpla Pedator) Infesting Tropical Tasar Silkworm on Healthy Silkworm Larvae

Madhusudhan, K.N.*, Chakrapani, Gupta, V.P., Naqvi, A.H., Singh, G.P. and Alok Sahay

Microbiology Section, Central Tasar Research and Training Institute, Piska Nagri, Ranchi, Jharkhand, India

ABSTRACT

Tasar culture is the livelihood of the majority of poor tribal peoples of central and north eastern India. The tasar culture is being practiced in the outdoor condition it is amenable to different pests and predators which also harbor the tasar silkworm infecting diseases causing pathogens such as pebrine disease. The present study was aimed at isolating and purifying the pebrine spores from Ichneumon fly infesting tasar silkworm. The purified spores were artificially inoculated to healthy tasar silkworm larvae per orally. The observation of pebrine spores in inoculated larvae showed the presence of pebrine spores after 16 days post inoculation (dpi). The inoculated larvae showed typical symptoms of pebrine in tropical tasar silkworm i.e., appearance of black pepper spots on the larval integument which were distributed sparsely. The result confirms that, pebrine disease can be transmitted by the Ichneumon fly carrying the pebrine spores. This also confirms that, Ichneumon fly can be secondary source of pebrine contamination in the tasar rearing fields.

Keywords: Ichneumon Fly, Xanthopimpla Pedator, Pebrine, Artificial Inoculation, Secondary Contamination.

I. INTRODUCTION

The tasar culture is a forestry based industry which is providing livelihood to poor tribal people residing in different parts of India. Tropical tasar silkworm (Antheraea mylitta D.) is a sericigenous, polyphagous insect which feeds on different plants in different states of India (Mahapatra, 2009). Since tasar culture is carried out in outdoor condition, the silkworm is easy target for more number of pests of both host plants and silkworm which can results in 70-80% crop loss (Mathur and Shkla, 1998).

Numerous insects thrive on tasar silkworm, among them Xanthopimpla (hymenoptera), Blepharipa (Diptera) are pupal and larval parasites, Sycanus, Cantherona, (hemiptera), Hierodulla bipapilla (dictyoptera), Polistes and Oecophylla (hymenoptera) are predators of different age groups of tasar silkworms. The cumulative effect of these results in 30 - 40% tasar crop loss (Shivakumar and Shamita, 2013).

The Ichneumon fly, Xanthopimpla pedator Fabricius (Hymenoptera: Ichneumonidae) are the major endo-parasitoids of tasar silkworm. It is widely distributed in tropical tasar region of India and other parts of world. The ichneumon fly belongs to the order Hymenoptera, family ichneumonidae. Adult fly is bright yellow in colour with a number of black bands and there is a black spot on each sternum located dorso-ventrally. Length of the adult is about 2cm with 1cm long ovipositor in female with long stylets (two in number) (Shivakumar and Shamita, 2013).

The female fly lays eggs inside the pre-pupal body by inserting its ovipositor through freshly formed / flimsy cocoon shell. Only one egg is deposited in each host. The maggot after hatching consumes the entire pupal
content except the skin and pupates. The adult fly emerges from the cocoon by piercing the cocoon which renders the cocoon unfit for reeling (Aruna et al., 2014).

Pebrine is a dreaded disease of Tasar silkworm caused by *Nosema mylitta* (Protozoa: Microsporidia) which is causing devastating effect with yield loss up to 25-40% (Sahay, 2000). Pebrine disease is transmitted through transovarial transmission viz., mother moth to offspring along with secondary source of infections (transovum and per oral) (Kumar et al., 2013). No much information is available on the transmission of pebrine spores from pests infesting tasar silkworm. With this background, the present work has been carried out to purify the pebrine spores from the Ichneumon fly and study the pathogenicity of purified spores on the healthy tasar silkworm larvae.

II. METHODS AND MATERIAL

Collection and Examination of Yellow Fly:

During pre-grainage operations, the emerged Ichneumon flies were collected from different grainages in PPC, Kharsawan. The individual Ichneumon fly moths were subjected to microscopic examination to confirm the presence of pebrine spores. The spores bearing Ichneumon fly samples were further subjected to purification of spores.

Purification of Pebrine Spores from Yellow Fly:

The pebrine spore bearing Ichneumon fly samples were pooled and subjected to centrifugation at 4,000 rpm for 10 minutes. The supernatant was discarded and the concentrated sugar solution was added to sediment and centrifugation was carried out as described earlier. The white sediment in the tube was observed for the purity of pebrine spores.

Inoculation of Purified Pebrine Spores to Healthy Tasar Silkworm Larvae:

Newly hatched disease free larvae were fed with leaf sprayed with pebrine spore purified from Ichneumon fly in the plastic box. After complete consumption of leaf, the larvae were shifted to plant free from pebrine contamination. The larval samples were collected regularly and examined for the presence of pebrine spores and results were recorded.

III. RESULT AND DISCUSSION

Results

The results of the inoculation of pebrine spores purified from the pebrinized Ichneumon flies collected from grainage house to healthy tasar silkworm produced typical pebrine symptoms (retarded growth, irregular and inactive feeding along with black peppery spots on the integuments) (Figure 1). The distribution of black spots was very scanty and sparse.

![Figure 1](image)

Figure. 1. The pebrine challenge inoculated tasar silkworm larvae showing black peppery spots on the integument (4th instar larvae)

Regular microscopic examination of pebrine inoculated larva showed presence of pebrine spores from 17 days post inoculation (dpi). The intensity of pebrine spores was very less (1-3 spores) in 17-21 dpi. The frequent increase in concentration of pebrine spores (4-5 spores) was noticed from 22-24 dpi. The more increased concentration of pebrine spores (more than 5 spores) was noticed from 25 dpi till the harvest of the crop. The majority of the cocoons produced from pebrine inoculated larvae were of flimsy nature (Table 1).

Table 1. Observation for the presence of pebrine spores in yellow experiment:

<table>
<thead>
<tr>
<th>Days post inoculation (DPI)</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No Pebrine spores noticed</td>
</tr>
<tr>
<td>2</td>
<td>(Upto 16 DPI)</td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
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<td>6</td>
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<td>8</td>
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<tr>
<td>9</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>
Discussion

The pebrine spores were noticed in the extract of Ichneumon fly which were collected from grainage house. The pathogenicity studies of isolated and purified pebrine spores from pebrinized Ichneumon fly revealed that, the pebrine spores present in the Ichneumon fly can also infect the healthy tropical tasar silkworm artificially (Figure 1). It is also understood that further studies on the incidence of Pebrine on Ichneumon fly and other insects may help provide better explanation for the high rates of horizontal transmission primarily in the tasar silkworm rearing fields (Table 1). The control over the secondary infection will reduce the damage caused and also increases the yield qualitatively and quantitatively (Shivakumar and Shamitha, 2013).

IV. CONCLUSION

The Ichneumon flies collected from the grainage showed the presence of pebrine spores. The pathogenicity test of purified from pebrine bearing Ichneumon flies showed the typical symptoms of pebrine in healthy tropical tasar silkworm. The mode of transmission of pebrine from Ichneumon fly to tasar silkworm larvae needs to be understood.

V. REFERENCES

Poly (Lactic Acid)/MMT Nanoclay Hybrid Nanocomposites: Mechanical and Thermal Properties

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ABSTRACT

Poly (lactic acid)/clay nanocomposites were prepared by solution-casting and melt-blending techniques, and their morphologies and mechanical properties were studied. In morphology studies revealed an intercalated–exfoliated mixed structure for the nanocomposites obtained by both techniques. SEM images show a good clay dispersion degree. Sodium lauryl sulphate (SLS here after called) is used to modify the MMT Clay to improve the surface characteristic of the clay. The mechanical properties of nanocomposites from the melt-blending technique were superior to those obtained by solution-casting method. In both cases, the highest elongation at break and Young’s modulus were achieved at 5wt% SLS-montmorillonite SLS-MMT content.

Keywords: Nanocomposites, Poly (Lactic Acid), Montmorillonite, SLS

I. INTRODUCTION

Polylactide (PLA) is rigid thermoplastic polyester with a semicrystalline or completely amorphous structure depending on the stereopurity of the polymer backbone. PLA has gained a considerable interest due to its biodegradability, bioresorbability, and biocompatibility. Furthermore, its ability to be crystallized under stress, thermally crystallized, filled, and copolymerized, turn it into a polymer with a wide range of applications. The principal drawbacks of such a biodegradable polymer in terms of industrials application like food packaging are its poor thermal resistance, low mechanical and limited gas barrier properties. These drawbacks could be overcome by improving the thermo mechanical properties through copolymerization, blending, and filling techniques. However, the use of fillers appears to be the most attractive approach because of lower cost. There are different approaches for the preparation of PLA nanocomposites: in-situ polymerization, solution intercalation, and melt intercalation. Since melt intercalation provides more advantages as compared to others, this technique has been used as a standard method to develop polymer-layer silicate nanocomposites. Depending on the specific interactions between the polymeric matrix and the clay, different structures such as intercalated and exfoliated may be obtained. The clay layers may be well dispersed provided that a strong interaction can be developed between the clay and the polymeric matrix. Moreover, an increase in clay-PLA interactions can influence the mechanical properties. The lack of thermal stability of PLA at high temperature is another main problem. It has been found that hydrolysis, random main-chain scission reaction, oxidative reaction, and transesterification are the main undesirable reactions, strongly affecting the physical and mechanical properties of PLA. The main objective of this research is to develop PLA-clay nanocomposites, where control of PLA mechanical strength is achieved using chain extenders. Specific objectives are aimed at determining the influence of chain extenders on clay dispersion, and mechanical and barrier properties of the final extruded products [1-31].
This paper covers the synthesis of PLA, the preparation of PLA nanocomposites, the effect of clay on the mechanical and thermal properties of the resulting nanocomposites and the degradation mechanisms of PLA.

II. METHODS AND MATERIAL

2.1 Materials

Poly (lactic acid) was supplied by Nature Works 4060D, and was used as a matrix. In addition, montmorillonite clay (1.28E) surface modified with 25-30% trimethyl stearyl ammonium (supplied by Nanocor® Inc., Aldrich, Nanomer®, USA), was used as filler material. SLS and chloroform (Merck, Germany) were used as a surfactant and solvent, respectively [9,10].

2.2. Modification of Montmorillonite (MMT)

Organoclay MMT was prepared by a cationic exchange process in an aqueous solution by vigorously stirring 20 g of montmorillonite dispersed in 800 ml of distilled water at 80 °C with a solution of 50 mmol SLS and 50 mmol concentrated HCl in 200 ml distilled water. The precipitate was filtered, washed with hot distilled water until no chloride was detected and dried at 60 °C for 24 h. The product was labelled SLS-MMT. Bath type ultrasonicator (BTUS) was used for mixing.

Preparation of PLA/ODA-MMT nanocomposites

The procedures used to obtain the nanocomposite films are shown in Figure 1 for solution casting and Figure 2 for melt blending. Nanocomposites with SLS-MMT contents of 1, 3, 5, 7, and 10 wt % were also prepared. In the solution-casting technique, films of 0.5 mm thick were obtained using chloroform as a solvent in an ultrasonic bath at room temperature for 15 min. In the melt-blending technique, films 0.8 mm thick were obtained by hot pressing [12, 10, 13]. in kilojoules per meter (kJ/m). Scanning electron micro- scopy (SEM) studies of the fractured surface of the tensile specimen were carried out on a Jeol (6380LA, Japan). The specimen was sputter-coated with gold to increase surface conductivity. Tensile strength tests were carried out on par with ASTM D 53455. Tensile and flexural tests were performed on Instron universal testing machine (3369).

III. RESULT AND DISCUSSION

Mechanical Properties

Fig. 3 shows two important mechanical properties, namely the elongation at break and Young’s modulus, for the PLA/SLS-MMT nanocomposites prepared by using solution-casting and melt-blending techniques. The highest value for elongation at break was obtained for 5wt% clay content in PLA. The highest Young’s modulus, the mechanical property improved by clay incorporation in to the polymer matrix, was also obtained for 5 wt% SLS-MMT content [14, 19, 25].
Figure 3: Elongation at break (a, b) and Young’s modulus (c, d) for PLA/SLS-MMT nanocomposites prepared by solution-casting and melt-blending techniques, respectively.

Scanning electron microscopy (SEM)

To examine exactly the dispersion of the clay layers in the film-type nanocomposites, we carried out SEM studies. Typical SEM images for the nanocomposites based on 5 wt% in solution-casting and melt-blending techniques are shown in Figure 4 (a & b).

Each clay displayed individual clay layers that were well dispersed, exfoliated, in the PLA matrix. The density and homogeneity of the samples are similar but dispersion in samples from melt-blending (Fig. 4b) is better than that of solvent casting (Fig. 4a). Similar observations were observed by the researchers [1-3].
IV. CONCLUSION

In this work, the PLA/SLS-MMT nanocomposites were prepared as an exfoliated structure by solution casting and melt blending methods. The optimum content of clay in both of methods was obtained at 5% because the highest elongation at break and Young’s modulus were occurred in this content. Further the mechanical properties of obtained films by melt blending were superior of the films obtained by solution casting. In addition, the absence of solvents, which can produce environmental problems, is an advantage for the melt blending method.

V. ACKNOWLEDGMENTS

The authors would like to thank the staff of the Department of Polymer Science and Technology, Sri Krishnadevaraya University, Anantapuramu for making this endeavour fruitful in all regards.

VI. REFERENCES

The Impact of Selecting Different Industrial Competitors on the Risk Level of Viet Nam Hardware Companies During The Financial Crisis 2007-2009

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MBA, PhD candidate, Banking University, HCMC – GSIM, International University of Japan, Japan

ABSTRACT

This research shows marketing factors such as business competitors could affect business market risk, from a quantitative point of view. Using a two (2) factors model, this research paper estimates the impacts of not only the size of firms’ competitors, but also leverage in the hardware industry, on the market risk of 22 listed companies in this category. This paper founds out that the risk dispersion level in this sample study could be minimized in case the competitor size remaining as current (measured by equity beta var of 0.067) and leverage down to 20%. Besides, the empirical research findings show us that when financial leverage increases up to 30%, max asset beta value decreases from 1.069 to 1.033 in case the size of competitor doubles. Last but not least, this paper illustrates calculated results that might give proper recommendations to relevant governments and institutions in re-evaluating their policies during and after the financial crisis 2007-2009.

Keywords: Risk Management, Competitive Firm Size, Market Risk, Asset And Equity Beta, Hardware Industry

JEL Classification : M00, G3, M3

I. INTRODUCTION

In marketing and business, choosing competitors might affect business strategies, esp., during the crisis period 2007-2009 in which hardware firms experience many risks, although Viet Nam hardware industry is considered as one of active economic sectors, which has some positive effects for the economy.

This paper is organized as follow. The research issues and literature review will be covered in next sessions 2 and 3, for a short summary. Then, methodology and conceptual theories are introduced in session 4 and 5. Session 6 describes the data in empirical analysis. Session 7 presents empirical results and findings. Next, session 8 covers the analytical results. Then, session 9 presents analysis of industry. Lastly, session 10 will conclude with some policy suggestions. This paper also supports readers with references, exhibits and relevant web sources.

A. Research Issues

For the estimating of impacts of the selection of different industrial competitors on the risk measured by beta for listed hardware companies in Viet Nam stock exchange, research issues will be mentioned as following:

Issue 1: Whether the selection of different competitors makes the risk level of hardware industry firms under the different changing scenarios of leverage increase or decrease so much.

Issue 2: Whether the selection of doubling size competitor makes the dispersion of beta values become large in the different changing scenarios of leverage in this industry.
B. Literature Review

Goldsmith (1969), Mc Kinnon (1973) and Shaw (1973) pointed a large and active theoretical and empirical literature has related financial development to the economic growth process.

Last but not least, Ana and John (2013) Binomial Leverage – Volatility theorem provides a precise link between leverage and volatility. Chen et all (2013) supports suspicions that over-reliance on short-term funding and insufficient collateral compounded the effects of dangerously high leverage and resulted in undercapitalization and excessive risk exposure for Lehman Brothers.

C. Conceptual Theories

Industrial Competitor Theories

There are many competitive advantages which are owned by industrial competitors. These advantages can be attributes such as access to natural resources or highly trained personnel human resources or capital or leverage. Using leverage can help firms to obtain new technologies which are another competitive advantage.

II. METHODS AND MATERIAL

D. Methodology

In this research, analytical research method is used, philosophical method is used and specially, scenario analysis method is used. Analytical data is from the situation of listed commercial electric industry firms in VN stock exchange and applied current tax rate is 25%. The below table 1 shows us three cases of choosing different competitors.

Finally, we use the results to suggest policy for both these enterprises, relevant organizations and government.

Table 1 – Analyzing market risk under three (3) scenarios of changing competitors (Made by Author)

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Company</th>
<th>Competitor size as current</th>
<th>Competitor size slightly smaller</th>
<th>Competitor size double</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CMT</td>
<td>TLC as comparable</td>
<td>TLC as comparable</td>
<td>VIE as comparable</td>
</tr>
<tr>
<td>2</td>
<td>SVT</td>
<td>UNI as comparable</td>
<td>ONE as comparable</td>
<td>LTC as comparable</td>
</tr>
<tr>
<td>3</td>
<td>VIE</td>
<td>TST as comparable</td>
<td>TST as comparable</td>
<td>ITD as comparable</td>
</tr>
<tr>
<td>4</td>
<td>HPT</td>
<td>VTC as comparable</td>
<td>VTC as comparable</td>
<td>ST8 as comparable</td>
</tr>
<tr>
<td>5</td>
<td>NIS</td>
<td>TST as comparable</td>
<td>TST as comparable</td>
<td>ITD as comparable</td>
</tr>
<tr>
<td>6</td>
<td>TST</td>
<td>UNI as comparable</td>
<td>UNI as comparable</td>
<td>TAG as comparable</td>
</tr>
<tr>
<td>7</td>
<td>ST8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>TAG</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>POT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>CKV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>ONE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>PMT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>SMT</td>
<td>PMT as comparable</td>
<td>HTP as comparable</td>
<td>NIS as comparable</td>
</tr>
<tr>
<td>14</td>
<td>UNI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>TLC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>KST</td>
<td>TLC as comparable</td>
<td>VTC as comparable</td>
<td>VIE as comparable</td>
</tr>
<tr>
<td>17</td>
<td>VAT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>VTC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>ELC</td>
<td>ITD as comparable</td>
<td>ITD as comparable</td>
<td>CMG as comparable</td>
</tr>
<tr>
<td>20</td>
<td>SAM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>LTC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>ITD</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
E. General Data Analysis

The research sample has total 22 listed firms in the hardware industry market with the live data from the stock exchange.

Firstly, we estimate equity beta values of these firms and use financial leverage to estimate asset beta values of them. Secondly, we change the competitors from what reported in F.S 2011 to those with size doubling and reducing slightly to see the sensitivity of beta values. We found out that in both cases of smaller competitors and double size competitors, asset beta mean values are reduced to 0.334 from 0.343 if the leverage up to 30%. Also in 3 scenarios of different competitors, we find out equity beta mean values are moving in the opposite direction with the leverage. Leverage degree changes definitely have certain effects on asset and equity beta values.

F. Empirical Research Findings and Discussion

In the below section, data used are from total 22 listed hardware industry companies on VN stock exchange (HOSE and HNX mainly). In the scenario 1, current financial leverage degree is kept as in the 2011 financial statements which is used to calculate market risk (beta) whereas competitor size is kept as current, then changed from double size to slightly smaller size. Then, two (2) FL scenarios are changed up to 30% and down to 20%, compared to the current FL degree. In short, the below table 1 shows three scenarios used for analyzing the risk level of these listed firms.

Market risk (beta) under the impact of tax rate, includes: 1) equity beta; and 2) asset beta.

Table 1 – Analyzing market risk under three (3) scenarios (Made by Author)

<table>
<thead>
<tr>
<th>Competitor size as current</th>
<th>FL as current</th>
<th>FL up 30%</th>
<th>FL down 20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competitor size as current</td>
<td>Scenario 1</td>
<td>Scenario 2</td>
<td>Scenario 3</td>
</tr>
<tr>
<td>Competitor size slightly smaller</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competitor size double</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7.1 Scenario 1: current financial leverage (FL) as in financial reports 2011 and competitor size as current, slightly smaller and double In this case, all beta values of 22 listed firms on VN hardware industry market as following:

Table 2 – Market risk of listed companies on VN hardware industry market under a two factors model (case 1) (source: VN stock exchange 2012)

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Company</th>
<th>stock code</th>
<th>Competitor size as current</th>
<th>Competitor size slightly smaller</th>
<th>Competitor size double</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Equity beta</td>
<td>Asset beta (assume debt beta = 0)</td>
<td>Equity beta</td>
</tr>
<tr>
<td>1</td>
<td>CMT</td>
<td>0.665</td>
<td>0.326</td>
<td>0.665</td>
<td>0.326</td>
</tr>
<tr>
<td>2</td>
<td>SVT</td>
<td>0.860</td>
<td>0.651</td>
<td>0.860</td>
<td>0.651</td>
</tr>
<tr>
<td>3</td>
<td>VIE</td>
<td>0.283</td>
<td>0.054</td>
<td>0.131</td>
<td>0.025</td>
</tr>
<tr>
<td>4</td>
<td>HPT</td>
<td>0.238</td>
<td>0.063</td>
<td>0.238</td>
<td>0.063</td>
</tr>
<tr>
<td>5</td>
<td>NIS</td>
<td>0.347</td>
<td>0.165</td>
<td>0.347</td>
<td>0.165</td>
</tr>
<tr>
<td>6</td>
<td>TST</td>
<td>0.739</td>
<td>0.236</td>
<td>0.739</td>
<td>0.236</td>
</tr>
<tr>
<td>7</td>
<td>ST8</td>
<td>0.891</td>
<td>0.682</td>
<td>0.891</td>
<td>0.682</td>
</tr>
<tr>
<td>8</td>
<td>TAG</td>
<td>0.632</td>
<td>0.411</td>
<td>0.632</td>
<td>0.411</td>
</tr>
<tr>
<td>9</td>
<td>POT</td>
<td>1.046</td>
<td>0.533</td>
<td>1.046</td>
<td>0.533</td>
</tr>
<tr>
<td>10</td>
<td>CKV</td>
<td>0.604</td>
<td>0.221</td>
<td>0.604</td>
<td>0.221</td>
</tr>
<tr>
<td>11</td>
<td>ONE</td>
<td>0.551</td>
<td>0.217</td>
<td>0.551</td>
<td>0.217</td>
</tr>
<tr>
<td>12</td>
<td>PMT</td>
<td>1.234</td>
<td>1.056</td>
<td>1.191</td>
<td>1.019</td>
</tr>
</tbody>
</table>
7.2. Scenario 2: financial leverage increases up to 30% and competitor size kept as current, slightly smaller and double If leverage increases up to 30%, all beta values of total 22 listed firms on VN hardware industry market as below:

Table 3 – Market risks of listed hardware industry firms under a two factors model (case 2) *(source: VN stock exchange 2012)*

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Company stock code</th>
<th>Competitor size as current</th>
<th>Competitor size slightly smaller</th>
<th>Competitor size double</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Equity beta</td>
<td>Asset beta (assume debt beta = 0)</td>
<td>Equity beta</td>
</tr>
<tr>
<td>1</td>
<td>CMT</td>
<td>0.665</td>
<td>0.394</td>
<td>0.665</td>
</tr>
<tr>
<td>2</td>
<td>SVT</td>
<td>0.903</td>
<td>0.728</td>
<td>0.903</td>
</tr>
<tr>
<td>3</td>
<td>VIE</td>
<td>0.498</td>
<td>0.176</td>
<td>0.292</td>
</tr>
<tr>
<td>4</td>
<td>HPT</td>
<td>0.356</td>
<td>0.146</td>
<td>0.356</td>
</tr>
<tr>
<td>5</td>
<td>NIS</td>
<td>0.411</td>
<td>0.238</td>
<td>0.411</td>
</tr>
<tr>
<td>6</td>
<td>TST</td>
<td>0.739</td>
<td>0.337</td>
<td>0.739</td>
</tr>
<tr>
<td>7</td>
<td>ST8</td>
<td>0.891</td>
<td>0.724</td>
<td>0.891</td>
</tr>
<tr>
<td>8</td>
<td>TAG</td>
<td>0.632</td>
<td>0.455</td>
<td>0.632</td>
</tr>
<tr>
<td>9</td>
<td>POT</td>
<td>1.046</td>
<td>0.636</td>
<td>1.046</td>
</tr>
<tr>
<td>10</td>
<td>CKV</td>
<td>0.604</td>
<td>0.297</td>
<td>0.604</td>
</tr>
<tr>
<td>11</td>
<td>ONE</td>
<td>0.695</td>
<td>0.358</td>
<td>0.695</td>
</tr>
<tr>
<td>12</td>
<td>PMT</td>
<td>1.234</td>
<td>1.092</td>
<td>1.191</td>
</tr>
<tr>
<td>13</td>
<td>SMT</td>
<td>0.998</td>
<td>0.759</td>
<td>0.882</td>
</tr>
<tr>
<td>14</td>
<td>UNI</td>
<td>1.186</td>
<td>0.823</td>
<td>1.186</td>
</tr>
<tr>
<td>15</td>
<td>TLC</td>
<td>1.066</td>
<td>0.829</td>
<td>1.066</td>
</tr>
<tr>
<td>16</td>
<td>KST</td>
<td>0.764</td>
<td>0.500</td>
<td>0.455</td>
</tr>
<tr>
<td>17</td>
<td>VAT</td>
<td>1.028</td>
<td>0.594</td>
<td>1.168</td>
</tr>
<tr>
<td>18</td>
<td>VTC</td>
<td>0.635</td>
<td>0.471</td>
<td>0.635</td>
</tr>
<tr>
<td>19</td>
<td>ELC</td>
<td>0.234</td>
<td>0.140</td>
<td>0.234</td>
</tr>
<tr>
<td>20</td>
<td>SAM</td>
<td>1.191</td>
<td>1.094</td>
<td>1.191</td>
</tr>
<tr>
<td>21</td>
<td>LTC</td>
<td>1.102</td>
<td>0.483</td>
<td>1.102</td>
</tr>
<tr>
<td>22</td>
<td>ITD</td>
<td>0.351</td>
<td>0.175</td>
<td>0.351</td>
</tr>
</tbody>
</table>

All three above tables and data show that values of equity and asset beta in the case of increasing leverage up to 30% or decreasing leverage degree down to 20% have certain fluctuation.
G. Comparing statistical results in 3 scenarios of changing leverage:

Table 5 - Statistical results (FL in case 1) *(source: VN stock exchange 2012)*

<table>
<thead>
<tr>
<th>Competitor size as current</th>
<th>Competitor size slightly smaller</th>
<th>Competitor size double</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Statistic results</strong></td>
<td><strong>Equity beta</strong></td>
<td><strong>Asset beta</strong></td>
</tr>
<tr>
<td>MAX</td>
<td>1.234</td>
<td>1.069</td>
</tr>
<tr>
<td>MIN</td>
<td>0.200</td>
<td>0.054</td>
</tr>
<tr>
<td>MEAN</td>
<td>0.748</td>
<td>0.441</td>
</tr>
<tr>
<td>VAR</td>
<td>0.1085</td>
<td>0.0893</td>
</tr>
</tbody>
</table>

Note: Sample size : 22 firms

Table 6 – Statistical results (FL in case 2) *(source: VN stock exchange 2012)*

<table>
<thead>
<tr>
<th>Competitor size as current</th>
<th>Competitor size slightly smaller</th>
<th>Competitor size double</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Statistic results</strong></td>
<td><strong>Equity beta</strong></td>
<td><strong>Asset beta</strong></td>
</tr>
<tr>
<td>MAX</td>
<td>1.234</td>
<td>1.033</td>
</tr>
<tr>
<td>MIN</td>
<td>-0.085</td>
<td>0.002</td>
</tr>
<tr>
<td>MEAN</td>
<td>0.691</td>
<td>0.337</td>
</tr>
<tr>
<td>VAR</td>
<td>0.1538</td>
<td>0.0945</td>
</tr>
</tbody>
</table>

Note: Sample size : 22 firms

Table 7- Statistical results (FL in case 3) *(source: VN stock exchange 2012)*

<table>
<thead>
<tr>
<th>Competitor size as current</th>
<th>Competitor size slightly smaller</th>
<th>Competitor size double</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Statistic results</strong></td>
<td><strong>Equity beta</strong></td>
<td><strong>Asset beta</strong></td>
</tr>
<tr>
<td>MAX</td>
<td>1.234</td>
<td>1.094</td>
</tr>
</tbody>
</table>

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III. RESULT AND DISCUSSION

Based on the calculated results, we find out:

First of all, if competitor size is kept as current, both max and min values of asset beta vary in 3 cases (max values decreasing to 1.033 and increasing to 1.094 when leverage up 30% and down 20%). Secondly, if competitor size is chosen with total asset doubling, max and min values of asset beta vary in all 3 scenarios. Thirdly, if competitor is chosen with total asset slightly smaller, there is tiny change in min values of equity and asset beta in the case of leverage down 20% (for example, min asset beta increasing to 0.103 from 0.030).

Additionally, the below chart 1 shows us: in the case of doubling competitor size, the risk is less dispersed in case Fl down 20%. Especially, if leverage down to 20%, equity beta var is at 0.084 (equity beta var is minimum in case Fl down 20% and approximate size competitors).

On the contrary, in the case of doubling size competitors, if leverage up to 30%, equity beta var increases to 0.210.

Last but not least, from chart 2, we could note that in the case of slightly smaller size competitors, keeping the current leverage degree, asset beta mean value reduces to 0.436 from 0.448 (approximate size competitors). On the other hand, in the case of doubling size competitors, asset beta mean value goes down to 0.381.

Chart 1 – Comparing statistical results of equity beta var and mean in three (3) scenarios of changing FL and competitor size (source: VN stock exchange 2012)

IV. CONCLUSION and POLICY SUGGESTION

In general, the government has to consider the impacts on the mobility of capital in the markets when it changes the macro policies and the legal system and regulation for developing the hardware market. The Ministry of Finance continues to increase the effectiveness of fiscal policies and tax policies which are needed to combine with other macro policies at the same time. The State Bank of Viet Nam continues to increase the effectiveness of capital providing channels for hardware companies. Furthermore, the entire efforts among many different government bodies need to be coordinated.
Last but not least, these companies might be aware of a minimum value of asset beta mean of 0.334 with either doubling size competitors or smaller competitors (leverage up 30%) and a maximum value of asset beta mean of 0.531 with approximate size competitors if leverage down 20%. In this case, the statement “the riskier the marketing strategy, the lower the market risk” is not totally correct.

Finally, this paper suggests implications for further research and policy suggestion for the Viet Nam government and relevant organizations, economists and investors from current market conditions.

V. ACKNOWLEDGEMENTS

I would like to take this opportunity to express my warm thanks to Board of Editors and Colleagues at Citibank HCMC, SCB and BIDV-HCMC, Dr. Chen and Dr. Yu Hai-Chin at Chung Yuan Christian University for class lectures, also Dr Chet Borucki, Dr Jay and my ex-Corporate Governance sensei, Dr. Shingo Takahashi at International University of Japan. My sincere thanks are for the editorial office, for their work during my research. Also, my warm thanks are for Dr. Ngo Huong, Dr. Ho Dieu, Dr. Ly H. Anh, Dr Nguyen V. Phuc and my lecturers at Banking University – HCMC, Viet Nam for their help.

Lastly, thank you very much for my family, colleagues, and brother in assisting convenient conditions for my research paper.

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The Characteristics of Fatty Raw Materials and their Influence on the Properties of Ethyl Biodiesel

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Instituto de Química/Universidade do Estado do Rio de Janeiro, Rio de Janeiro, Brazil

ABSTRACT

Various sources of fat ingredients may be used in the production of biodiesel thus allowing the agricultural potential to be vastly explored. However, in order to do so, the specific characteristics of the biodiesel produced from various raw materials may be known. In this research work, the biodiesel produced by the ethyl transesterification reaction of ten fatty raw materials was characterized according to its acidity index, kinetic viscosity, specific weight and iodine value. The experimental data were used to develop the correlation between each biodiesel property and the characteristics of the fat sources. Biodiesel properties are strongly influenced by the specific fatty esters composition in the raw material. A good correlation was observed between the values estimated by the equations obtained from the multiple linear regression and the experimental values, with exception of the iodine value.

Keywords: Biodiesel, Statistical Analysis, Physical Chemistry Properties

I. INTRODUCTION

The search for alternative solutions to crude oil and the growing concern with environmental pollution have been pushing up the production of biofuels all over the world. As a pioneer in the use of biofuels, Brazil has reached a position desired by many countries that search for renewable sources of energy as strategic alternatives to fossil fuels. In Brazil, the two main biofuels are the ethanol from sugar cane and the biodiesel produced from vegetable oils or animal fats [1].

Different processes are currently available and have been adopted for the production of biodiesel fuel, but the most commonly used method for converting oils to biodiesel is through the transesterification of vegetable oils or animal fats [2-3]. Vegetable oils, with various compositions of fatty acids, are the usual fatty raw materials used for biodiesel production, since they are renewable and can be produced on a large scale. Due to this flexibility, there is a much lower risk of fuel shortage and this diversity also avoids a production concentration similar to the one that occurs for fossil fuels. However, no matter the source of raw material used, the biodiesel produced should meet the specifications defined by each country’s Regulatory Oil Agency for the product commercialization. In Brazil, ANP (Agência Nacional do Petróleo, Gás Natural e Biocombustíveis) is the Regulatory Agency for Petroleum, Natural Gas and Biofuels. Therefore it becomes important to know the specific characteristics of the biodiesel produced from the different fatty raw materials.

The fatty acids used to produce the biodiesel differ from each other by three main characteristics: length of hydrocarbon chain, degree of unsaturation and presence of functional groups [4]. There are studies in the literature about biodiesel production which use various raw materials such as animal fats [5-6], microalgae [7-8] or vegetable oils. Among the vegetable oils studied the most common are soybean [9-11], rapeseed [12-14], palm [15-16] and sunflower oils [17-18]. However, there are few research works that analyze the biodiesel properties and correlate them to some parameter related to the source of fatty acid. Moreover, those studies have been limited to methyl biodiesel. According to Knothe [4], some methyl biodiesel properties, such as lubricity, viscosity, heat of combustion and oxidative stability, become higher as the ester chain gets longer and decrease as the degree of unsaturation in the chain increases. Ramos et al [19] studied the influence of the
composition of ten raw materials on the methylic biodiesel properties. The authors verified an inverse relationship between the cetane number and the concentration of linoleic and linolenic esters, and a direct correlation between the iodine value and the degree of unsaturation of the starting oil. The negative effect of the degree of unsaturation over the oxidative stability and the fluid properties has also been reported in the literature [19-22].

The purpose of this work was to produce ethyl biodiesel using ten different oilseed sources and to verify the influence of their specific characteristics over the biofuel properties.

II. METHODS AND MATERIAL

1. Reaction

The biodiesel was produced by the homogeneous ethyl transesterification reaction of ten fat sources: refined soybean, rice, canola, sunflower, corn and olive oils, Cyclus® (a commercial blend of canola, corn and sunflower oils); unrefined castor bean and murumuru oils; and frying residue. The fat source/alcohol molar ratio was 1/6 and the catalytic agent used was potassium ethanoate at a 1% ratio to the mass of fat. After 1h, at 343 K, the product was purified by decantation and vacuum evaporation.

2. Characterization of biodiesel and raw materials

The following tests were done in triplicate, both for the biodiesel samples and for the specific fat source.

The C16-C18 esters composition was obtained by gas chromatography, using a Varian CP3800 equipment and a CPWAX52CB column. The main esters content derived from the fatty acids were measured: C16:0 (palmitic acid), C18:0 (stearic acid), C18:1 (oleic acid), C18:2 (linoleic acid) and C18:3 (linolenic acid).

The acidity index was determined by titration using a KOH alcoholic solution and phenolphthalein as the indicator. The ANP Resolution no. 45/2014 establishes that the acidity index should have a maximum value of 0.50 mg KOH/g of sample [23].

The kinematic viscosity was determined using a calibrated glass capillary viscometer immersed in a thermostatic bath at a stable temperature of 313 K. The ANP Resolution no. 45/2014 establishes that the viscosity at 313 K should be between 3.0 and 6.0 mm²/s [23].

The specific weights of the biodiesel samples and of their respective raw materials were determined at 293 K using a calibrated pycnometer. The ANP Resolution no. 45/2014 establishes that the specific weight at 293 K should be within the range of 850-900 kg m⁻³ [23].

The iodine value was obtained through the Hulb method: a certain amount of sample is mixed with CCl₄, Hulb reactant (I₂ + HgCl₂) and KI. After stirring and letting the mixture rest for 16 hours, it was titrated with a Na₂S₂O₃ solution. The ANP Resolution no. 45/2014 suggests that the iodine value should be reported, but does not define a limit value.

3. Statistical Analysis

Initially, an exploratory analysis of the data obtained from the determination of the oil and biodiesel properties was conducted using principal components analysis (PCA). The PCA is a method for multivariate data analysis, by reducing the dimensionality of the original data in low dimensionality subspaces defined by few principal components [24], through the general equation (1):

\[ X = \sum_{a=1}^{A} t_a p_a^T + E = Tp^T + E \]  

where P (K x A) is the matrix that contains vectors pa of loadings or principal components; T is the score matrix which contains the orthogonal projection location for the original observations at a latent subspace, ta are the vectors of the scores matrix T, which represent the new principal components with variances given by their respective auto values (λa) and the matrix E (m x K) contains the residues, i.e., the part that is not explained by the model [25].

The experimental results obtained were normalized so that they had zero average and standard deviations equal to one. The normalization was done by subtracting the value determined experimentally from the average of the results and dividing this value by the standard deviation. The purpose of working with normalized values is to reduce the influence of a set of very high values (e.g.:
specific weight) over another set of very low values (e.g.: acidity index). The correlations to estimate the biodiesel properties were obtained by using multiple linear regression analysis (MLR). For both cases, data were obtained using the Statistica 7.0 and Matlab 7.0 programs.

III. RESULTS AND DISCUSSION

A. Esters Composition
The raw material composition data obtained by chromatography are shown in Table I. The biodiesel samples showed different chemical compositions, including the high content of monounsaturated fats in olive (81.6%) and canola oils (65.7%), the high content of the ester derived from linoleic acid in soybean (57.4%) and sunflower oils (58.1%), and the low content of C16-C18 fatty esters in the murumuru sample (23.6%).

TABLE I
C16-C18 Fatty Esters Composition Obtained from Gas Chromatography

<table>
<thead>
<tr>
<th>Sample</th>
<th>C16:0 (%)</th>
<th>C18:0 (%)</th>
<th>C18:1 (%)</th>
<th>C18:2 (%)</th>
<th>C18:3 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>18.2</td>
<td>1.8</td>
<td>42.9</td>
<td>35.5</td>
<td>0.88</td>
</tr>
<tr>
<td>Olive</td>
<td>9.7</td>
<td>2.4</td>
<td>81.6</td>
<td>3.9</td>
<td>0.42</td>
</tr>
<tr>
<td>Canola</td>
<td>4.9</td>
<td>1.7</td>
<td>65.7</td>
<td>18.2</td>
<td>7.8</td>
</tr>
<tr>
<td>Cyclus®</td>
<td>7.8</td>
<td>2.4</td>
<td>48.8</td>
<td>34.4</td>
<td>4.4</td>
</tr>
<tr>
<td>Frying residue</td>
<td>11.9</td>
<td>3.3</td>
<td>29.9</td>
<td>48.2</td>
<td>6.7</td>
</tr>
<tr>
<td>Sunflower</td>
<td>5.2</td>
<td>2.7</td>
<td>33.0</td>
<td>58.1</td>
<td>0.06</td>
</tr>
<tr>
<td>Castor</td>
<td>3.8</td>
<td>3.1</td>
<td>12.7</td>
<td>28.9</td>
<td>3.5</td>
</tr>
<tr>
<td>Corn</td>
<td>11.1</td>
<td>1.8</td>
<td>35.6</td>
<td>50.3</td>
<td>0.49</td>
</tr>
<tr>
<td>Murumuru</td>
<td>8.9</td>
<td>3.3</td>
<td>9.1</td>
<td>2.1</td>
<td>0.11</td>
</tr>
<tr>
<td>Soybean</td>
<td>10.1</td>
<td>2.4</td>
<td>22.2</td>
<td>57.4</td>
<td>7.3</td>
</tr>
</tbody>
</table>

The results regarding the average values from the properties determined for the biodiesel samples and the respective fat sources are shown in Tables II and III. Each one of these properties will be discussed separately.

B. Acidity Index
According to Tables II and III, it is possible to observe that the acidity index values for biodiesel are lower than those for the respective raw material. It is worth noting that the acidity indexes for the biodiesel samples are in compliance with the ANP specifications, except for the murumuru biodiesel. This exception may be explained by the high acidity of the raw material and by the fact that the raw material was not refined.

C. Kinematic Viscosity
As shown in Tables II and III, the viscosities of the fat sources are quite higher than that for the biodiesel obtained, being considered as an indication of their conversion into ethyl esters.

In general, the viscosity values for the biodiesel samples are in accordance to the ANP specifications. One of the exceptions is the murumuru biodiesel whose viscosity value, though very close to the minimum value established, is still below the specification. The murumuru oil viscosity is the lowest of all the raw materials tested. On the other hand, the viscosity of the castor oil biodiesel is well above the value defined by ANP and does not comply with the specifications. This is caused by the high viscosity value for the fat ingredient.

D. Specific Weight

TABLE III
Average Values Determined for Fat Raw Materials

<table>
<thead>
<tr>
<th>Sample</th>
<th>Acidity Indexa</th>
<th>Kinematic Viscosityb</th>
<th>Specific Weightc</th>
<th>Iodine valued</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>1.102</td>
<td>35.76</td>
<td>917.0</td>
<td>73</td>
</tr>
<tr>
<td>Olive</td>
<td>4.310</td>
<td>37.78</td>
<td>910.6</td>
<td>63</td>
</tr>
<tr>
<td>Canola</td>
<td>0.288</td>
<td>32.32</td>
<td>916.8</td>
<td>99</td>
</tr>
<tr>
<td>Cyclus®</td>
<td>1.884</td>
<td>33.07</td>
<td>915.6</td>
<td>81</td>
</tr>
<tr>
<td>Frying residue</td>
<td>1.809</td>
<td>33.06</td>
<td>923.7</td>
<td>119</td>
</tr>
<tr>
<td>Sunflower</td>
<td>0.289</td>
<td>32.27</td>
<td>916.7</td>
<td>90</td>
</tr>
<tr>
<td>Castor</td>
<td>0.561</td>
<td>256.04</td>
<td>955.4</td>
<td>71</td>
</tr>
<tr>
<td>Corn</td>
<td>0.284</td>
<td>33.21</td>
<td>917.1</td>
<td>106</td>
</tr>
<tr>
<td>Murumuru</td>
<td>5.110</td>
<td>29.27</td>
<td>904.0</td>
<td>13</td>
</tr>
<tr>
<td>Soybean</td>
<td>0.546</td>
<td>30.89</td>
<td>921.2</td>
<td>122</td>
</tr>
</tbody>
</table>

\[(mg \text{KOH g}^{-1}); (mm^2 \text{s}^{-1}); (kg \text{m}^{-3}); (g/100g)\]
In general, the increase in the specific weight of the biodiesel follows the increase trend for the raw material specific weight.

For all samples studied, the specific weight values are in accordance with those from the Brazilian Regulatory Agency for Petroleum, Natural Gas and Biofuels, except for the castor oil biodiesel. The specific weight for the castor oil biodiesel is above the value defined by ANP and, as for the viscosity, the explanation may be related to the presence of ricinoleic acid ($C_{18}H_{34}O_3$) in this oil. Similar results were obtained by Albuquerque et al [26].

E. Iodine Value

The biodiesel’s iodine values are lower than those for their respective raw materials (Tables II and III). However, the increase in iodine values for the biodiesel samples is not directly correlated to the increasing values for the respective oils.

F. Exploratory Data Analysis

The data matrix was built with 30 samples and 15 variables, previously described. The data were preprocessed using the autoscale. Therefore, the training set for the PCA model was built with 30 biodiesel samples, and the validation was carried out using the cross validation procedure. This internal validation is based on the removal of one sample at a time from the training set, which is, then, tested in the model created, making it a more robust model since all samples are tested.

The following parameters were defined to evaluate the quality of the model: the root mean square error of calibration (RMSEC) and the root mean square error of validation (RMSECV). The last one is used to measure the model’s ability to predict new samples. The values obtained were 0.49 and 2.41, respectively.

Two principal components (PC) accounted for 74.39% of the data variance, with 43.16% for PC1 and 31.23% for PC2. By plotting PC1 versus PC2 scores, it was possible to observe that the castor oil biodiesel samples are completely different from all the others, thus producing a biodiesel with different characteristics (Fig. 1). This is supported by the fact that some of the castor oil biodiesel properties (the specific weight and the viscosity) are very different from those for the other samples. This result can be explained by the high content of hydroxyl groups and unsaturations due to the presence of ricinoleic acid in the unrefined castor oil.

![Figure 1: Scores PC2 versus PC1](image)

It was also observed that the murumuru oil differs from the other oils and confirms the analytical data showing high acidity value and low iodine value for this biodiesel when compared to the other oils. The unrefined murumuru oil [27] also shows a distinct chemical composition, with low total C18 and low unsaturated values, since it is a rich source of fatty esters with a number of carbon atoms lower than 16, as shown in Table IV.

PCA confirmed the analytical results which indicated that the murumuru oil biodiesel samples (raw material with high acidity level) and the castor oil biodiesel (raw material with high viscosity) did not comply with some of the ANP specifications for the product.

<table>
<thead>
<tr>
<th>Fatty acid</th>
<th>Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caproic (C6:0)</td>
<td>1.2</td>
</tr>
<tr>
<td>Capric (C10:0)</td>
<td>1.3</td>
</tr>
<tr>
<td>Lauric (C12:0)</td>
<td>47.8</td>
</tr>
<tr>
<td>Myristic (C14:0)</td>
<td>29.0</td>
</tr>
<tr>
<td>Palmitic (C16:0)</td>
<td>8.9</td>
</tr>
<tr>
<td>Estearic (C18:0)</td>
<td>3.1</td>
</tr>
<tr>
<td>Linolenic (C18:2)</td>
<td>6.3</td>
</tr>
</tbody>
</table>

G. Prediction of Biodiesel Properties

The data matrix (X) was built with 30 samples and 9 variables from the raw materials, as previously described. The matrix (Y) was built with the biodiesel property
measured for the 30 samples. For the two matrices (X and Y), the data were preprocessed using autoscale. The following biodiesel properties were predicted: acidity index (AI), kinematic viscosity (VS), specific weight (SW) and iodine value (IV). In all cases, multiple linear regression (MLR) was applied to predict the biodiesel properties. In the model’s equation only the regression coefficients with statistical significance are shown ($\alpha = 0.05$), after the hypothesis test was performed.

The following figures of merit were evaluated to measure the quality of the model: RMSEC and RMSECV, both defined previously, and also the coefficients of determination of calibration ($R^2_{\text{Cal}}$) and validation ($R^2_{\text{Val}}$). These data are shown in Table V.

As can be seen in Table V, the figures of merit showed excellent results for all biodiesel properties under study, except for iodine value. Therefore, the proposed methodology for evaluation of acidity index, kinematic viscosity and specific weight for biodiesel samples can be used.

### Table V

<table>
<thead>
<tr>
<th>Figures of Merit for MLR Models of Biodiesel Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acidity Index</strong></td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>RMSEC</td>
</tr>
<tr>
<td>RMSECV</td>
</tr>
<tr>
<td>$R^2_{\text{Cal}}$</td>
</tr>
<tr>
<td>$R^2_{\text{CV}}$</td>
</tr>
</tbody>
</table>

$^a$(mg KOH g$^{-1}$); $^b$(mm$^2$s$^{-1}$); $^c$(kg m$^{-3}$); $^d$(g/100g)

#### Biodiesel Acidity Index

The use of MLR provided the following equation to predict the acidity index for biodiesel, where the regression coefficients and the standard deviations are indicated between parentheses.

\[
\text{ACIDITY INDEX (biodiesel)} = (0.008 \pm 0.002) \times \text{VS} + (0.006 \pm 0.002) \times \text{IV} - (0.036 \pm 0.007) \times \text{C16:0} - (0.038 \pm 0.005) \times \text{C18:1} - (0.039 \pm 0.003) \times \text{C18:2} - (0.064 \pm 0.010) \times \text{C18:3}
\]  

(2)

It can be inferred from equation (2) that the acidity index for biodiesel increases as the oil viscosity and the iodine value increase. On the other hand, an increase in C16 and C18 contents in the oil causes a reduction in the biodiesel acidity index.

#### Biodiesel Viscosity

The use of MLR provided the equation (3) to predict the kinematic viscosity for biodiesel.

\[
\text{VISCOSITY (biodiesel)} = (0.038 \pm 0.002) \times \text{VS} - (0.011 \pm 0.002) \times \text{IV} + (0.061 \pm 0.007) \times \text{C16:0} + (0.235 \pm 0.076) \times \text{C18:0} + (0.023 \pm 0.001) \times \text{C18:1} + (0.030 \pm 0.003) \times \text{C18:2} + (0.161 \pm 0.010) \times \text{C18:3}
\]  

(3)

According to the aforementioned equation, the biodiesel viscosity increases with an increase in the raw material viscosity and a reduction of the iodine value for the oil. This last result is in accordance with the data obtained by Garcia [28], who also verified the reverse correlation between the iodine value for the oil source and the biodiesel viscosity. Besides that, the fatty acid that contributes the most for the increase in viscosity is the stearic (C18:0), followed by the linolenic acid (C18:3). Garcia [28] also observed a greater contribution from the stearic acid for the viscosity value for methyl esters, but it was followed by oleic (C18:1) and palmitic acids (C16:0).

#### Biodiesel Specific Weight

The use of MLR provided the equation (4) to predict the specific weight for biodiesel.

\[
\text{SPECIFIC WEIGHT (biodiesel)} = (720.6 \pm 117.8) + (0.158 \pm 0.024) \times \text{VS} - (0.054 \pm 0.019) \times \text{IV} + (0.663 \pm 0.083) \times \text{C16:0} + (0.068 \pm 0.018) \times \text{C18:1} + (0.281 \pm 0.037) \times \text{C18:2} + (1.404 \pm 0.130) \times \text{C18:3}
\]  

(4)

The specific weight for biodiesel tends to increase with higher oil viscosity values. On the other hand, this same property increased with a reduced iodine value for the raw material, although to a less extent. Linolenic acid (C18:3) is the acid that contributes the most to the specific weight of biodiesel, followed by palmitic acid.

#### IV. CONCLUSION

Under the experimental conditions used, it was possible to obtain biodiesel through the homogeneous ethanolic
The transesterification of various fat sources, which, in most of the cases, met the product’s specifications for some properties. Statistical analysis confirmed the analytical results, which showed that biodiesel samples from castor oil (high viscosity and specific weight) and from murumuru oil (high acidity index and low viscosity) did not meet the specification defined for the product. The specific characteristics of the castor oil biodiesel may be explained by the high hydroxyl group content and unsaturated groups present in the raw material, and the murumuru’s, by the high content of fatty acids with less than 16 carbon atoms. Multiple linear regression analysis allowed the prediction of the biodiesel properties from the characteristics of the fat source that were quite appropriate for use, as verified through the analysis of the merit parameters for the proposed models. The results obtained confirm that the characteristics of the fat raw material strongly influence the biodiesel physicochemical properties.

V. REFERENCES


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Synchronization of Ovulation in Bovines - A Review

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ABSTRACT

Reproductive performance is the pivotal physiological process for a successful dairy farm. Many dairy herds incur a substantial cut in the economy due to the poor conception rate and proper herd replacement. Proper oestrus detection coupled with efficient insemination technique using quality semen in a healthy uterine environment critically resulted in high rate of reproduction in bovines (Yildiz, 2005). However, first service conception rate to Artificial Insemination (AI) in cows had fallen away from approximately 65 to 40 per cent or lower (Weigel, 2006). Although, the cause has not yet been fully described, the fertility of dairy cows is declining worldwide (Thatcher et al., 2006). Development of Timed Artificial Insemination (TAI) programs allows reduced emphasis on detection of oestrus because all cows are inseminated at a specific time in relation to the hormone injection (Yildiz, 2010).

Keywords: GnRH, PGF2α, TAI, ECP, Ovsynch, Heatsynch, Presynch, Select Synch, Co-Synch, Hybrid Synch, Ovsynch plus progesterone

I. INTRODUCTION

Synchronization of oestrus and ovulation protocols currently recommended for cows involve combination of GnRH and PGF2α (Pursley et al., 1995). Each GnRH based protocol started with the same basic framework, which involved an injection of GnRH followed with an injection of PGF2α six (or) seven days later. The inclusion of GnRH analogues with PGF2α (7 days prior to PGF2α) in oestrus synchronization programmes not only improved oestrus detection rates and synchrony of oestrus (Wolfenson et al., 1994 and Twagiramungu et al., 1995), but also induced fertile oestrous cycles in both cyclic and anoestrus bovines (Thompson et al., 1999 and Stevenson et al., 2000). Not only the degree of synchrony increased, but also the variability in the time to oestrus in beef (Thatcher et al., 1996) and lactating cows (Pursley et al., 1997b and Wolfenson et al., 1994) was decreased with the interval to oestrus after PGF2α injection averaging three days.

The use of GnRH seven days prior to synchronization of oestrus with PGF2α altered follicular development and produced preovulatory follicles which were more

II. METHODS AND MATERIAL

GnRH-PGF2α Based Synchronization Protocols
Numerous new synchronization protocols currently recommended for cows use gonadotropin releasing hormone (GnRH) in conjunction with PGF2α. Each GnRH based protocol uses the same basic framework, which involves an injection of GnRH followed 7 days later with an injection of PGF2α. The way animals are subsequently handled for heat detection and breeding is where the protocols begin to vary. To understand the benefits of GnRH based synchronization protocols and how they work, you must first understand the concept of follicular waves in cattle.

Follicular Waves
Follicles are blister-like structures that grow on the ovaries. Each follicle contains an unfertilized egg that will be released to the oviduct if the follicle ovulates. Research using ultrasound technology has revealed that follicular growth occurs in waves throughout the estrous cycle. Each wave is characterized by rapid growth of numerous small follicles. From this wave of follicles, one follicle is allowed to grow to a much larger size than
Follicular Waves and GnRH

An injection of GnRH causes a release of Luteinizing Hormone (LH) from the pituitary gland in the brain. This LH “surge” results in ovulation or luteinization of most large dominant follicles. A new “synchronized” follicular wave is initiated in these animals 2 to 3 days later. Because GnRH stimulates development of luteal tissue in place of the dominant follicle, a higher percentage of cows will possess sufficient luteal tissue to respond to PGF2α 7 days later. Injecting cows with PGF2α 7 days after a GnRH injection synchronizes luteal regression in animals with previously synchronized follicular development. The result is a higher estrus response rate and much tighter synchrony of estrus when compared to PGF2α alone. Although GnRH synchronizes follicular development in most cows, some cows do not respond to the first GnRH injection. If the GnRH injection fails to luteinize a follicle in animals that were due to show heat naturally around the time of the PGF2α injection.

Follicular Waves and PGF2α

Any dominant follicle has the capacity to ovulate provided the inhibitory effects of progesterone can be removed at an opportune time. Prostaglandins serve this function by destroying the CL, however, PGF2α has no direct effect on the normal pattern of follicular waves. Thus, the stage of follicular development at the time of PGF2α injection will affect the interval from injection to standing estrus. Animals injected when the dominant follicle is in the growing phase will display estrus within 2 to 3 days, whereas animals with aged or regressing dominant follicles may require 4 to 6 days before a new follicle can be recruited for ovulation. Thus, the interval from PGF2α injection to estrus and ovulation is highly variable due to differences between cows in the stage of follicular development at the time of PGF2α injection.

GnRH-PGF2α Based Synchronization Options

1) Ovsynch

Ovsynch was introduced by Pursley et al. (1995). It is a fixed time AI synchronization protocol that has been developed, tested and used extensively in dairy cattle. It has also proven to be a reliable timed AI (TAI) program for beef cows. The protocol builds on the basic GnRH-PGF2α format by adding a second GnRH injection 48 hours after the PGF2α injection (Drost and Thatcher, 1992) has been shown to synchronize oestrus and ovulation effectively. This second GnRH injection induces ovulation of the dominant follicle recruited after the first GnRH injection. All cows are mass inseminated without estrous detection at 8 to 18 hours after the second GnRH injection. Across large numbers of dairy cattle, pregnancy rates to Ovsynch generally average in the 30 to 40% range to a single fixed time AI without heat detection.

In ovsynch technique, a second GnRH injection was administered at 24 hours (Thatcher et al., 1996); 48 hours (Wolfenson et al., 1994 and Pursley et al., 1995) or 54 hours (Twagiramungu et al., 1995) after the PGF2α injection. This second GnRH injection induced ovulation of the dominant follicle recruited after the first GnRH injection (Pacala et al., 2010).

Timed artificial insemination (TAI) was done without the need for detection of oestrus in dairy cows (Pursley et al., 1997a) at 8-18 hours (Pursley et al., 1995); 10-20 hours (Mee et al., 1990) or 16-24 hours (Geary et al., 1998 and Steveson et al., 1999) after the second GnRH injection in ovsynch programme.

Ovsynch also had the ability to induce fertile ovulation in anoestrus cows due to the GnRH injection (Geary and Whitter, 1998). Large follicles that responded to the GnRH injection ovulated and formed a functional CL (Twagiramungu et al., 1995).

The success of the ovsynch protocol was influenced by the number of follicular waves or length of the follicular waves (Pursley et al., 1997b) as well as the stage of oestrous cycle when the first GnRH dose was administered (Vasconcelos et al., 1997 and Vasconcelos et al., 1999). The early luteal stage of the oestrous cycle (day 5 to 9) was the optimal period for initiating the
ovsynch protocol (Vasconcelos et al. 1997; Vasconcelos et al., 1999 and Moreira et al., 2000a). A higher pregnancy rate was reported when cows were started on the ovsynch protocol in the early luteal phase compared with the first 3 to 4 days (Vasconcelos et al., 1999) or after day 10 of the oestrous cycle (Moreira et al., 2000).

Pursley et al. (1995), Dagli et al. (2008) and Vijayarajan et al. (2009) reported 100 per cent ovulatory response between 24 and 32 hours after the second injection of GnRH in ovsynch treated lactating dairy cows. Vasconcelos et al. (1997) demonstrated that 87 to 100 per cent; Keskin et al. (2011) recorded 88.4 per cent in Holstein Friesian cows and 88.5 per cent in Swedish Red cattle. Vasconcelos et al. (1999) observed 87 per cent in lactating dairy cows. But, Steckler et al. (2002) found 88 per cent and Fricke et al. (1998) found only 84.90 per cent ovulatory response in ovsynch treated post-partum Holstein dairy cows. Velladurai et al. (2015) recorded the overall ovulatory response in retained fetal membrane (RFM) affected and normally calved cows were 75.00 and 81.25 per cent, respectively following Ovsynch treatment.

Pursley et al. (1997b) reported similar pregnancy rates for first (37 vs 39 per cent), second (42 vs 45 per cent) and third AI (48 vs 61 per cent) using the ovsynch protocol compared with breeding at a detected oestrus in lactating dairy cows. Stevenson et al. (1999) reported 35.60 per cent; Moreira et al. (2000) reported 37.5 per cent; 47 to 49 (Fricke and Wiltbank, 1999); 40 to 55 (Pursley et al., 1995; Geary et al., 1998; Sathiyamoorthy and Kathirchelvan, 2010 and Ramakrishnan et al. 2012); 59 per cent (Geary et al. 1998); 60 to 62 per cent (Cecyre et al., 2002) and 61.00 to 90.00 per cent (Muneer et al. 2009) conception rates have been reported following induction of ovolation using ovsynch protocol in lactating dairy cows. Stevenson et al., (1999) found only 84.90 per cent ovulatory response in ovsynch treated post-partum Holstein dairy cows. Velladurai et al. (2015) recorded the overall ovulatory response in retained fetal membrane (RFM) affected and normally calved cows were 75.00 and 81.25 per cent, respectively following Ovsynch treatment.

In post-partum lactating cattle varying conception rates of 20 to 27 (Dejarnette et al., 2001a); 30 to 38 (Fricke et al., 1998; Stevenson et al., 1999; Jemmeson 2000; Klindworth et al., 2001 and Punyapornwitthaya et al., 2002); 41 (Fricke et al., 1998) and 43.50 (Tenhagen et al., 2001) have been reported following ovsynch treatment. Velladurai et al. (2015) recorded the overall conception rate in retained fetal membrane (RFM) affected and normally calved cows were 62.50 and 75.00 per cent, respectively following Ovsynch treatment.

2) Heatsynch

Heatsynch is a newly developed synchronization protocol that used the less-expensive hormone oestradiol cypionate (ECP) in place of the second GnRH injection of the ovsynch protocol (Dejarnette et al., 2001b). ECP is a commercially available form of the natural hormone, estrogen. Estrogen is the hormone that causes cows to show the many signs of heat when they come into estrus, and it creates a surge-type release of gonadotropin-releasing hormone (GnRH) from the brain. GnRH, causes the release of luteinizing hormone (LH), which results in ovulation of the mature follicle. GnRH has a direct and almost immediate effect on the release of LH, while ECP has a delayed effect. A recent study found that cows injected with GnRH have a LH surge within about an hour, while the LH surge of ECP treated cows was not detected for about 41 hours. This difference in time to LH surge means the hormone injection intervals must also be altered when substituting ECP for GnRH (Dejarnette et al., 2004). One milligram of ECP was administered at 24 hours after the PGF_2α injection, while Ovsynch treated cows receive GnRH 48 hours later. Because of the delayed interval to the LH surge, the interval to fixed-time AI is 72 hours after PGF_2α (48 hours after ECP) for Heatsynch, compared with 56-64 hours after PGF_2α (8-16 hours after GnRH) for Ovsynch. Pregnancy rate observed in heatsynch was 30 to 40 per cent (Dejarnette et al., 2001b).

3) Presynch

Thatcher reported the Presynch system in 1998. The Presynch uses 2 injections of PGF_2α at 14 days intervals to pre-synchronize most of the cycling animals. 14 days after the 2nd PGF_2α injection, these cows will be in the proper stage of the estrous cycle to respond to the first GnRH injection in any of the GnRH-PGF_2α (Ovsynch, Heatsynch or Select Synch) based breeding protocol (Thatcher, 1998). Preliminary results using Presynch in front of Ovsynch suggests pregnancy rates were improved by 10-20 percent (Moreira et al., 2000 and EI-Zarkouny et al., 2004). In presynch protocol, the pregnancy rate was 40 to 50 per cent (Thatcher et al., 1998).

4) Select Synch

In select synch system, the cows were injected with GnRH and PGF_2α 7 days apart. Detection of oestrus began 24-48 hours before the PGF_2α injection and continued for the next 5-7 days (Dejarnette et al., 2004).
The majority of cows exhibited oestrus 36 to 72 hours after PGF2α injection (Stevenson et al., 2000). Animals were inseminated 8 to 12 hours after being observed in standing oestrus (Geary et al., 2001; Dejarnette et al., 2001a and Dejarnette et al., 2004). Overall, estrus response rates in well-managed herds average approximately 70 to 75% with no adverse effect on conception rates (60 to 70%), resulting in synchronized pregnancy rates that average between 45 and 50%. Pregnancy rate was 41 (Stevenson et al., 2000); 45 (Patterson et al., 2001); 47 (Kojima et al., 2000); 61 (Dejarnette et al., 2001a) and 65 (Constantaras and Kesler, 2004) per cent following select synch system.

5) Co-Synch
Co-Synch was an alternative to ovsynch in which, second GnRH injection was given at the time of AI (Geary et al., 2001). Larson et al. (2004) reported that the cows were bred at 54 hours after the injection of PGF2α following co-synch protocol. However, small reduction in conception rate was observed in cows following co-synch when compared to ovsynch (Pursley et al., 1998; Geary et al., 2001 and Dejarnette and Marshall, 2003). Overall, pregnancy rates have averaged 48%. The protocol is quite simple to employ as all injections and timed AI can be done at the same time of the day. In co-synch, the pregnancy rates were between 40 and 50 per cent (Dejarnette et al., 2004).

6) Hybrid Synch
Hybrid synch was a combination of select synch and co-synch systems (Stevenson et al., 2000). Oestrus detection and AI carried out until 72 hours after the PGF2α injection and then mass-AI along with GnRH injection were done to those cows that did not exhibited oestrus until 72 hours (Larson et al., 2004; Dejarnette et al., 2001b and Dejarnette et al., 2004). Pregnancy rates in cows administered the hybrid synch protocol was 34 (Stevenson et al., 2000); 46 (Dejarnette et al., 2001b); 53 (Larson et al., 2004) and 52 per cent (Dejarnette et al., 2004).

6) OvSynch plus progesterone
An alternative to improve synchronization and conception without lengthening timed AI programs is progesterone (P4) supplementation during the protocol. The use of intra vaginal devices (CIDR) for controlled release of progesterone from the GnRH to the PGF2α injections maintains blood progesterone concentrations that prevent premature estrous behavior, LH surge and ovulation. These devices have been used during timed AI protocols to improve fertility of dairy cows (El-Zarkouny et al., 2004 and McDoughall, 2010). Steckler et al. (2002) reported the conception rates of 49 and 72 per cent respectively at 28 days post timed artificial insemination in ovsynch plus CIDR treated post-partum dairy cows. He also found 55.20 per cent conception rate at 28 days post timed artificial insemination in ovsynch plus CIDR treated anovular lactating dairy cows.

Among those GnRH-PGF2α based synchronization protocols, the OvSynch protocol is the best method for Synchronization of ovulation but some limitation is present in this method.

III. RESULT AND DISCUSSION

OvSynch: Limitations
Cows treated with OvSynch yield overall conception rates similar to those obtained after breeding to detected estrus (37 versus 39 %, respectively; P > 0.05) (Pursley et al., 1997a). However, a major limitation to OvSynch is the wide variability of synchronization rates. Up to 30% of cows may not synchronize (Vasconcelos et al., 1999; DeJarnette et al., 2001a and Peters and Pursley, 2002). Variation among dairy cows in their synchronization rate to OvSynch was attributed primarily to the stage of the estrous cycle in which OvSynch is initiated (Vasconcelos et al., 1999).

Cows started on OvSynch at mid-cycle (d 5-9 of cycle) have a greater probability of synchronizing to OvSynch, and have a greater chance of conception (Vasconcelos et al., 1999; Moreira et al., 2000). The key physiological reasons for increased synchronization rate in mid-cycle are: (1) presence of a functional Dominant follicle (DF) capable of ovulating to first GnRH of OvSynch (2) presence of a CL that remained functional during the 7-d period between first GnRH and PGF2α of OvSynch. Ovulation to first GnRH of OvSynch is followed by emergence of a new follicular wave. The dominant follicle from this new wave generally develops to become the ovulatory follicle of OvSynch. Presence of a functional CL at PGF2α of OvSynch reduces the occurrence of spontaneous ovulation prior to final GnRH of OvSynch.
In contrast, if cows are started on Ovsynch early in the estrous cycle (d 1 to 4), ovulation to first GnRH of Ovsynch is impaired by the presence of an emerging follicular wave, (Vasconcelos et al., 1999; Moreira et al., 2000). It is unlikely for a follicle 3 d post-emergence to have LH receptors and respond to first GnRH of Ovsynch with ovulation (Sartori et al., 2001). Thus, at the time of PGF$_2$α of Ovsynch, this follicle would be 10- d old and likely already undergoing atresia. By the time of final GnRH of Ovsynch, another follicular wave would be emerging and the follicle destined to be dominant would be too young to ovulate in response to final GnRH of Ovsynch. In these cases, ovulation is likely to occur 3 to 5 d after finalization of Ovsynch.

If cows are started on Ovsynch in late estrous cycle, spontaneous luteolysis is likely to occur before PGF$_2$α of Ovsynch (Vasconcelos et al., 1999; Moreira et al., 2000). In cows with spontaneous luteolysis prior to PGF$_2$α, the dominant follicle is likely to trigger spontaneous ovulation prior to final GnRH of Ovsynch.

IV. CONCLUSION

In conclusion, successful synchronization of ovulation is less likely if cows are started on Ovsynch during early or late estrous cycle compared to mid-cycle. Since insemination occurs at a fixed time after final GnRH of Ovsynch, chances of conception to timed AI are lower in non-synchronized cows. Cows started on Ovsynch at mid-cycle (d 5-9 of cycle) have a greater probability of synchronizing to Ovsynch, and have a greater chance of conception (Vasconcelos et al., 1999; Moreira et al., 2000). The use of GnRH to synchronize follicle growth and Ovulation is the most recent of these developments. PGF$_2$α is still the most widely used hormone for induction and synchronization of estrus. The Ovsynch/TAI protocol, which strategically uses GnRH and PGF$_2$α to synchronize ovulation offers potential “freedom” to dairy farmers from their daily time-consuming of estrus detection. Pregnancy outcome with Ovsynch/TAI is poor in dairy heifers and cattle. However, the use of CIDR-B device in combination with the Ovsync/TAI protocol has the potential to improve pregnancy rates (Ravikumar, 2014). Cows with high concentration of progesterone at the initiation of the Ovsynch protocol have a greater chance for conception (Stevenson et al., 1999; Ambrose et al., 2000; Moreira et al., 2000). Pre-Ovsynch program using PGF$_2$α prior to Ovsynch are another ways of improving pregnancy rates in bovines. Further research is needed to determine if this approach would consistently increase pregnancy rates following Ovsynch/Timed AI in dairy heifers and cattle.

V. REFERENCES


Observations on the Woody Wall Flora of Varanasi City, India
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ABSTRACT
An observational study was conducted to explore the woody wall flora of the world’s oldest city of Varanasi, India located at the bank of sacred Ganges River. Forty one woody plants of 35 genera belonging to 18 families were recorded on the walls of the city represented exclusively by the dicotyledonous angiospermic group of plants. Fabaceae, Moraceae and Apocynaceae were the dominant families of the woody wall flora of Varanasi city. Native woody species were greater in number compared to exotic woody species on the walls of Varanasi city.

Keywords: Varanasi City, Vertical Wall Surface, Woody Wall Flora

I. INTRODUCTION
Walls are manmade habitats representing a specific environment which is partly similar to rocks and rock fissures [1]. The artificial origin in urban landscape and technology of wall building influence a range of plant species which are able to colonize such habitats [2]. Walls as a specialized microenvironment conditioned by human beings are colonized only by plant species with specific adaptations for development and reproduction [3, 4]. Considering vertical division, walls usually consist of three different zones (i) the base, (ii) the vertical wall surface with joints (fissures); and (iii) the wall top.

The study of wall flora provides a better understanding of the urban environment [1, 5-7]. Several studies have been conducted to explore the wall flora in urban environment [1, 2, 5, 6-14]. However, till date no any information is available regarding the exploration of woody wall flora of a place from any part of the world. Therefore, the main objective of the present study was to explore the woody wall flora of Varanasi city (India), which is one of the oldest living cities of the world. Varanasi also known as Benares (or Banaras) and Kashi is the cultural capital of India. The city is a melting pot of religion and culture. Varanasi has a long continuous history since 1500 B.C. and finds a mention in Atharvaveda and in Indian Epics and most of the Indian Puranas [15].

STUDY AREA
Varanasi is situated on the left crescent bank of sacred Ganges (also called as Ganga) River (Fig. 1) (25° 18’ N Latitude and 82° 59’ E Longitude). It spreads over an area of about 1,550 km² with population of about 1.4 million according to 2011 census. The city area stands a height between 71-80 m above mean sea level.

Figure 1: Map of the Study Area
The climate is Tropical monsoonal type with three distinct seasons; the cold (November to February), the hot (March to mid-June), and the rainy (mid-June to September) while October is regarded strictly as transitional month. The diurnal range of temperature ranges on average between 13 and 14.5°C in the cold and hot months. The highest monthly temperature is recorded in May, varying between 32 and 42°C. The annual rainfall is around 100 cm of which about 90% occurs in the rainy season [15].

II. METHODS AND MATERIAL

The present study is based on a yearlong intensive field survey and collection taken from July 2014 to June 2015. Regular field visits were made to record and collect the various woody plant species growing on the walls of Varanasi city. The walls surveyed to record and collect the woody plants included older walls surrounding residential compounds, parks, gardens, schools, colleges, universities, hospitals, temples, forts, monuments etc., and also the walls of all types of buildings, temples, forts and monuments as well. The collected specimens were identified through flora of Hooker (1875-1897) [16] and Duthie (1903-1922) [17].

![Figure 2. Ficus benghalensis and Ficus racemosa growing on vertical wall surface in the street of world famous Sankatmochan temple in Varanasi city](image)

III. RESULT AND DISCUSSION

Woody plants recorded on the walls of Varanasi city are presented in the Table 1. A total of 41 woody plants belonging to 35 genera and 18 families were recorded on the walls of Varanasi city. All the recorded species were represented by the dicotyledonous angiospermic group of plants. A previous study on the wall flora of Varanasi city reports the dominance of dicotyledonous plant species on the walls with greater degree of variety compared to monocotyledonous plant species [14]. In the present study Ficus with 6 species was the dominant genus of the woody wall flora of Varanasi city.

The maximum number of woody plants in the study were represented by the Fabaceae (10 species) family followed by the Moraceae (7 species) and Apocynaceae (4 species) families. Therefore, the study suggests that Fabaceae, Moraceae and Apocynaceae are the dominant families of the woody wall flora of the Varanasi city. However, a study on the vascular wall flora of Varanasi city reports the dominance of Asteraceae, Poaceae and Amaranthaceae families [14]. Several other studies conducted on the wall flora suggests the dominance of Asteraceae and Poaceae families [7, 11, 18-20]. In present study the Fabaceae, Moraceae and Apocynaceae families together constituted more than half of the woody plant species of the walls of Varanasi city.

Analysis of the origin status of the woody wall plants reveals that of total woody plants recorded on the walls of the Varanasi city, 23 (56.10%) were represented by the native species while 18 (43.90%) were represented by the exotic species. Thus the number of indigenous woody species was greater compared to non-indigenous species on the walls of Varanasi city. Several studies on the wall flora reports adequate representation by the exotic species [7, 13, 21]. Furthermore, Singh (2014) [14] reported greater number of exotic species compared to native species on the walls of Varanasi city.

Woody plants frequently colonizing the wall base of Varanasi city were represented by Calotropis gigantea, Calotropis procera, Ficus hispida, Lantana camara, Senna occidentalis, Ziziphus nummularia and Ziziphus oenoplia. These woody species are the component species of the surrounding vegetation. Species composition of the base of walls consists of plant species of nearby vegetation [2].

![Figure 2. Ficus benghalensis and Ficus racemosa growing on vertical wall surface in the street of world famous Sankatmochan temple in Varanasi city](image)

It was observed during the study that Ficus benghalensis, Ficus hispida, Ficus racemosa, Ficus religiosa and Ficus virens var. sub lanceolata were the most common woody plants colonizing the vertical wall surfaces of the Varanasi city. Colonization of plants on vertical wall
surfaces depends on the level of disintegration of mortar, concrete or any other type of binding material [2].

Woody plants colonizing the wall tops of the Varanasi city were represented by Albizia lebbeck, Azadirachta indica, Alstonia scholaris, Bombax ceiba, Dalbergia sissoo, Ficus religiosa and Leucaena leucocephala. The colonization of plant species is determined by the disintegration of material on the wall tops [2].

IV. CONCLUSION

It can be concluded from the study that walls of Varanasi city hosts variety of woody plants dominated chiefly by the Fabaceae, Moraceae and Apocynaceae families which clearly indicates that the city is old with low level of urbanization.

V. REFERENCES

Table 1. List of woody plants recorded on the walls of Varanasi city

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Plant species</th>
<th>Family</th>
<th>Origin status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><em>Abutilon indicum</em> (L.) Sweet</td>
<td>Malvaceae</td>
<td>Native</td>
</tr>
<tr>
<td>3.</td>
<td><em>Albizia lebbeck</em> (L.) Willd.</td>
<td>Fabaceae</td>
<td>Native</td>
</tr>
<tr>
<td>4.</td>
<td><em>Alstonia scholaris</em> R. Br.</td>
<td>Apocynaceae</td>
<td>Native</td>
</tr>
<tr>
<td>5.</td>
<td><em>Anona squamosa</em> L.</td>
<td>Annonaceae</td>
<td>Exotic</td>
</tr>
<tr>
<td>7.</td>
<td><em>Bombax ceiba</em> L.</td>
<td>Malvaceae</td>
<td>Native</td>
</tr>
<tr>
<td>8.</td>
<td><em>Calliandra haematocephala</em> Hassk</td>
<td>Fabaceae</td>
<td>Exotic</td>
</tr>
<tr>
<td>9.</td>
<td><em>Calotropis gigantea</em> (L.) R. Br.</td>
<td>Apocynaceae</td>
<td>Native</td>
</tr>
<tr>
<td>10.</td>
<td><em>Calotropis procera</em> (Ait.) R. Br.</td>
<td>Apocynaceae</td>
<td>Native</td>
</tr>
<tr>
<td>11.</td>
<td><em>Cestrum nocturnum</em> L.</td>
<td>Solanaceae</td>
<td>Exotic</td>
</tr>
<tr>
<td>12.</td>
<td><em>Dalbergia sissoo</em> Roxb.</td>
<td>Fabaceae</td>
<td>Native</td>
</tr>
<tr>
<td>14.</td>
<td><em>Ficus benghalensis</em> L.</td>
<td>Moraceae</td>
<td>Native</td>
</tr>
<tr>
<td>15.</td>
<td><em>Ficus hispida</em> L. f.</td>
<td>Moraceae</td>
<td>Native</td>
</tr>
<tr>
<td>16.</td>
<td><em>Ficus mollis</em> Vahl</td>
<td>Moraceae</td>
<td>Native</td>
</tr>
<tr>
<td>17.</td>
<td><em>Ficus racemosa</em> L.</td>
<td>Moraceae</td>
<td>Exotic</td>
</tr>
<tr>
<td>18.</td>
<td><em>Ficus religiosa</em> L.</td>
<td>Moraceae</td>
<td>Native</td>
</tr>
<tr>
<td>19.</td>
<td><em>Ficus virens</em> var. <em>subanceolata</em> Miq. Corner</td>
<td>Moraceae</td>
<td>Native</td>
</tr>
<tr>
<td>20.</td>
<td><em>Holoptelea integrifolia</em> (Roxb.) Planch.</td>
<td>Ulmaceae</td>
<td>Native</td>
</tr>
<tr>
<td>No.</td>
<td>Taxonomy</td>
<td>Family</td>
<td>Status</td>
</tr>
<tr>
<td>-----</td>
<td>---------------------------------------------</td>
<td>-----------------</td>
<td>----------</td>
</tr>
<tr>
<td>22</td>
<td><em>Lantana camara</em> L.</td>
<td>Verbenaceae</td>
<td>Exotic</td>
</tr>
<tr>
<td>23</td>
<td><em>Lawsonia inermis</em> L.</td>
<td>Lythraceae</td>
<td>Exotic</td>
</tr>
<tr>
<td>24</td>
<td><em>Leucaena leucocephela</em> Willd.</td>
<td>Fabaceae</td>
<td>Exotic</td>
</tr>
<tr>
<td>25</td>
<td><em>Moringa oleifera</em> Lam.</td>
<td>Moringaceae</td>
<td>Exotic</td>
</tr>
<tr>
<td>26</td>
<td><em>Morus alba</em> L.</td>
<td>Moraceae</td>
<td>Exotic</td>
</tr>
<tr>
<td>27</td>
<td><em>Murrya paniculata</em> (L.) Jacq.</td>
<td>Rutaceae</td>
<td>Native</td>
</tr>
<tr>
<td>28</td>
<td><em>Nyctanthes arbor-tristis</em> L.</td>
<td>Oleaceae</td>
<td>Native</td>
</tr>
<tr>
<td>29</td>
<td><em>Ocimum sanctum</em> L.</td>
<td>Lamiaceae</td>
<td>Native</td>
</tr>
<tr>
<td>30</td>
<td><em>Psidium guajava</em> L.</td>
<td>Myrtaceae</td>
<td>Exotic</td>
</tr>
<tr>
<td>31</td>
<td><em>Punica granatum</em> L.</td>
<td>Lythraceae</td>
<td>Exotic</td>
</tr>
<tr>
<td>32</td>
<td><em>Ricinus communis</em> L.</td>
<td>Euphorbiaceae</td>
<td>Exotic</td>
</tr>
<tr>
<td>33</td>
<td><em>Senegalia polyacantha</em> (Willd.) Seigler &amp; Ebinger</td>
<td>Fabaceae</td>
<td>Native</td>
</tr>
<tr>
<td>34</td>
<td><em>Senna alata</em> (L.) Roxb.</td>
<td>Fabaceae</td>
<td>Exotic</td>
</tr>
<tr>
<td>35</td>
<td><em>Senna occidentalis</em> (L.) Link.</td>
<td>Fabaceae</td>
<td>Exotic</td>
</tr>
<tr>
<td>36</td>
<td><em>Sesbania sesban</em> (L.) Merr.</td>
<td>Fabaceae</td>
<td>Exotic</td>
</tr>
<tr>
<td>37</td>
<td><em>Tecoma stans</em> (L.) H.B. &amp; K</td>
<td>Bignoniaceae</td>
<td>Exotic</td>
</tr>
<tr>
<td>38</td>
<td><em>Thevetia peruviana</em> Schum</td>
<td>Apocynaceae</td>
<td>Exotic</td>
</tr>
<tr>
<td>39</td>
<td><em>Vachellia nilotica</em> (L.) P.J.H. Hurter &amp; Mabb.</td>
<td>Fabaceae</td>
<td>Native</td>
</tr>
<tr>
<td>40</td>
<td><em>Ziziphus nummularia</em> (Burm f.) Wt. &amp; Arn.</td>
<td>Rhamnaceae</td>
<td>Native</td>
</tr>
<tr>
<td>41</td>
<td><em>Ziziphus oenoplia</em> Mill.</td>
<td>Rhamnaceae</td>
<td>Native</td>
</tr>
</tbody>
</table>
The Relationship between Attention Deficit & Hyperactivity Disorder ADHD and Learning Disabilities

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ABSTRACT
The purpose of the study was to investigate the relationship between attention deficit and hyperactivity disorder. The study adopted a descriptive survey research design. The sample of the study was 40 pupils suffering from learning disabilities. The instrument used for the study was a ADHD scale designed by the researcher, which was face and content validated by three experts. Cronbach's Alpha reliability method was adopted to determine the internal consistency of the scale, which yielded a reliability coefficient of 0.83. The data collected were analyzed using frequencies, percentage and correlation. The study indicated that there are relationship between learning disabilities and attention deficit & hyperactivity disorders, and the prevalent of attention deficit and hyperactivity disorders among learning disabilities is 87.5%.

Keywords: Attention-Deficit Hyperactivity-Learning Disabilities, Special Need

I. INTRODUCTION

Specific learning disability” means a disorder in one or more basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in an imperfect ability to listen, speak, read, write, spell, or to do mathematical calculations. The term includes such conditions as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. The term does not apply to children who have learning problems that are primarily the result of visual, hearing, or motor disabilities, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage. (Moats, & Lyon, 1993).

The prevalence of learning disability identification has increased dramatically in the past 20 years. The “real” prevalence of LD is subject to much dispute because of the lack of an agreed-upon definition of LD with objective identification criteria. Some researchers have argued that the currently recognized 5% prevalence rate is inflated; others argue that LD is still under identified.

In fact, it appears that there are both sound and unsound reasons for the increase in identification rates. (Lyon, 1996).

Cynthia. & etal (1994) pointed that the learning disability is not a single disorder, but is a general category of special education composed of disabilities in any of seven specific areas: (1) receptive language (listening), (2) expressive language (speaking), (3) basic reading skills, (4) reading comprehension, (5) written expression, (6) mathematics calculation, and (7) mathematical reasoning. These separate types of learning disabilities frequently co-occur with one another and with certain social skill deficits and emotional or behavioural disorders such as attention deficit disorder. LD is not synonymous with reading disability or dyslexia although it is frequently misinterpreted as such. However, most of the available information concerning learning disabilities relates to reading difficulties, and the majority of children with LD have their primary deficits in reading.
The most common disorder that co-exists with learning disabilities is attention deficit/hyperactivity disorder (ADHD). Many studies over the years have indicated a very strong co-morbidity of the two conditions but the exact percentage of overlap varies widely in these studies because of methodological inconsistencies. Studies of the families of children with either learning disabilities or ADHD indicate strong patterns of inheritance for both conditions, but also show that they are independent disorders. ADHD and learning disabilities are two discrete disorders with distinct symptom clusters. However, some symptoms may be common to both disorders, including disorganization, weak executive functioning, and inefficient use of strategies. Without careful assessment, distinguishing between ADHD and learning disabilities can be difficult because of overlapping symptoms and because some behaviors that may, result from learning disabilities can look like ADHD symptoms. For example, individuals with central auditory processing deficits can appear inattentive, and students who have (Ldad Staff 2014).

a. How Learning Disabilities Differ From ADHD

There are several different types of learning disabilities, and a child may have more than one. When you or your child’s teachers suspect a learning disability, your child will undergo psycho-educational testing to confirm it. The testing measures ability or intelligence versus achievement on standardized tests. Students with learning disabilities typically have average or above average intelligence, but they have difficulty processing and retrieving information, which is why they don’t do well on tests in school. ADHD may also affect a child’s ability to learn. ADHD children have brain function impairments that can make them inattentive, hyperactive, and impulsive. “ADHD children may appear to have learning disabilities because they often are unable to acquire information and working skills as a result of their inattentiveness or hyperactive behaviors,” Rubin says. (Beth, 2010)

b. The Connection between ADHD and Learning Disabilities

The most common learning disability in children with ADHD is dyslexia. “We find that 15 to 30 percent of ADHD kids have a reading disability, which is twice the usual prevalence,” Rubin says. “We also find that impairments in several areas of functioning social, academic, and emotional are worse when someone has both a learning disability and ADHD.” If a child has a specific learning disability, it needs to be distinguished from the behavioral and attention aspects of ADHD so that it can be addressed, Rubin says. If your child has been diagnosed with ADHD, she is eligible to receive special education services under the Individuals with Disabilities Education Act. A child with a learning disability or ADHD can benefit from, and is legally entitled to, an individualized educational program (IEP) that addresses her needs. Parents, teachers, and guidance counselors should work closely together on forming the IEP before school starts and evaluating and updating it as the school year progresses. No one knows what causes ADHD or learning disabilities, Rubin says. “We believe there are usually multiple factors, including a genetic family predisposition.” Once your child has been identified as having ADHD or a learning disability or both, you should work to help him overcome the challenges and succeed in school. Medications and targeted education strategies can help. (Andersen, Egeland, & Merete. 2013)

c. Literate Review:

A few studies have examined the relationships between Attention deficit & hyperactivity disorder ADHD and learning disabilities; LD Study conducted by Cantwell & Baker (1991) discusses the relationship between attention deficit-hyperactivity disorder (ADHD) and learning disability (LD). The data show an increased prevalence of both LD and ADHD among children with early speech/language impairments. Furthermore, LD was strongly associated with ADHD in both the initial and follow-up samples. Study conducted by Ponde, Cruz, Antonio & Andre (2012) Objective to assess the impact of attention deficit on learning problems in a sample of schoolchildren in the city of Salvador, Bahia, Brazil. Results show that a very strong association was found between attention deficit and learning problems (prevalence ratio [PR] = 31.7; 95% confidence interval = [16.1, 62.3]). They suggest either that attention deficit leads to learning problems or that attention deficit or learning problems are comorbid conditions, in which case learning problems may also contribute to secondary symptoms in ADHD. Study conducted by Cynthia & et al (1994) it found that there are significant relationships between learning disabilities and ADHD.
There are some studies conducted to explore the characteristics of children with learning disabilities. One of the earliest profiles, developed by Handwerk & Marshall (1998), includes the following ten frequently cited attributes: hyperactivity, impulsivity, perceptual-motor impairments, disorders of memory and thinking, emotional labiality, academic difficulties, coordination problems, language deficits, disorders of attention and equivocal neurological signs. Lerner (2005) identified nine learning and behavioral characteristics of individuals with learning disabilities: disorders of attention, reading difficulties, poor motor abilities, written language difficulties, oral language difficulties, social skills deficits, psychological process deficits, quantitative disorders and information processing problems. Study conducted by Barkauskien & Bieliuskaite (2002) found that children with learning disabilities had significantly more internal (somatic complaints, isolation, anxiety/depression) and external problems (aggression and delinquency) as well as attention and social problems. Study conducted by Larry & Silver (1981) The findings lend some support to the view that there is a clinical relationship between children who have learning disabilities and children who are hyperactive and/or distractible. Study of McConaughy, Mattison, & Peterson, (1994) show that children with LD scored significantly higher than children with LD on all but CBCL scale and all TRF scales; both groups scored higher than normal controls on all but scale. Teacher-reported aggressive behaviour was the best predictor of SED versus LD classification. Other significant predictors included attention problems, delinquent behaviour, social problems, thought problems, and withdrawal. A study conducted by Epstein, Cullinan & Neiminen, (1984) indicated that the same four factors were found with the learning-disabled boys in both studies: Conduct Problem, Anxiety Withdrawal, Attention Deficit, and Social Maladjustment. Teachers rated the learning disabilities boys on the 55 items. In the ratings given by the teachers, hyperactivity and restlessness were associated with other attention items for younger children. Study conducted by Jennifer & et al (2006) revealed significant associations with anxious/depressed and withdrawn behaviours, as well as an increased likelihood of attention problems among children with LD.

II. METHODS AND MATERIAL

Method Research Approach:
The study was carried out in basic school in Khartoum, capital of Sudan. The study adopted a descriptive method.

Study group:
The population of the study was 230 children suffering from learning in elementary school in Jazan area south of Kingdom of Saudi Arabia.

Study sample:
The researcher chosen 40 children randomly from study group as a study sample. 25 children whom suffering from academic learning disabilities and 15 suffering from developmental learning disabilities as in table 1.

Sample:
Table 1 shows the sample of study according to disabilities type

<table>
<thead>
<tr>
<th>Disabilities Type</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic learning disabilities</td>
<td>25</td>
<td>62.5%</td>
</tr>
<tr>
<td>Developmental learning disabilities</td>
<td>15</td>
<td>37.5%</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>100</td>
</tr>
</tbody>
</table>

Tool:
ADHD scale containing 36 items developed by the researcher from literature reviewed was used for data collection. The scale was divided into three sections, A, B AND C, A was designed to obtain hyperactivity disorder, B was designed to obtain impulsivity disorder, and C was designed to obtain attention deficit disorder. The instrument was face and content validated by three experts from Special Education Department in University of Jazan. Cronbach's Alpha reliability method was adopted to determine the internal consistency of the instrument. A reliability coefficient of 0.83 was obtained.

Practical Procedures:
The researcher with the help of three research assistants administered the scale. The respondents were allowed a period of three weeks, after which the researcher and the research assistants went round to collect the scale items for analysis. The data collected was analysed using frequency, percentage, and Cronbach's Alpha.
III. RESULTS AND DISCUSSION

A: RESULT:

When the researcher analysed the data the result are as following:

1- There are Correlation relationship between learning disabilities and attention deficit & hyperactivity disorders.

To verify this hypothesis the researcher used correlation test. Table 2 shows the result of this hypothesis. As you, see in table 2 the value of correlation is 0.86 this value is significant at level 0.01 because the value of Sig 0.005 is less than significant level 0.01. That means there are relationship between learning disabilities and attention deficit & hyperactivity disorders.

Table 2 shows the relationship between learning disabilities and ADH

<table>
<thead>
<tr>
<th>Variables test</th>
<th>Number</th>
<th>R value</th>
<th>Sig</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning disabilities</td>
<td>40</td>
<td>0.86</td>
<td>0.005</td>
<td>Significant</td>
</tr>
</tbody>
</table>

3- What is prevalent of attention deficit among learning disabilities children?

To answer this question the researcher used Frecouncy and percentage. Table 4 show the result of this question. As you, see in table 4 the numbers of children with learning disabilities and had suffering from attention deficit disorders are 33 children out of 40, that means the prevalent of attention deficit disorders among learning disabilities is 82.5%.

Table 4 shows the prevalent of attention deficit among learning disabilities

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Total Number</th>
<th>Number of child with ADHD</th>
<th>Prevalent Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADHD</td>
<td>40</td>
<td>33</td>
<td>0.825</td>
</tr>
</tbody>
</table>

4- What is prevalent of hyperactivity among learning disabilities children?

To answer this question the researcher used Frecouncy and percentage. Table 5 show the result of this question. As you, see in table 5 the numbers of children with learning disabilities and had suffering from hyperactivity disorders ADHD are 34 children out of 40, that means the prevalent of hyperactivity disorders among learning disabilities is 85%.

Table 5 shows the prevalent of ADHD among learning disabilities

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Total Number</th>
<th>Number of child with ADHD</th>
<th>Prevalent Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADHD</td>
<td>40</td>
<td>35</td>
<td>0.85</td>
</tr>
</tbody>
</table>

B- Discussion:

When the researcher verify the hypothesis and answering the questions, the study revealed that:

There are relationship between learning disabilities and attention deficit & hyperactivity disorders. This result is in line with many studies; in study of Cantwell & Baker (1991), the data show that learning disabilities was strongly associated with ADHD in both the initial and follow-up samples. Ponde, Cruz, Antonio & Andre
(2012) show that a very strong association was found between attention deficit and learning problems. Larry & Silver (1981) the findings show that there is a clinical relationship between children who have learning disabilities and children who are hyperactive and/or distractible. Cynthia & et al (1994) it found that there are significant relationship between learning disabilities and ADHD. The researcher pointed that many studies over the years have indicated a very strong co-morbidity of the two conditions but the exact percentage of overlap varies widely in these studies because of methodological inconsistencies. Studies of the families of children with either learning disabilities or ADHD indicate strong patterns of inheritance for both conditions, but also show that they are independent disorders. Larr & Silver, (1981) pointed that ADHD and learning disabilities are two discrete disorders with distinct symptom clusters. However, some symptoms may be common to both disorders, including disorganization, weak executive functioning, and inefficient use of strategies. Without careful assessment, distinguishing between ADHD and learning disabilities can be difficult because of overlapping symptoms and because some behaviours that may, result from learning disabilities can look like ADHD symptoms. For example, individuals with central auditory processing deficits can appear inattentive, and students who have become discouraged due to learning problems may not stay on task or may appear distractible.

In addition, the study revealed that prevalent of attention deficit disorders among learning disabilities children is 82.5%. This result is in line with study of Barkauskien & Bieliauskaite (2002) they found that children with learning disabilities had significantly more internal and external problems (aggression and delinquency) as well as attention and social problems. McConaughy, Mattison, & Peterson, (1994) show that children with LD scored significant predictors included attention problems, delinquent behaviour, social problems, thought problems, and withdrawal. Epstein, Cullinan & Neiminen, (1984) indicated that the same four factors were found with the learning-disabled boys in both studies: Conduct Problem, Anxiety Withdrawal, Attention Deficit, and Social Maladjustment. Teachers rated the learning disabilities boys on the 55 items. In the ratings given by the teachers, hyperactivity and restlessness were associated with other attention items for younger children. The researcher pointed that many people mistakenly believe that attention deficit hyperactivity disorder (ADHD) is a learning disability. This may stem from the fact that the two conditions often occur together about 20 to 30 percent of ADHD children also have specific learning disabilities. “Having one condition makes the other more likely,” ADHD can also cause difficulties learning ADHD children often can’t focus on subjects long enough and have trouble following directions. Still, ADHD is not considered a learning disability. In addition, most common disorder that co-exists with learning disabilities is attention deficit/hyperactivity disorder (ADHD). Additionally the most common disorder that co-exists with learning disabilities is attention deficit/hyperactivity disorder (ADHD).

**IV. CONCLUSION**

Our study conducted to find out the relationship between learning disabilities and attention deficit and hyperactivity disorder, to verify this aims the researcher used ADHD scale. The study indicated that there are relationship between learning disabilities and attention deficit & hyperactivity disorders, and the prevalent of attention deficit and hyperactivity disorders among learning disabilities is 87.5%. According to these results, the researcher suggest that it is important to distinguish between the two conditions because of different methods of treatment. Intervention for learning disabilities may involve academic skills instruction, the development of compensatory strategies and self-advocacy skills, and appropriate accommodations. Treatment for ADHD may include behavioural strategies, modifications to the learning environment, family counselling, and the use of specific medications.
V. REFERENCES


Incidence of Toxin Producing Bacteria in Milk and Milk Products

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ABSTRACT

Milk and milk products is a very good source to support the growth of microorganism. Their presence may cause health hazards. Considering its unhygienic aspects in view, the present study was undertaken to judge the occurrence of toxin producing microorganism. A good number of milk, curd, ice-cream and khoa samples supplied to Tura town (Head quarter of District West Garo Hills, Meghalaya) were assessed for their total bacterial, clostridial and staphylococcal counts. Out of total clostridia and total coagulase positive staphylococcus count about twenty percent were identified as clostridium botulinum and ninety percent as staphylococcus aureus respectively. These isolates, pure and identified cultures of these organisms were incubated in litmus milk for one week for production of toxins. Heat stability of toxins were determined by heating the inoculates at 75, 85, and 100°C for five minutes. Toxicity of toxins produced by these microorganisms was tested by intra peritoneal injection and orally feeding to mice and seen that 1.5 c.c intra peritoneal injection was lethal dose. Heating of inoculates at 85°C for five minutes has partially inactivated botulinam toxin, whereas it has not effected staphylococcus enterotoxin. Heating at 100°C for five minutes has completely inactivated botulinam and partially inactivated staphylococcal enterotoxin. It can be concluded from the experimental results that the bacteriological quality of milk and milk products supplied to Tura town is very poor.

Key words: Toxin Producing Bacteria, Milk, Dairy Products.

I. INTRODUCTION

Milk and milk products is a suitable food, support vigorous multiplication of a number of microorganisms. The survival and presence of these micro-organisms may spread epidemic diseases through them, if these are produced and handled under unhygienic conditions. Clostridium botulinum and stablyococcus aureus is a versatile pathogens in human and animals which is responsible for many diseases raging from skin infection to life threatening. (Genigeorgis, 1989) They are also known as one of the most important agent of food poisoning worldwide, because of their extracellular metabolities production and their wide occurrence in soil, air, water, human body and even over clothes. These toxigenic organisms may gain access to raw milk and survive in milk and milk products if these are not properly pasteurized, or get recontaminated with raw milk. The outbreaks of this food poisoning are exposing serious challenges to the workers engaged in the field of food/dairy microbiology (Janga and Singh2010). Unavailability of organized dairy sector in the region may be the reason of unhygienic milk production in the area, thus the present investigation was undertaken to assess the incidence of toxin producing bacteria in milk and milk products in Tura town of Garo Hills regions of Meghalaya.

II. METHODS AND MATERIAL

(A) Collection, Handling and Treatment of Samples:

(i) Milk – under the present study a total of 30 milk samples were collected from different selling booths, vendors, dairy farms and sweet shops. The samples were collected aseptically in clean sterilized glass bottles and cooled promptly to about 4°C in an ice-box to minimize further multiplication of bacteria. The samples immediately after arrival at laboratory were subjected to bacteriological analysis as per Bureau of Indian Standard (B.I.S), 1981.

(ii) Dahl/Curd – Twenty dahi samples were collected from sweet shops and vendors. The samples were collected aseptically in clean sterilized bottles and cooled to 4°C in an ice-box. For the analysis of dahi 11 gm. of sample was
mixed in sterilized glass mixer for 2 minutes at 3,000 rpm with 99 ml of buffered dilution. Suitable dilutions (1 and 2 for Clostridia and Staphylococci counts were plated for their respective bacterial counts.

(iii) **Ice-Cream** - A total of 12 ice-cream samples from local market were collected in the same manner as for dahi samples. The samples were analyzed for their microbial quality as per the BIS, 1981.

(iv) **Khoa** - Ten Khoa samples were collected from different sweet makers of the Tura town. The samples were held at about 4°C in order to prevent the further growth of micro-organism. For the analysis of the Khoa sample suspension was prepared by transferring 11 gm. of sample with the help of a sterile spatula to 99 ml buffered dilution blank in sterile blender and was shake vigorously for 2-3 minutes. The suspension thus obtained was uniform (Sharma et al 1972). The suitable dilution was plated for their counts.

The clostrisel agar medium was used for enumeration of clostridium, while for staphylococcus count was done as per methods described by Chalmers, 1962. In order to confirm the presence of either *staphylococcus aureus* or *clostridium botulinum* five isolates from each product were studied in their respective selective media as prescribed by BBL manual.

Identification of Colonial Isolates: Five colonies resembling in their colony characteristics to clostridium and staphylococci were picked up from each product. The colonies were then transferred to the sterilized litmus milk tubes and grown in anaerobic conditions; the tubes were then incubated at 30°C for 48 ± 2 hours for *clostridium botulinum*. While for staphylococcus colonies from Vogel and Johnson agar plates incubated at 37°C for 48 ± 2 hours.

In general, all the biochemical tests were performed and interpreted as per procedure recommended in ‘Identification Methods for Microbiologist’ by Gibbs and Skinner (1966), Bergey’s manual of determinative bacteriology by Breed et al (1957) and BBL manual (Table 1).

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of Test</th>
<th>Clostridium botulinum</th>
<th>Staphylococcus aureus</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Glucose</td>
<td>+ ve</td>
<td>+ ve</td>
</tr>
<tr>
<td>2.</td>
<td>Lactose</td>
<td>- ve</td>
<td>+ ve</td>
</tr>
<tr>
<td>3.</td>
<td>Sucrose</td>
<td>- ve</td>
<td>+ ve</td>
</tr>
<tr>
<td>4.</td>
<td>Maltose</td>
<td>+ ve</td>
<td>+ ve</td>
</tr>
<tr>
<td>5.</td>
<td>Fructose</td>
<td>+ ve</td>
<td>not performed</td>
</tr>
<tr>
<td>6.</td>
<td>Manitol</td>
<td>- ve</td>
<td>+ ve</td>
</tr>
<tr>
<td>7.</td>
<td>Gelatin</td>
<td>+ ve</td>
<td>+ ve</td>
</tr>
<tr>
<td>8.</td>
<td>Nitrite</td>
<td>- ve</td>
<td>+ ve</td>
</tr>
<tr>
<td>9.</td>
<td>Indole</td>
<td>- ve</td>
<td>not performed</td>
</tr>
<tr>
<td>10.</td>
<td>Coagulase production</td>
<td>not performed</td>
<td>+ ve</td>
</tr>
</tbody>
</table>

Note: Out of the 20 isolated from all the products six were found to be resembling *clostridium botulinum* and nine were resembling *staphylococcus aureus*.

**Production of Toxin**

Isolated, pure and identified cultures of these organisms were incubated in litmus milk for one week for the production of toxin.

**Determination of Toxicity**

The subject selected for testing the toxicity of these two organisms were mice. All the animals ranged in their age group of 1-2 months. In all, 10 mice were used in this experiment. For testing the toxicity of both organism 1 ml, 1.5 ml and 2 ml of pure inoculates were injected intraperitoneally and also orally in three different subjects and symptoms were recorded.

**Heat treatment of Toxins**

The inoculates were heated at 75, 85 and 100°C for 5 minutes and were injected in the quantity of 1.5 ml as was to be lethal. The toxicity symptoms were noted.

### III. RESULT AND DISCUSSION

In the present study the details of the occurrence of total *clostridial* and *staphylococci* count in milk and milk products have been investigated. An attempt has also been made to isolate the *clostridium botulinum* and *staphylococcus aureus* species from the respective groups. The isolated species were then incubated in litmus milk for a week for the production of their toxins.
Later on these toxins were tested for their toxicity and heat stability by the use of laboratory mice.

Thirty milk samples, 20 dahi samples, 12 ice-cream and 10 samples of khoa supplied to Tura town were assessed for their clostridia and staphylococci count per ml/gm.

As evident from the table 2 the clostridial count was recorded maximum from dahi (246.95 ± 19.49 per gm) that was nearer to khoa (195.5 ± 35.52 per gm) followed by ice-cream and milk (111.33 ± 33.67 and 81.13 ± 9.79 respectively).

Out of total clostridia counted about 20 percent were identified as botulinum species while coagulase positive staphylococcus aureus were identified as 90 – 95 percent.

Table 2: The minimum maximum and average of clostridia and staphylococci count per ml/gm in milk and milk products:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of Product</th>
<th>Clostridia Count per ml/gm</th>
<th>Staphylococci per ml/gm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>minimum</td>
<td>maximum</td>
<td>average</td>
</tr>
<tr>
<td>1.</td>
<td>Milk</td>
<td>15</td>
<td>181</td>
</tr>
<tr>
<td>2.</td>
<td>Dahi</td>
<td>92</td>
<td>410</td>
</tr>
<tr>
<td>3.</td>
<td>Ice-cream</td>
<td>12</td>
<td>355</td>
</tr>
<tr>
<td>4.</td>
<td>Khoa</td>
<td>37</td>
<td>380</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of Product</th>
<th>Staphylococci Count per ml/gm</th>
<th>average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>minimum</td>
<td>maximum</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>59</td>
<td>508.5</td>
<td>222.7±20.68</td>
</tr>
<tr>
<td>2.</td>
<td>94</td>
<td>420.5</td>
<td>237.2±19.77</td>
</tr>
<tr>
<td>3.</td>
<td>25</td>
<td>255</td>
<td>95.45±18.65</td>
</tr>
<tr>
<td>4.</td>
<td>100.5</td>
<td>651</td>
<td>273.70±54.82</td>
</tr>
</tbody>
</table>

Just before toxicity tests the clostridium botulinum and staphylococcus aureus were counted as 45x10^6 per ml, respectively. In order to determine the lethal dose of these toxins 2, 1.5 and 1 cc of inoculate were intraparetoneally injected and 2 and 1 c.c. orally fed to mice. Two and 1.5 cc intraparetoneal injections of each inoculate resulted in death of mice whereas 1 cc did not show any effects. Oral feeding slightly effected at 2 cc concentration whereas failed to show any effects at 1 cc concentration in both cases (Table 3 and 4). It was assured that their lethal doses were 1.5 cc intraparetoneal injections. Heating of inoculates at 85°C for 5 minutes has completely inactivated botulinal toxin where as it has partially inactivated staphylococcal enterotoxin. The finding of this study have also been supported by Neill and Grimes (1947) they found that 33% of the ice-cream in cork city contained clostridia. The range of staphylococci noted 25x10^2 to 255x10^2 per ml of ice-cream. This higher count may be due to the higher staphylococci count present in milk used for ice-cream. In contrast to our finding, Faroane (1966) reported the occurrence of staphylococci in ice-cream as very low, whereas Pograia and Saraswat (1969) and Singh et al (1974) reported staphylococci in much higher number. A number of workers Kudthodkar and Singh (1964) have reported the presence of staphylococci in Khoa obtained from various cities. The numbers of these organisms in their studies have always been higher than in our study.

In contrast to clostridium botulinum the number of staphylococcus aureus to produce lethal dose of toxin for mice, was much more in the present study (69x10^6). Other workers (Donnelly etal 1969) reported that a concentration of 5x10^7 staphylococcus aureus cell per ml was required before enterotoxin was detected. By the injection of 1.5 cc of inoculates the toxicity symptoms developed after 4½ hours in case of clostridium and after 6½ hours in case of staphylococci. In case of clostridium specific symptoms were noted as diarrhoea, vomiting, nausea and paralysis, where as in case of staphylococci the symptoms were vomiting, diarrhoea and prostration etc.

As against our observation Ayres et al (1969) have indicated that clostridium botulinum toxins are low heat resistance and according to them, these toxins were inactivated at temperature, 50°C and above when heated for 5 minutes. The variation in the different heat resistance of toxins found in their studies and that of ours could be explained on the ground that typical toxins might have been different in different cases.
Table 3-Toxicity of Clostridium botulinum inoculates in mice (45×10⁶ per ml).

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Weight of mice</th>
<th>Method of injection</th>
<th>Amount injected</th>
<th>Symptoms observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>63.5 gm</td>
<td>Intraparetoneal</td>
<td>2.0 cc</td>
<td>Nausea, diarrhoea, and vomiting observed after 3.5 hours death after 18 hours.</td>
</tr>
<tr>
<td>2.</td>
<td>62.7 gm</td>
<td>Intraparetoneal</td>
<td>1.5 cc</td>
<td>Vomiting and diarrhoea after 4.5 hours and death after 20 hours.</td>
</tr>
<tr>
<td>3.</td>
<td>63.7 gm</td>
<td>Intraparetoneal</td>
<td>1.0 cc</td>
<td>No effect.</td>
</tr>
<tr>
<td>4.</td>
<td>29.5 gm</td>
<td>Intraparetoneal</td>
<td>2.0 cc</td>
<td>Slight effect of diarrhoea and vomiting, paralysis of leg after 8 hours. Recovered within 24 hours</td>
</tr>
<tr>
<td>5.</td>
<td>30.4 gm</td>
<td>Intraparetoneal</td>
<td>1.0 cc</td>
<td>No effect</td>
</tr>
</tbody>
</table>

Table 4-Toxicity of Staphylococcus aurius inoculates in mice (69×10⁶ per ml).

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Weight of mice</th>
<th>Method of injection</th>
<th>Amount injected</th>
<th>Symptoms observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>64.4 gm</td>
<td>Intraparetoneal</td>
<td>2.0 cc</td>
<td>Vomiting, nausa with slight diarrhea and prostration observed after 8 hours, death after 20 hours.</td>
</tr>
<tr>
<td>2.</td>
<td>62.9 gm</td>
<td>Intraparetoneal</td>
<td>1.5 cc</td>
<td>Vomiting and diarrhoea after 6.5.5 hours and death after 24 hours.</td>
</tr>
<tr>
<td>3.</td>
<td>63.1 gm</td>
<td>Intraparetoneal</td>
<td>1.0 cc</td>
<td>No effect.</td>
</tr>
<tr>
<td>4.</td>
<td>29.1 gm</td>
<td>Intraparetoneal</td>
<td>2.0 cc</td>
<td>Very slight effect as vomiting and prostration after 10 hours. Recovered within 24 hours.</td>
</tr>
<tr>
<td>5.</td>
<td>30.2 gm</td>
<td>Intraparetoneal</td>
<td>1.0 cc</td>
<td>No effect</td>
</tr>
</tbody>
</table>

IV. CONCLUSION

It can be concluded from the experimental results that the bacteriological quality in terms of Clostridium botulinum and Staphylococcus aurius supplied to Tura town is very poor. Although the microbial quality of milk products was not up to the mark but these are safer from health hazards as their Clostridial and Staphylococcal counts were noted quite low to produce detectable levels of toxins. The botulin toxin can be destroyed by heating whereas as it is difficult to destroy Staphylococcal enterotoxins by heat treatment. It is rather better to avoid contamination and destruction of bacteria than inactivation of toxin.

V. REFERENCES
