© 2017 IJSRST | Volume 3 | Issue 6 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section: Science and Technology

Analysis of Water for the Presence of Pollutants by using Physicochemical Parameter in Control Water, Polluted and Treated Hussainsagar Lake Water, Hyderabad, Telangana, India

Sreenu Noothi[*1], C. Venkateswar[2], B. Reddya Naik[1], J. Avinash Kumar[2], Abdul-Kadri Yahaya[2]
[1]Department of Zoology, Osmania University, Hyderabad, Telangana, India
[2]Pharmacognosy and Medicinal Plants Lab, Department of Botany, Osmania University, Hyderabad, Telangana, India

ABSTRACT

Hussainsagar lake is highly polluted with untreated domestic sewage and toxic industrial effluents. So this type of water can be treated by CV technology and analysed for water quality parameters. The present study was carried out for the water quality of polluted Hussainsagar lake water and treated Hussainsagar lake water (Treated by C.V. Technology) by keeping for two years (2013-14 and 2014-15) period. Lake water is collected and stored as Hussainsagar lake polluted water tank, after treatment by CV technology it is stored as treated Hussainsagar lake water tank and compared to control water tank filled with bore water of Osmania University. In each tank four sites are selected to analyze the physico-chemical parameters of three tanks and are compared with Indian Standards and WHO. As per the results, Hussainsagar Lake water was highly polluted and after treating by using CV Technology it was found that there were no pollutants in treated Hussainsagar water. This treatment is very useful for treating of sewage waste waters. Which is indicated by the results obtained.

Keywords : Hussainsagar Polluted Water, CV Technology, Osmania University Bore Water, Physicochemical Parameters.

I. INTRODUCTION

Hussainsagar lake underwent extensive environmental degradation due to pollution from untreated domestic sewage and toxic industrial effluents (Noothi et al., 2017). Water quality is the main factor controlling the health and diseased states in both humans and animals (Sridhar Kumar et al., 2014). Nowadays naturally existing dynamic equilibrium of water bodies like rivers, lakes and estuaries are affected by the human activities (Mahananda et al., 2010; Mehari and Mulu, 2013). The discharge of effluents and associated toxic compound in to aquatic system represents an ongoing environmental problem due to their possible impact on communities in the receiving aquatic water and a potential effect on human health (Abbas Alkarkhi et al., 2008). Drinking water is one of the basic needs of life and essential for survival. Still more than one billion people all over the world do not have ready access to an adequate and safe water supply and more than 800 million of those unsaved lives in rural areas (Manoj Kumar and Avinash Puri, 2012). The quality of drinking water should be checked at regular time of interval, because due to use of contaminated drinking water, human population suffers from various water borne diseases (Basavaraja et al., 2011). A healthy lake eco-system could conserve natural and social balance by contributing healthy environment of its location (Lodh et al., 2014). Increased human population, industrialization, use of fertilizers in the agriculture and man-made activity it is highly polluted with different harmful contaminants (Patil et al., 2012).

II. METHODS AND MATERIAL

Study Area

Hyderabad is the capital of Telangana state. The water body selected for the present investigation is a manmade tank (17°25′02.32″N, 78°31′57.43″E) formed due to the construction for fish culture. Water spread area of the control tank was 14,508 lts, Hussainsagar lake water tank was 14,280 lts and treated Hussainsagar Lake water tank was 14,293 lts. Climate is tropical wet and dry with most rainfall from June to October. The samples were collected in four places of the tank and analyzed.

Methods

For pH Electrometric method (APHA-2012), Electric conductivity (EC) : Digital Equipment (APHA-2012), Total Dissolved Solids (TDS) : Digital Equipment (APHA-2012), Dissolved Oxygen (DO) : Winkler's method (APHA-2012), Chemical Oxygen Demand (COD) : Closed reflux titrimetric method (APHA-2012), Biological Oxygen Demand (BOD) : Titrimetric method (APHA-2012), Calcium (Ca) : Muroxide–EDTA Titrimetric method (APHA-2012), Magnesium (Mg) :Brilliant Yellow method (APHA – 2012), Chlorides (Cl) :Argentometric method (APHA–2012), Nitrates (NO_3) :Ultraviolet Spectrophotometric method (APHA-2012), Phosphates (PO_4) :Stannous chloride method (APHA – 2012).

Permissible limits for drinking water quality according to World Health Organization (WHO) and Indian Standard Institution (ISI) are compared in this article.

Result and discussion:

The variations in physico-chemical parameters are depicted in table 1and 2.

pH

pH maintain the acidic or basic property, is a vital characteristic of any aquatic ecosystem since all the biochemical activities and retention of physico-chemical attributes of the water are greatly dependent on pH of the surrounding water (Shenoy et al 2016, Laxman K et al., 2016, Jalal and Sanal Kumar, 2013 and Tiwari et al 2016). pH is considered as an important ecological factor and is the result of the interaction of various substances in solution in the water and also of numerous biological phenomenon(Rajashekar A. V et al., 2012). Most of the fresh water bodies are alkaline due to the above components. The productivity of inland water will good in a slight alkaline reaction with pH between 7.5 to 8.5. (Piska 2001; Chary, 2003 and Rao, 2004). The quantitative and qualitative changes of these compounds depend upon lithogenic inputs, transformation and regeneration in the trophogenic and tropholytic compartments of the ecosystem.

The pH of Control water and treated Hussainsagar lake water was found to be in normal range. i.e., within the permissible limits of WHO and ISI values, this states that the water is of good quality. The untreated Hussainsagar lake water showed a higher pH value when compared to permissible levels. This type of polluted water (Hussainsagar lake water) can be treated and converted in to potable water by C.V. technology. After treatment the pH value have reduced and come down to the control water range.

Electro Conductivity (EC)

Electrical conductivity (EC) in natural waters is the normalized measure of the water's ability to conduct electric current. This is mostly influenced by dissolved salts such as sodium chloride and potassium chloride. The common unit for electrical conductivity is Siemens per meter (S/m). Most freshwater sources will range between 0.001 to 0.1 S/m. (Shenoy et al 2016, APHA, Revised 2012. IS 10500 (1991) Revised, 2012). Chary (2003) reported the EC values as 585-1210 ms/cm in Durgam cheruvu reservoir and Rao (2004) reported as 1545 to 1810 ms/cm in Julur Tank.

The EC of the control and treated Hussainsagar water tank were within the permissible levels and untreated Hussainsagar water tank was exceeding the range specified by ISI value. So the untreated Hussainsagar water was not of good quality and polluted too. This type of polluted water (Hussainsagar lake water) can be treated and converted in to normal water by C.V. technology. After treatment the untreated Hussainsagar lake water have shown EC ranges near to that of control water.

Total Dissolved Solids (TDS)

The variation may be due to exposure of water to atmosphere in different seasons. Minimum values recorded post monsoon may be due to high metabolic rate of organisms. Maximum values reported during in monsoon period, may be due to low atmospheric temperature.

Several authors reported that high concentration of TDS reduces the solubility of gases (Pandey *et al* 2008) in water and increases density of water (Soni V et al., 2013). Indeed, high concentration of TDS enriches the nutrient status of water body which results into eutrophication of aquatic ecosystem, indicative of pollution, Pandey *et al* (2015), Narwaria *et al* (2014) and Pandey (2013).

The Hussainsagar lake water show high value of TDS when compared to control and treated Hussainsagar water. After the treatment TDS value have reduced and comedown to the normal range. The treated water have shown TDS values nearer in range to that of control water.

Dissolved Oxygen (DO)

Oxygen gets into water by diffusion from the surrounding air by, aeration (rapid movements) and as a waste product of photosynthesis. Total dissolved solids, gas concentration in water should not exceed 110% (above 13-14 mg/l) concentration can be harmful to aquatic life. Fish in waters containing excessive dissolved gases may suffer from "gas bubble disease" (Manoj Kumar and Avinash Puri, 2012). A low content of dissolved oxygen is a sign of organic pollution. Low dissolved oxygen may prove fatal for many organisms for their survival (Abowe i J. F. N, 2010) as is evident in the study area by reported death of 220 rare tortoises inhabiting the lake (Rajasthan Patrika 2015). This oxygen depletion might be due to high temperature, addition of sewage, other waste and algal growth (Pandey et al., 2015). Das et al (2002) stated that dissolved oxygen along with turbidity could provide information about the nature of an ecosystem better than any other chemical parameters. It is observed that dissolved oxygen concentration more than 5 mg/lit favors good growth of flora and fauna. Rao (2004) reported 6.42 to 7.18 ppm in Julur tank.

The Dissolved oxygen was found to be more in treated water sample when compared with control and untreated Hussainsagar lake water tanks.

Chemical Oxygen Demand (COD)

Chemical oxygen demand test determines the oxygen required for chemical oxidation of organic matter with the help of strong chemical oxidant. COD which was observed in the range of 3.7 mg/l (Lakhwar dam) to 5.6 mg/l (Water quality status of Yamuna river 1999-2005 CPCB). Seasonal analysis reveals that maximum values of COD noted in summer and monsoon and minimum in winter.

When compared amongst the three, the least value of COD was found in treated water sample, moderate value was found in control water and high value was found in untreated water. The untreated Hussainsagar lake water tank showed high value of chemical oxygen demand because of organic metals, decomposition and respiration of bacteria. The treatment helps in neutralizing the many chemicals added to Hussainsagar lake water so the COD decrease in treated Hussainsagar lake water tank.

Biological Oxygen Demand (BOD)

BOD is usually used for determining the oxygen demand of municipal or industrial discharge. High BOD indicates high scale contamination of organic matter in the water (Lodh *et al*, 2014). At high BOD values, the aquatic life, both plants and animals are adversely affected (Pandey et al., 2015). Similar treads also reported by Patki Saroj (2002). The average value of BOD levels (1.8 mg/l) in every season indicates the absence of organic pollution sources in project-affected area. Bhatt et al., (1999) reported maximum value of BOD in summer and lowest in winter. He also reported that high values in summer due to higher rate of organic decomposition. Gradual decline of BOD from monsoon followed by winter due to decrease in temperature which in turn retards microbial activity.

Due to the contamination by heavy sewage and industrial discharge the Biological Oxygen Demand was high in Hussainsagar lake water tank when compared to control and treated Hussainsagar lake water tanks.

Calcium and Magnesium (Ca &Mg)

The total hardness is often employed as indication of waste water quality, depends on the concentration of carbonate and bicarbonate salts of calcium and magnesium or sulphate, chloride or other anions of mineral acids. The main source of magnesium is sewage inflows and minerals generated due to soil erosion and are important for enzyme activation, growth of chlorophyll and phytoplankton (Ramesh and Seeta, 2013; Verma et.al, 2012). Biologically temporary hardness plays a key role in buffering capacity, thus neutralizing the pH due to addition of acidic products. This has a great effect on biodiversity of an ecosystem. The concentration of Ca and Mg ions in water is less than 40ppm then it is soft water and more than 40ppm then it is hard water. Effect of the major cations on the growth of flora is of ecological significance (Ansar, 2010; Piska and Rao, 2005). Very high concentration of magnesium imparts an unpleasant taste to the potable water (Piska, 2000, and Sridhar 2014). The increase in hardness can be attributed to the decrease in water volume and increase in the rate of evaporation at high temperature (M.Thirupathaiah et al., 2012).

The total hardness of control and treated Hussainsagar Lake water tanks were in the permissible range specified by WHO and ISI. Whereas untreated Hussainsagar lake water tank showed higher value.

Sodium (Na)

Sodium in water can come from geological sources, rock salt or as a result of using a water softener. A level of 20 µg/l in drinking water is suggested by the EPA for the high risk population of hypertensive and heart patients. Sodium is present in number of minerals. Majorly rock salt (sodium chloride). The increased pollution of surface and ground water during the past resulted in a substantial increase in the sodium content of drinking water in different regions of the world. Sewage, industrial effluents and sea water intrusion in coastal area contribute to sodium concentration in water because of the high solubility of sodium salts and minerals.

In the present study sodium concentration control and treated Hussainsagar Lake water tanks were in permissible range specified by WHO and ISI. Whereas untreated Hussainsagar lake water tank showed higher value.

Chlorides (Cl)

Chlorides mainly come from inorganic salts like NaCl, KCl and $CaCl_2$ etc. which are generally provided by soil, natural layers of chloride salts, municipal and industrial sewage and animal wastes (Gopalkrushna, 2011). High chloride content in water is a good indicator of pollution (Pandey et al., 2015). The fluctuations of chloride in the point source of pollution are usually governed by the dilution due to inflow of water, concentration by evapo-transpiration and inputs from surface run-off during the early monsoon showers. The minimum chloride values found during monsoon months, due to dilution by the monsoon floods with the decrease of inflow in winter, chloride concentration increase due to increase in evapo-transpiration (Srinivas, 2005 and Ansar, 2010). Natural water normally has a low chloride content compared to bicarbonates and sulphates. High chlorides indicate pollution from domestic sewage and industrial effluents. Chloride content above 250 ppm makes water salty in taste. (Pulle and Khan, 2001).

The Chlorides concentration is high in Hussainsagar lake water due to pollution by metals, domestic waste and industrial effluents and is in permissible levels in control and treated Hussainsagar lake water tanks that is within the levels specified by WHO and ISI.

Nitrates (NO_3)

In urban areas sewage water rich in nitrates contaminate surface water thus increases the nitrate amount (Lodh et al., 2014, Sridhar Kumar et al 2014, Gopalkrushna, 2011). Nitrate is the most highly oxidized form of nitrogen compounds, commonly present in natural waters, because it is the product of aerobic decomposition of organic nitrogenous matter. Significant sources of nitrate are domestic effluents, sewage sludge's, industrial discharges and decayed vegetable and animal matter. These sources can contaminate lakes, rivers and seas (Rajashekar et al., 2012). The nitrogen pool of limnotic environment comprises of two components namely the organic component consisting of organic materials liberated by the biota or generated in the heterotrophic bacterial activity upon proteinaceous substrates. The second component is made up of inorganic compounds of nitrogen such as ammonia, nitrite and nitrate. A great deal of work on the distribution pattern of different forms of nitrogen and their interrelationship in fresh waters have been made (Piska and Rao, 2005; Srinivas, 2005 and Ansar, 2010).

The Hussainsagar lake water tank have shown higher nitrate concentration value than the other two samples. Yet the three water samples showed values in permissible limits given by WHO and ISI.

Phosphates (PO_4):

In aquatic ecosystem phosphorus occurs both in inorganic and organic forms, the inorganic phosphorus as orthophosphate plays a dynamic role by acting as a nutrient along with nitrates. High concentration of phosphate gives rise to an algal bloom and results in eutrophication (Kumar et al., 2016). Dumping of high amounts of organic matter, nitrogen and phosphorous in to the water and indicating the increased eutrophication (Sridhar Kumar et al., 2014). On oxidation the orthophosphate gets precipitated and is trapped in the sediment, while in reducing conditions as obtained in most of the eutrophic water bodies some sedimentary phosphorus is recycled insoluble (Rajashekar et al., 2012). During multiplication of plankton, concentration of phosphate decreases automatically simultaneously with the decrease in dissolved oxygen (Bhatnagar et al 2013, Saxena and Sharma 2014, Pandey 2013, Narwaria et al., 2014 and Kulkarni et al 2014). A small concentration of phosphates is tolerable even though it is harmful to humans and animals as it is an essential constituent of bones and some of the enzyme system. This may be due to discharge of effluent containing soil organic matter and use of fertilizer (Rajashekhar et al., 2007).

The PO_4 concentration was reduced after the treatment. Both control and treated Hussainsagar lake water tanks has shown values lesser when compared to Hussainsagar Lake water tank.

Table -1: Physico-chemical parameters of CON, UHW and THW during the year 2013-2014

S.No.	Parameter	Mean ± SD			WHO	ISI
		CON	UHW	THW	standards	standards
1.	PH	7.458±0.229	8.467±0.207	7.35±0.162	6.5-8.5	6.5-8.5
2.	EC	725.33±19.106	2234±19.1	841.87±21.36	-	2000
3.	TDS	546.75±22.143	1462±40.64	452.37±9.01	-	500-2000
4.	DO	5.367±0.2	4.175±0.41	6.467±0.216	-	-
5.	COD	48.667±4.293	116.2±5.252	13.75±2.706	-	-
6.	BOD	14.583±1.805	34.08±2.004	14.5±1.569	-	-
7.	Ca^{+2}	76.25±2.937	134.8±2.29	94.833±2.351	75	75
8.	Mg^{+2}	34.667±2.285	44.25±2.509	34.833±2.011	50	30
9.	Na	25.667±2.208	34.33±2.101	25.583±2.681	-	-

10.	Cl	210.83±5.311	353.6±5.232	153.5±2.228	250	250-1000
11.	NO_3	7.967±0.244	15.17±2.266	6.2±0.311	50	45
12.	PO_4	0.549±0.031	12.5±1.654	1.564±0.284	-	-

- CON=Control
- UHW=Untreated Hussainsagar Water
- THW=Treated Hussainsagar Water

Table -2: Physico-chemical parameters of CON, UHW and THW during the year 2014-2015

S.No.	Parameter	Mean ± SD			WHO	ISI
		CON	UHW	THW	standards	standards
1.	PH	7.475±0.232	8.45±0.252	7.342±0.127	6.5-8.5	6.5-8.5
2.	EC	741.3±15.82	2235.3±24.46	825.33±20.731	-	2000
3.	TDS	554±16.5	1256±15.6	458.33±8.283	-	500-2000
4.	DO	5.433±0.2	4.3±0.14	6.533±0.222	-	-
5.	COD	63±2.266	122.7±3.772	13.667±2.299	-	-
6.	BOD	14.25±1.434	34.167±1.833	12.583±1.694	-	-
7.	Ca^{+2}	75.67±2.731	145.53±2.629	94.75±2.269	75	75
8.	Mg^{+2}	35.67±2.087	43.917±2.185	32.417±2.855	50	30
9.	Na	38.33±2.328	44.5±2.635	32.333±2.655	-	-
10.	Cl	210.8±2.958	359.1±2.329	154.3±1.997	250	250-1000
11.	NO_3	8.025±0.217	14.75±2.042	7±0.382	50	45
12.	PO_4	0.508±0.026	12.5±2.266	1.408±0.156	-	-

- CON=Control
- UHW=Untreated Hussainsagar Water
- THW=Treated Hussainsagar Water

Plate 1: SATILITE IMAGE OF HUSSAINSAGAR LAKE

Plate 2: AFTER POLLUTED HUSSAINSAGAR LAKE

III. CONCLUSION

All physicochemical water quality parameters are within the permissible limits in Control and treated Hussainsagar lake water. The polluted Hussainsagar lake water have shown high values except for NO3 concentration. These results indicate that, the Hussainsagar lake water is alkaline, less productive in nature, highly polluted, not suitable for drinking and culture of fishes. If in future the water is polluted by sewage and industrial effluents etc. that water can be treated by using C.V. technology and the pollutants studied in this research can be brought to permissible levels so such treated water can be reused for irrigation, fishing and generation of hydroelectricity etc.

IV. REFERENCES

[1]. Abbas Alkarkhi, F.M., Ismail, N., and Mat Easa, A., (2008). Assessment of arsenic and heavy metal contents in cockles (Anadara granosa) using multivariate statistical techniques. Journal of Hazardous Materials 150: 783-789.

[2]. Abowei J. F. N., Salinity dissolved oxygen, pH and surface water temperature conditions in Nkoro River, Niger Delta, Nigeria, Adv. J. Food Sci. Technol., 2(1), 36-40, (2010).

[3]. Ansar., 2010. Studies on fisheries of Jamulamma reservior, Gadwal, Mahaboobnagar Dist, Andhra Pradesh. Ph.D. Thesis, Osmania University.

[4]. APHA., 2012. Standard Methods for the examination of water and waste water, American Public Health Association, 22nd Edition Washington, DC.

[5]. Basavaraja Simpi., KNS Murthy., K.N.Chandrashekarappa., Anil N Patel., E.T.Puttiah and S.M. Hiremath (2011), Analysis of Water Quality Using PhysicoChemical Parameters Hosahalli Tank in Shimoga District, Karnataka, India, Global Journal of Science Frontier Research, Volume 11 Issue 3, 31-34.

[6]. Bharat, S. and Jha, P., 2002. Changes in the water quality and total coliform bacterial load in a stretch of river Mahananda at Siliguri City, West Bangal, India, Asian Journal of Microbiology, Biotechnology and Environmental Science, 4(4):571-575.

[7]. Bhatt L.R., Lacoul P., Lekhak H.D., Jha P.K., 1999. Physico-chemical characteristics and phytoplanktons of Taudaha Lake, Kathmandu, Poll Res. 18 (4), 353 – 358.

[8]. Bhatnagar M. K., Singh R., Gupta S. and Bhatnagar P., Study of tannery effluents and its effects on sediments of river Ganga in special reference to heavy metals at Jajmau, Kanpur, India, J. Environ. Res. Develop., 8(1), 56-59, (2013).

[9]. Chary. K. D (2003). Present status, Management and Economics of Fisheries of a minor Reservoir, Durgamcheruvu of Rangareddy District, Ph.D. thesis, Osmania University.

[10]. Chary. K. D (2003). Present status, Management and Economics of Fisheries of a minor Reservoir, Durgamcheruvu of Rangareddy District, Ph.D. thesis, Osmania University.

[11]. Das.M., Dutta. T., Acharya.S and Bhowmick. S (2002). Sublethal temperature stress in juvenile Labeo rohita (Ham.) and Ritarita (Ham.) some physiological changes.Indian.J.Exp.Biol.40:589-593.

[12]. Gopalkrushna H.M., 2011. Assessment of physic chemical status of Ground Water Sample in Akotcity. Research Journal of Chemical Sciences, 1(4), 117-124.

[13]. IS 10500: 1991 Indian Standard Specification for Drinking Water Revised, (2012).

[14]. Jalal F.N., Sanal kumar M.G., 2013. Water quality assessment of Pampa River in relation to Pilgrimage season, International Journal of Research in Chemistry and Environment, vol.3 (1), 341 – 347.

[15]. Jha, Pritwiraj; Ashis Mandal and Sudip Barat, 2004. Mahananda Reservoir, W.B: Its Ichthyofauna, fishery and socio-economic profile of fish production, Fishing Chimes, Vol. 24, No.6:14-17.

[16]. Kulkarni P. S., Malik M. A. and Masoom S. M., Groundwater quality of Pravara sub basin, Ahmednagar, Maharashtra, India, J. Environ. Res. Develop., 9(2), 298-305, (2014).

[17]. Kumar M., Singh R., Chaurasia S. and Khare P. K. (2016). Physico-chemical examination of lotic water of river Yamuna at Kalpi, Dist- RICT Jalaun, Uttar pradesh, India, Journal of Environmental Research And Development Vol.10 No. 03, 529-536.

[18]. Laxman K. D., Sateesh K., Praveen R. S., Satyanarayana E. and Edukondal A., (2015) Assessment of Groundwater quality and its suitability for drinking and irrigation purposes in Maheshwaram area, Ranga Reddy District, Telangana State, India. J. Environ. Res. Develop, 9(3), 523-529, (2015).

[19]. Lodh R., Paul R., Karmakar B., Das M.K., 2014 Physicochemical studies of water quality with

special reference to ancient lakes of Udaipur City, Tripura, India, International Journal of Scientific and Research Publications, vol.4, issue6.
[20]. M.Thirupathaiah., Ch.Samatha, Chintha Sammaiah.(2012), Analysis of water quality using physico-chemical parameters in lower manair reservoir of Karimnagar district, Andhra Pradesh Volume 3, No 1, 2012.
[21]. Mahananda M.R., Mohanty B.P., Behera N.R., 2010. Physico-chemical analysis of surface and ground water of bargarh district, Orissa, india, International Journal of Research and Reviews in Applied Sciences, vol.2(3), 284-295.
[22]. Manoj Kumar., Avinash Puri., 2012. A review of permissible limits of drinking water, Indian Journal of Occupational & Environmental Medicine, Vol.16 (1), 40-44.
[23]. Mehari M., Mulu B., 2013. Distribution of Trace Metals in Two Commercially Important Fish Species (Tilapia Zilli and Oreochromis Niloticus) Sediment and Water from Lake Gudbahri, Eastern Tigray of Northen Ethiopia, International Journal of scientific and Research Publications, vol. 3, 2250-3153.
[24]. Mohanty, R.K. (2000). Activated Microbial suspension and nitogen control in aquaculture System. Fishing Chimes, 20 (9) 50-51.
[25]. Narwaria Y. S., Khushwah K. and Saxena D. N., Study of groundwater quality at Karera block of Shivpuri district, M.P., India, J. Environ. Res. Develop., 9(2), 562576, (2014).
[26]. Noothi S., C. Venkateswar and B. Reddya Naik, 2017. Physicochemical studies of water quality of treated and polluted Hussainsagar lake water Hyderabad, Telangana state, India. Journal of Water Research. Photon, 138, 326-332.
[27]. Pandey A., Groundwater quality study of Bilaspur, Chattisgarh, India, J. Environ. Res. Develop., 8(3A), 582-586, (2013).
[28]. Pandey S. C., Bharadwaj P. S. and Peerzada M. P. Physicochemical analysis of water quality of Ratan Talao, Bharuch, Gujarat, India, Journal of Environmental Research And Development, Volume 10, No. 02, 304-310 (2015).
[29]. Pandey S. C., Pani S. and Malhosia S., Studies on eco-toxicological status of Laharpur reservoir, Bhopal India in relation to its conservation and management, J. Environ. Res. Develop., 3(1), 68-81, (2008).
[30]. Patil. P.N, Sawant. D.V and Deshmukh. R.N (2012), Physico-chemical parameters for testing of water – A review, International Journal Of Environmental Sciences, Volume 3, No 3, 1194-1207.
[31]. Patki Saroj (2002). Hydrobiological studies of Banshelki dam at Udgir. Ph.D. Thesis submitted to Dr. Babasahed Ambedkar Marathwada University.
[32]. Piska R.S., Madhusudhan Rao., 2005. Impact of juvenile stocking size on the major carp production in a minor reservoir, Bibi Nagar, Inida; Reviews in Fish Biology and Fisheries 15, 167-173.
[33]. Piska, R.S (2000). Concepts of Aquaculture. Lahari Publications, Hyderabad. Piska, R.S (2001). Fisheries of minor reservoir, Shathamraj, Hyderabad. Ind. J. Fish 48 (2), 119-122.
[34]. Pulle, J.S. and Khan, A. M (2001). Seasonal variations in primary production in Isapur Dam, Maharashtra. J. Aqua. Biol. 16 (2), 19 – 33.
[35]. R.D. Tiwari Ecological Problems In The Upper Lake, Bhopal (M.P.) Problems And Suggestions Em International, Publishers Of Quality International Journals, Ecology, Environment And Conservation Paper Vol.05, Issue 02, 1999; Page No.(115-117)
[36]. Rajashekar A.V., Sunil Kumar A., Sreenu Noothi., Savalla Murali Krishna., Ravishankar Piska., 2012 The studies on water quality of Nizamsagar reservoir, Nizamabad, Andhra Pradesh, India, Journal of Environmental Research And Development, Vol.6 No.4, 1006-1011.
[37]. Rajashekhar A.V., Lingaiah A., Satyanarayana Rao M.S., Ravi Shankar Piska., (2007). The studies on water quality parameters of a minor reservoir, Nadergul, Rangareddy district, Andhra Pradesh J. Aqua. Biol. 22(1), 118-122.
[38]. Rajasthan Patrika, Surat, Gujarat, India, http://epaper.patrika.com/590286/Surat/17 -09-2015#page/4/1, visited on September 18th, (2015).
[39]. Ramesh K., Seetha K., 2013. Hydro chemical Analysis of Surface water and Groundwater in Tannery belt in and around Ranipet, Vellore district, Tamil Nadu, India, International Journal

of Research in Chemistry and Environment, vol.3(3), 36-47.
[40]. Rao, A M (2004). Studies on Limnology and fisheries in a Tilapia – Dominated Perenial Tank, Julur, Nalgonda District, Andhra Pradesh, Ph.D. Thesis, Osmania University.
[41]. Saxena R. and Sharma M., Qualitative and quantitative evaluation of water sources of few areas in and around Gwalior, M.P., India, J. Environ. Res. Develop., 8(3), 459469, (2014).
[42]. Henoy K. N., Ananya H. M. and Inchara R (2016), Quality of open well water in Udupi municipal area, Karnataka, India, Journal of Environmental Research And Development, Vol.11 No. 01, 43-51.
[43]. Soni V. et al., Preimpoundmental studies on water quality of Narmada River of India, Int. Res. J. Environ. Sci., 2(6), 3138, (2013).
[44]. Sridhar Kumar, K. Shnakaraiahb, P.L.K.M.Raoc and M. Sathyanarayana (2014), Assessment of water quality in Hussainsagar lake and its inlet channels using multivariate statistical techniques, International Journal of Scientific & Engineering Research, Volume 5, Issue 9, 327-333.
[45]. Srinivas Ch., 2005. Impact of river Musi pollution on the fisheries of Edulabad reservoir, Ranga Reddy District, Andhra Pradesh, India. Ph.D. Thesis, Osmania University, Hyderabad.
[46]. Tiwari A. K., Prasoon K. S. and Mukhesh K. M., (2016), Hydrogeochemical investigation and qualitative assessment of surface water resources in West Bokaro coalfield, India, J. Geol. Soc. Ind., 87(6), 631-760.
[47]. Verma P., Chandawat D., Gupta U., Solanki H., 2012. Water Quality Analysis of an Organically Polluted Lake by Investigating Different Physical and Chemical Parameters, International Journal of Research in Chemistry and Environment, vol.2(1), 105-111.