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Degradation of Adjacent Agricultural Land with Leachates of Packaged and Waste Food Dumped Near It

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ABSTRACT

Physico chemical parameters of dumped food leachates at dump site adjacent agricultural soil at Chapra city, Bihar were investigated for possible pollution impacts. Soil samples were collected in three replicates from two sampling points within the dump site and for control soil samples were collected about 200m. Standard methods were used to determine the following parameters. The pH of leachate affected soil ranged between 7.3 to 7.5 while in control it was 7.6 to 7.8. The electric conductivity 3.6 to 3.82 while in control 1.89 to 1.91, sodium % 5.62 to 7.86 in LAS and 4.25 to 4.68 in control, organic matter g/kg = 16.7 to 20.5 in LAS and 14.30 to 17.64 in control. Calcium carbonates (g/kg) 288.6 to 305.4 in LAS and 264.6 to 280.2 in control. Total nitrogen % in LAS 0.36 to 0.42% and 0.2 to 0.24 in control available phosphorous in mg/kg in LAS. 14.5 to 11.6 mg/kg and 8.62 and 9.15 mg/kg in control. Available potassium in LAS required between 432.4 to 451.6 mg/kg and 332.3 to 362.7 mg/kg in control amount of calcium 14.2 to 16.5 Cmol/kg in LAS and 12.2 to 12.8 Cmol/kg in control. The magnesium contents ranged between 4.2 to 4.6 Cmol/kg in LAS and 3.60 to 3.90 C mol/kg in control.

Keywords: Food leachate, Degradation, Agricultural soil, Leachate affected soil, Control soil, Pollutants.

I. INTRODUCTION

Along with the economic growth of the country the economic conditions of common people have also changed. Due to green revolution in India productions of cereals, vegetables and other commodities have also increased. Even the population has gone much higher no one is dying without food. In the present time we have forgotten the values of food and in every function, hotels and other shops 40% of the readymade food materials are dumped as waste in a particular dumping site in the city. When these food wastes are dumped, they are degraded by different microbes and the chemical present in these packaged or cooked foods which may includes cereals, pulses, vegetables, parts of fishes, mutton or chickens

are released in the soil. They gradually accumulate there and thus degrade the soil quality. The physico-chemical analysis of soil may give a clear picture regarding the chemical compositions of the soil which is affected by the leachates and the control soil which away from the dumping site. From the survey of literatures, it was gathered that several workers have worked on physico-chemical parameters analysis from the soil adjacent to different landfills. Some of them may be cited here such as Slack et al; (2007); Theepharaksapan et al; (2011); Chaudhary (2013); Dixit et al; (2015); Soni (2016); Nisha et al; (2017); Prajapati eet al; (2018); Akhionkare and Okoro (2019); Dandawate and Changdeo (2020) respectively. These workers have clearly pointed out that the land fill where different municipal waste or waste form the vegetables markets are dumped, on degradation releases several unwanted and toxic substances which do leach in the nearby agricultural land or water bodies, where they cause pollution. In the present work physico-chemical study was done for the selected parameters of soil taken from the adjacent agricultural land where the cooked and waste foods which also includes packaged foods are dumped. The leachate altered the soil with respect to different parameters.

II. Materials & Methods:

Soil samples were collected from the two sites near the dumping points of the waste food materials and two sites 200 M away from it. Samples from each site were collected in triplicates and placed into a re-sterilized poly bags. It was brought in the laboratory. 25 g of each soil sample was taken is 100 ml beaker. 40 ml distilled water was added in each. By regular stirring homogenous solution was prepared for the above soil. Soil samples near the dumping site were labeled as LAS means Leachate Affected Soil. While samples taken form distance as control. pH of each sample was taken with the help of digital pH meter. The electrical conductivity of the soil was determined in the filtrate of the water extract using conductivity meter. Percentage of organic carbon was determined by adopting chromic acid, wet digestion method, where di-phenyl amine was used as an indicator, nitrogen content was determined by Kjeldhal methods. Similarly, available, phosphorous, potassium, calcium, sodium, magnesium and calcium carbonate etc. were determined as per the methodology prescribed by different authors and the text book. The means of the data for all the above parameters have been presented in the table-1. All the experiments were done in triplicates.

III.Results and Discussion

pH of soil taken near the dumping sit as denoted by Las as well as the control sites revealed variations. The pH of LS ranged between 7.3 to 7.8, whereas form the control sites soil, it ranged between 7.6 to 7.86. Although normal soil is acidic but here the LAS soil revealed more acidic than that of the control. Similarly, electrical conductivity of LAS ranged between 3.6μ S cm2 to 3.82 μ S cm2 while at the control site it ranged between 1.89 to 1.91 μ S cm2.. So, due to the rotting food leachate the electrical conductivity of the LAS was increased more in comparison to the control soil. The organic carbon percentage of LAS ranged between 16.7% to 20.5% while at the control site soil, it ranged between 14.30 to 17.61%. This may also be correlated with the release of leachate from the degrading food materials. The variations in percentage of sodium at LAS site ranged between 5.62 to 7.86% in comparison to the control soil where it ranged between 4.25 to 4.68% respectively. Similarly, the amount of potassium ranged between 432.4 mg/kg to 4.51 mg/kg at LAS soil while at the control site, it was 332.3 mg/kg to 367.7 mg/kg respectively. In case of calcium content also the soilat LAS had higher amount than that of the control. The range was between 14.2 Cmol to 16.5 C mol in comparison to the control soil which was 12.2 C mol to 12.8 C mol respectively. Amount of nitrogen

also revealed variations between LAS soil and the control soil. While at LAS percentage of nitrogen ranged between 0.36 to 0.46% while at the control site it was 0.20 to 0.24% respectively. These variations may also be correlated with rotting or degrading different food materials dumped in the soil. So sample near this such as LAS had higher percentage of nitrogen them that of the control soil respectively. Amount of phosphorous was also calculated at the site of LAS and the control. Here it ranged between 14.5 mg/kg to 11.6 mg/kg at LAS and 8.62 mg/kg to 9.15 mg/kg at the control sites. This may be due to the adjacent soil of the dumping site that was LAS. While at the control site it was less. The amount of magnesium was also determined at both the sites. At LAS it ranged between 4.2 to 4.6 C mol while at the control site it ranged between 3.60 to 3.90 C mol respectively. The amount of calcium carbonate was also determined which ranged between 288.5 to 305.4 g/kg at LAS and 264.6 to 280.2 g/kg at the control sites.

Physico-chemical analysis of different parameters of soil near the landfills where, municipal waste materials are dumped have been done by different authors such as:- Azize et al; (2015); Mukherjee et al;(2015); Naveen et al; (2017); Ismail et al; (2018); Kumari et al; (2018); Maneka and Nilza (2020); and Thakur et al; (2019). All these workers also reported that there were variations in the different physico-chemical parameters of soil taken from the lands near the land fill and soil taken from the distance field form the land fill. Therefore, present findings corroborate with the above because here also the soil of LAS and soil taken form control field revealed discrepancy in different physico-chemical parameters considered here.

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Tables:

Table-1

Showing means of three replicates of leachate affected soil and control soil at two sites taken from dumping point at Chapra.

Parameters	Site-1		Site-2	
	LAS	Control	LAS	Control
pH	7.3	7.6	7.8	7.86
E.C. μ S cm^2	3.6	1.89	3.82	1.91
Organic carbon	16.7	14.30	20.5	17.64
Na%	5.62	4.25	7.86	4.68
K mg/kg	432.4	332.3	4.51	367.7
Ca C mol/kg	14.2	12.2	16.5	12.8
N%	0.36	0.20	0.46	0.24
P mg/kg	14.5	8.62	11.6	9.15
Mg C mol	4.2	3.60	4.6	3.90
$CaCo_3$ g/kg	288.5	264.6	305.4	280.2

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