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Research Article

EFFECT OF MUNICIPAL SOLID WASTE ON CHEMICAL NUTRIENTS OF SOIL – A CASE STUDY

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ABSTRACT

Soil is one of the important natural resource in environment. Soil fertility refers to the ability of a soil to sustain plant growth. A fertile soil will contain all the major nutrients for basic plant nutrition (e.g., nitrogen, phosphorus, and potassium), as well as other nutrients needed in smaller quantities (e.g., calcium, magnesium, sulfur, iron, zinc, copper, boron, molybdenum, nickel). Soil pollution caused by human activities, either directly or indirectly. Municipal solid waste is one of soil pollutant generated from homes, institutions (e.g., schools), commercial establishments, and industrial facilities. In the present study the investigation focus on the effect of municipal solid waste on the chemical nutrition levels of soil and analyze how much area is affected in and around the study area.

INTRODUCTION

Soil is a medium for plant growth in the way of transport of water and nutrients from the root level. Soil pollution occurs when the presence of toxic chemicals, pesticides, and fertilizers causing by increasing its salinity making it imperfect for crop bearing and the soil lose its fertility. In the recent days open waste dumping that cause land pollution. In the environment, chemicals and other contaminants found in solid waste can seep into our groundwater and the water become contaminated. Due to rapid increase in urbanization, industrialization and population, the generation rate of municipal solid waste in Indian cities and towns is also increased.

Objectives

- To determine the soil nutrition levels in the study area at a distance 0.5Km, 1Km, 2Km and 3Km.
- To analyze the results of nutrition levels in the study area between the years of 2016 & 2018 reports.

Study Area

Visakhapatnam is a biggest city and one of the smart city of Indian state of Andhra Pradesh. It has the administrative headquarters in Visakhapatnam district and eastern naval command of Indian navy. The Greater Visakhapatnam Municipal Corporation (GVMC) is preparing to reclaim nearly 100 acres of land at the Kapuluppada dumping yard, through a bio-mining process. The dumping yard is located about 30 km from the city and has received waste since 2001. Kapuluppada dumping yard is located in Bheemunipatnam at Visakhapatnam district. The dumping yard lies between latitude 17° 50'45 26"N and longitude 83° 22'03 27"E in kapuluppada. The dumping yard is located about 30km from the city and the waste is received since 2001.

METHODOLOGY

In this work, the preliminary data was collected from the Kapuluppada dumping site and for laboratory tests we approached Soil Testing Laboratory, Department of Agriculture, Vizianagaram District, Andhrapradesh. The test results are analyzed with reference to Indian Agricultural Standards .The first soil sample was collected at a distance of 0.5Km i.e nearer to the dump site and remaining samples were collected away from the dump site i.e at a distance of 1Km, 2Km and 3Km in and around the study area. After conducting laboratory tests on taken samples, the reports are obtained. From the reports we had done an analysis and prepare a

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comparative report with reference to the previously available data from the year of 2016.

RESULTS AND DISCUSSION

Results

In the present study, each time four soil samples collected from different points in the circumferential direction for laboratory testing at a distance of 0.5Km, 1Km, 2Km and 3Km away from the origin (centre) of dumping yard. The soil samples were collected at a depth of 15cm from the ground surface .After conducting laboratory tests on soil samples the following results were obtained.

Table 1 Laboratory test results of pH, EC& nutrition levels at a distance of 0.5Km, 1Km, 2Km &3Km

S. No	Parameters	0.5Km	1Km	2Km	3Km
1.	pH	8.05	7.69	7.53	7.82
2.	EC(mmho's/cm)	0.51	0.33	0.39	0.07
3.	Organic carbon	0.89	0.81	0.68	0.66
4.	Nitrogen(kg/acre)	238.3	129	118	223
5.	P205(kg/acre)	54.71	19.04	9.52	30.94
6.	K20(kg/acre)	1306	620	116.6	119.7

Table 2 Laboratory test results of micro nutrients at a distance of 0.5Km, 1Km, 2Km & 3Km

S. No	Parameters	0.5Km	1Km	2Km	3Km
1.	Sulphur(S)	20	33	30.5	16.3
2.	Zinc(Zn)	11.77	0.510	0.582	0.896
3.	Iron(Fe)	52.78	42.02	52.5	11.5
4.	Manganese(Mn)	22.0	4.89	4.24	20.2
5.	Copper(Cu)	17.84	0.483	0.781	0.283
6.	Boron(B)	2.56	1.17	1.00	0.38

Analysis between the Results of 2016 &2018 Years

Table 3 Results of pH, EC& nutrition levels at distance of 0.5Km from the origin of dump site

S.No	Parameters	Nutrition levels in the year of 2016 report	Nutrition levels in the year of 2018 report	Nutrition level changes between 2016&2018 reports	Remarks
1	pH	6.18	8.05	1.87	Increased
2	EC (mmhos/cm)	1.24	0.51	-0.73	Decreased
3	Organic compound	3.04	0.89	-2.15	Decreased
4	Nitrogen	262	238.3	-23.7	Decreased
5	P_2O_5(kg/acre)	91	54.71	-36.29	Decreased
6	K_2O (kg/acre)	363	1306	943	Increased

Table 4 Results of pH, EC& nutrition levels at distance of 1 Km from the origin of dump site

1	pH	7.63	7.69	0.06	Increased
2	EC (mmhos/cm)	1.18	0.33	-0.85	Decreased
3	Organic compound	2.13	0.81	-1.32	Decreased
4	Nitrogen	187	129	-60	Decreased
5	P_2O_5(kg/acre)	84	19.04	-64.96	Decreased
6	K_2O (kg/acre)	235	620	385	Increased

Table 5 Results of pH, EC& nutrition levels at distance of 2 Km from the origin of dump site

S.No	Parameters	Nutrition levels in the year of 2016 report	Nutrition levels in the year of 2018 report	Nutrition level changes between 2016&2018 reports	Remarks
1	pH	7.84	7.53	-0.31	Decreased
2	EC (mmho/cm)	1.14	0.39	-0.75	Decreased
3	Organic compound	2.04	0.68	-1.36	Decreased
4	Nitrogen	144	118	-26	Decreased
5	P_2O_5(kg/acre)	76	9.52	-66.48	Decreased
6	K_2O (kg/acre)	179	116.6	-62.4	Decreased

Table 6 Results of pH, EC& nutrition levels at distance of 3Km from the origin of dump site

S.No	Parameters	Nutrition levels in the year of 2016 report	Nutrition levels in the year of 2018 report	Nutrition level changes between 2016&2018 reports	Remarks
1	pH	7.86	7.82	-0.04	Decreased
2	EC (mmhos/cm)	1.09	0.07	-1.02	Decreased
3	Organic compound	1.42	0.66	-0.76	Decreased
4	Nitrogen	115	223	108	Increased
5	P_2O_5(kg/acre)	73	30.94	-42.06	Decreased
6	K_2O (kg/acre)	157	119.7	-37.3	Decreased

DISCUSSIONS

1. The pH values are decreased away from the dumping site i.e at a distance of 2Km & 3Km when compared to nearer to the dumping site. But compared to 2016 results there values are increased the P^H value is increased by 23% nearer to the site and increased by 50% at a distance of 3Km. when compare to 2016 results. When considering standard ranges of pH, the values in 1Km, 2Km & 3Km distances are in neutral. Soil pH is major factor influencing the elements in the soil for plant uptake.
2. Electrical conductivity is a measure of ionic concentration in the soils. The E.C is drastically decreased away from the dumping site. When compare to 2016 results, these values are decreased by 59% nearer to the site and 93% at away from the site i.e at of distance of 3Km if the E.C values is low in range is hazard to plant growth. If the E.C values are not in permissible limits, it effects the crop or plant growth. In the present study the E.C values are in permissible limits both in the years of 2016 & 2018.
3. The organic carbon is also drastically fall down by 71%, 62%, 66% and 53% at a distance of 0.5Km,1Km, 2Km & 3Km respectively when compare to 2016 results. The results shown that the O.C is very low at nearer to the dumping site. The fertility of soil is affected in and around the area of dumping site due to lake of organic carbon in the soil.
4. When considering standard ranges of Nitrogen, the present study area values are in medium range. But comparatively the nitrogen levels are low in 2018.

5. The phosphorous values are acceptable from the results of 2018. It is drastically decreased up to 3Km from nearer to the site.

6. The potassium levels are increased by 72% and 62% at 0.5Km and 1Km distances respectively and decreased by 34% and 24% in the distance of 2Km and 3Km respectively. It shows that the potassium levels increased nearer to the site and decreased away from the site.

Micro Nutrients

Sulphur: The Sulphur values are in above critical limits from the obtained results in the year of 2018 so it does not helps to plants resistance to disease.

Zinc: Zinc is useful in small amount to plant growth but it is also crucial. It is not affected in 1Km and 2Km distances but in above critical limits at nearer to the site.

Iron & Manganese*:* The levels of Fe & Mn are in above critical limits at all the distances in the study area. This deficiency leads improper growth of plant.

Copper*:* Deficiency of copper can lead to increased plant susceptibility to disease. In the present study area copper values are in above critical limits.

Boron*:* Boron values also in above critical limits. Boron deficiency affects vegetative and reproductive growth of plants.

CONCLUSION

From the above discussion it is concluded that the pH, E.C and nutrient levels are decreased and micronutritions like Mn, Cu, S and B levels are fall down up to 2Km away from the origin of dumping site.

In the coming years especially during the raining season, this could potentially lead to spread surrounding areas and contamination of the groundwater resources in the area

Recommendations

- Further study will help to determine how the ground water will contaminate in the coming years.
- A deep study will help to find out the rate of increment or decrement in chemical nutrients in the coming years.

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