

Assessment of the Impact of Municipal Solid Waste on Soil Quality Characteristics in Kannahalli, A Urban Fringe Area of Bangalore

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ABSTRACT

Disposal of municipal solid waste (MSW) in the cities has become a colossal problem worldwide. Indian cities are also facing many problems due to improper solid waste. Littering of waste indiscriminately leads to the formation of leachate and landfill gas polluting water and air. Bengaluru generates around 1.385 million tonnes of MSW annually and is generally landfilled. In the present study, an attempt has been made to understand the effect of MSW on the soil characteristics of Kannahalli, a peri-urban area in the northern part of Bengaluru which is around 20kms away from the city center. MSW is being dumped in this site since a year. Soil samples were collected by excavation at two different locations in the site viz., one right below the landfill and the other about 90ft away from the landfill site. The soil samples collected from sites were tested for change in pH, chloride percentage, alkalinity, BOD and COD. The chemical analysis depicts a rise in alkalinity, biochemical oxygen demand (BOD) and Chemical Oxygen Demand (COD) in soil collected in the landfill site signifying that this contamination of soil is due to MSW.

Keywords: Disposal of Municipal Solid Waste (MSW), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Chemical analysis, Contamination.

1. INTRODUCTION

Solid waste Management is a complex problem in both developing and developed countries. With the rapid increase in population, living standards, ever expanding cities and towns, there is an increase in quantity of municipal solid waste generation and hence the importance of solid waste management. Wastes contain all sorts of inorganic and organic contents. Though our Indian government has made rules for segregation of wastes before its disposal, implementation is very rare. Unscientific disposal of wastes can lead to many issues such as public ill health caused by bacteria present in the garbage, pollution of streams and other water sources, etc.

India being a developing nation, this problem of solid waste management is very crucial. Bangalore city, have a population of more than 10 million, and more than 1800 industries, generates about 5000 TPD of municipal solid waste. Currently, Bangalore wastes are being dumped at Kannahalli site.

Ever expansion of the city has encroached old dump yards and thereby demanding for its reclamation by improving geotechnical properties which has been deteriorated by dumping of wastes. Improper methods of ground improvement can

cause defects in structures built over it. As wastes degrade with time, it also changes in the chemical and engineering properties of soil, hence any reclamation of land for infrastructural development should be carried out after thorough analysis of chemical and geotechnical properties of soil.

Dr.Krishna M K et al. [1] collected contaminated and uncontaminated soil samples from Nayandahalli and Kengeri MSW disposal site and studied the effect of MSW on geotechnical properties on soil. Test results showed that chloride content of contaminated soil was higher than uncontaminated soil. pH and alkalinity of contaminated soil was lower than uncontaminated soil.

Olu korede M Osuolale et al. [2] collected laterite soil sample from a burrow pit at LAUTECH, dried for 24 hours and then soaked in different pH solutions (pH = 3,5,7,9) using diluted tetra oxosulphate acid and ammonia. Soil samples were taken and soaked for 14, 28,42,56,70 and 84 days for sun drying and tested in laboratory. Laboratory tests showed that consistency limits and maximum dry density decreased with increase in number of days. CBR values decreased with time.

Beena K S et al. [3] collected lateritic soil samples from Karukutty. Leachates were collected at site and added to sample in varying % (0, 25, 50, 75,100 %). Geotechnical properties were determined after 100 days of curing. The results indicated reduction in Atterberg limits, increase in shear strength as well as permeability.

The present study is to evaluate how the chemical properties vary with contamination. Laboratory tests were conducted to analyze refuse material. These include: BOD, COD, alkalinity, pH, and chloride content.

1.1. Materials and Methodology

In the present paper an attempt has been made to evaluate the effect of Municipal solid waste on geotechnical properties of soil at Kannahalli waste disposal site, Bangalore. Soil pits were excavated at two locations, one pit right below the land fill and the other one about 90ft away from landfill. Disturbed samples were collected in polythene bags, labeled and transported to laboratory for testing the chemical properties.

1.2. Laboratory determinations

Dumpsite soil contains several hazardous substances which pose threat to the environment. In this paper, contaminated and uncontaminated soils were analyzed for chemical properties such as pH, BOD, COD, alkalinity and chloride content.

2. RESULTS AND DISCUSSIONS

2.1 Uncontaminated Soil :

Table 1: Chemical properties of uncontaminated soil

Sl. No	Parameters	Results	Test method
	Description	Pale brown colored moist soil	Textbook of soil chemical analysis
1	pH (20% suspension)	6.86 at 23.7 °C	
2	Chlorides , as Cl ,%	0.030	
3	Alkalinity , as CaCO ₃ , ppm	15.2	IS: 3025 (part 23)
4	Bio chemical Oxygen Demand (at 27 °C for 3 days)	8.2	IS: 3025 (part 44)
5	Chemical Oxygen Demand	53.5	APHA

2.2. Contaminated Soil :**Table 2: Chemical properties of contaminated soil**

Sl. No	Parameters	Results	Test method
	Description	Pale brown colored moist soil	Textbook of soil chemical analysis
1	pH (20% suspension)	7.02 at 23.7 °C	
2	Chlorides , as Cl ,%	0.008	
3	Alkalinity , as CaCO ₃ , ppm	19.2	IS: 3025 (part 23)
4	Bio chemical Oxygen Demand (at 27 °C for 3 days)	8.8	IS: 3025 (part 44)
5	Chemical Oxygen Demand	57.6	APHA

2.3 pH of contaminated and uncontaminated soil

The results of test show that pH value of contaminated soil is little higher than that of uncontaminated soil. Since the range of pH values are around 7.0, both the soils are acidic in nature.

2.4 Alkalinity of contaminated and uncontaminated soil

The test results show that alkalinity value of contaminated soil is higher than that of uncontaminated soil. This may be the reason that pH of contaminated soil is slightly lesser than that of uncontaminated soil.

2.5 Chloride content of contaminated and uncontaminated soil

The chloride concentration in contaminated soil is lesser than that of uncontaminated soil. This may also be due to seasonal variations and the quality of dump at landfill site. Second reason may be alkalinity of contaminated soil being higher than that of uncontaminated soil.

2.6 BOD and COD of contaminated and uncontaminated soil

The results of test show that BOD and COD values of contaminated soil is higher than that of uncontaminated soil. But BOD/COD ratios of both soils are almost same and since their value is less than 0.3, samples are toxic in nature.

3. CONCLUSIONS

Based on experiment results obtained after analyzing both contaminated and uncontaminated soil samples, following conclusions have been drawn,

1. pH of contaminated soil is slightly higher than uncontaminated soil. pH of both soils is around 7.0, hence both soils are acidic in nature.
2. Chloride content of contaminated soil is lesser than that of uncontaminated soil, this may be due to higher alkalinity value of contaminated soil.
3. BOD and COD of contaminated soil is higher than that of uncontaminated soil.
4. Study concludes since alkalinity of contaminated soil is higher, the chemicals in wastes are oxidized and contaminating the soil. Also pH value is around 7.0, hence acidic in nature. These factors affect the quality of soil.

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