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STUDY OF THE IMPACT OF MUNICIPAL SOLID WASTE DUMPING ON SOME SOIL PARAMETERS NEARER TO VETTEKODE SOLID WASTE LANDFILL SITE IN MANJERI MUNICIPALITY

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Abstract: Dumping of solid wastes on land is a common waste disposal method and practiced almost by all the cities around the globe. Precipitation that infiltrates through the municipal solid waste leach the constituents from the decomposed waste mass and while moving down cause the subsurface soil to be contaminated by organic and inorganic solutes. In the present study an attempt has been made to evaluate the impact of municipal solid waste on the properties of soil at a landfill site of Manjeri Municipality at Vettekode. We have studied and made a comparison in properties of soil from dump site and non dump site area. The physical and chemical parameters such as pH, electrical conductivity, total organic matter, moisture content, available nitrogen, phosphorus, potassium in the soil samples were studied using various analytical techniques. The findings show that pH values are slightly higher in the polluted area than in the control. The electrical conductivity values are found to be very high for soil samples from polluted area when compared to control soil. Other parameters such as organic matter, total nitrogen, available potassium and available phosphorus are also found to be higher in the polluted area than the control.

Introduction

Solid waste land filling is the most common method of solid waste disposal. The landfill site at Vettekode is an open dumpsite, because the open dumpsites are low operating costs and lack of expertise and equipment provided no systems for leachate collections [1]. Open dumps are unsightly, unsanitary, and generally smelly. They attract scavenging animals, rats, insects, pigs and other pests. Surface water percolating through the trash can dissolve out or leach harmful chemicals that are then carried away from the dumpsites in surface or subsurface runoff [2, 3]. The Municipal Solid Waste (MSW) includes commercial and residential waste generated in municipal areas, in either solid or semi-solid form, excluding industrial hazardous waste, but including treated biomedical waste. The dumping of MSW without proper segregation adds to the complexity of the issue. The most commonly adopted method to manage solid waste in developing countries is to dispose in open dumps which causes serious environmental problems including health hazards [4]. Dumping of solid waste on land is a common waste disposal method, and practiced almost by all the cities around the

globe. In the last 200 years, world population has increased six times, and the urban population has multiplied 100 times [5]. Population growth and industrial revolution contribute to enormous amount of solid waste generation.

The solid waste dumping plant existed in Vettekode of Manjeri municipality has a capacity of two tonnes per day and run successfully by Socio economic unit foundation and was closed down three years back on account of public protest. This study involves the soil quality analysis in the Vettekode solid waste dumpsite nearer area. The aim of the study is to understand how the soil gets polluted due to the dumping of solid waste. The ten samples were selected for analysis Samples 1-4 were taken from dumpsite area and samples 5-10 were taken from less polluted areas.



The Municipal Solid Waste dumping plant at vettekode

Experimental

Sampling

For routine soil testing the field is divided to proportions according to variations. Separate samples are collected from different portions. These samples are mixed thoroughly and spread on a clean sheet of paper and divided into a 4 equal parts. Two opposite quarters are rejected and samples from the other two are mixed and the procedure is repeated till the desired quantity of the samples is obtained (1-2 kg). The final sample must be dried before collecting care has to be taken in to avoid contamination. The bag or the box must be properly labelled and taken to laboratory for analysis.

Laboratory Determinations

The soil pH was measured using a pH meter in 1:2.5 soil to water ratio. The electrical conductivity (EC) is used to measure the ability of an aqueous solution to carry an electric

current. The EC was determined using a conductivity cell containing a platinized electrode. For the determination of percentage organic matter the sample is made into fine powder by sieving. Take 10g of each ten soil samples. After pouring it in the separated crucible weight-out the ten samples. Then they are heated in a muffle furnace to 600⁰C and again weighed. Total organic matter is calculated from the difference between the two weights. Total Moisture content is determined by heating a known weight of the soil sample to constant weight in an electric oven at 70⁰c and finding the loss in weight. A known weight of the soil sample is oxidized using K₂Cr₂O₇ followed by the determination of nitrogen present in the soil sample by using digital balanced cell colorimeter. Potassium present in the soil is extracted with neutral ammonium acetate of 1M. This is considered as plant available K in the soil and it is estimated with the help of flame photometer. The readily soluble Phosphorus is extracted by combination with HCl and NH₄F phosphate in the extract is determined calorimetrically with ammonium molybdate and ascorbic acid as reducing agent

Results and Discussion

Experimental results obtained on effect of municipal solid waste Lechate on the characteristics of soil on both contaminated and uncontaminated soil were presented in Table 1. The pH of all the 10 samples lies in the acidic range, (i.e., <7). We can conclude that, pH value of uncontaminated soils is higher than the contaminated soils. The pH of the soil samples taken from dumping site signifies that it is slightly acidic in nature compared to uncontaminated soil which may be due to the presence of the solid waste [6]. The electrical conductivity of samples taken from less polluted areas have the value less than one and the samples taken from dumpsite have value greater than one [7]. The highest and lowest value of electrical conductivity is 0.183 and 1.839. All samples except sample 6, which is taken from a less polluted area, has a moisture content greater than five (5.8337) . The total organic matter present in the soil is higher for samples taken from dumpsite. The nitrogen availability in the soil is greater than one for highly polluted soil samples and that of samples from less polluted areas is less than one. The phosphorus present in soil for sample 6 and 9 is less and sample 10 is moderate (15.7), that of other samples are much high (32). The potassium present in the soil for all samples is greater than 200 and samples taken from dumpsite have value around 450. The results are consolidated in the in Fig. 1.

Table 1. *Soil Parameters estimated in contaminated and uncontaminated soils*

Samples	p ^H	EC (ds/m)	Moisture (%)	Organic Matter (%)	Nitrogen (N in Kg/Ha)	Phosphorus (P in Kg/Ha)	Potassium (K in Kg/Ha)
Sample 1	5.09	1.040	2.8808	22.3584	1.25	32	448
Sample 2	6.4	1.350	2.6950	28.2302	1.25	32	448
Sample 3	5.4	0.194	2.4976	23.0736	0.63	32	296
Sample 4	6.4	1.839	2.1002	16.6119	1.25	32	448

Sample 5	5.8	0.278	3.8093	11.1443	0.66	32	448
Sample 6	6.1	0.459	5.83377	16.4313	0.26	5.8	264
Sample 7	5.0	0.183	2.8037	11.5409	0.48	32	448
Sample 8	5.6	0.326	1.6519	11.1410	0.95	32	448
Sample 9	5.1	0.231	0.9869	10.8682	0.96	1.3	340
Sample 10	4.8	0.253	2.7884	20.3651	0.78	15.7	305

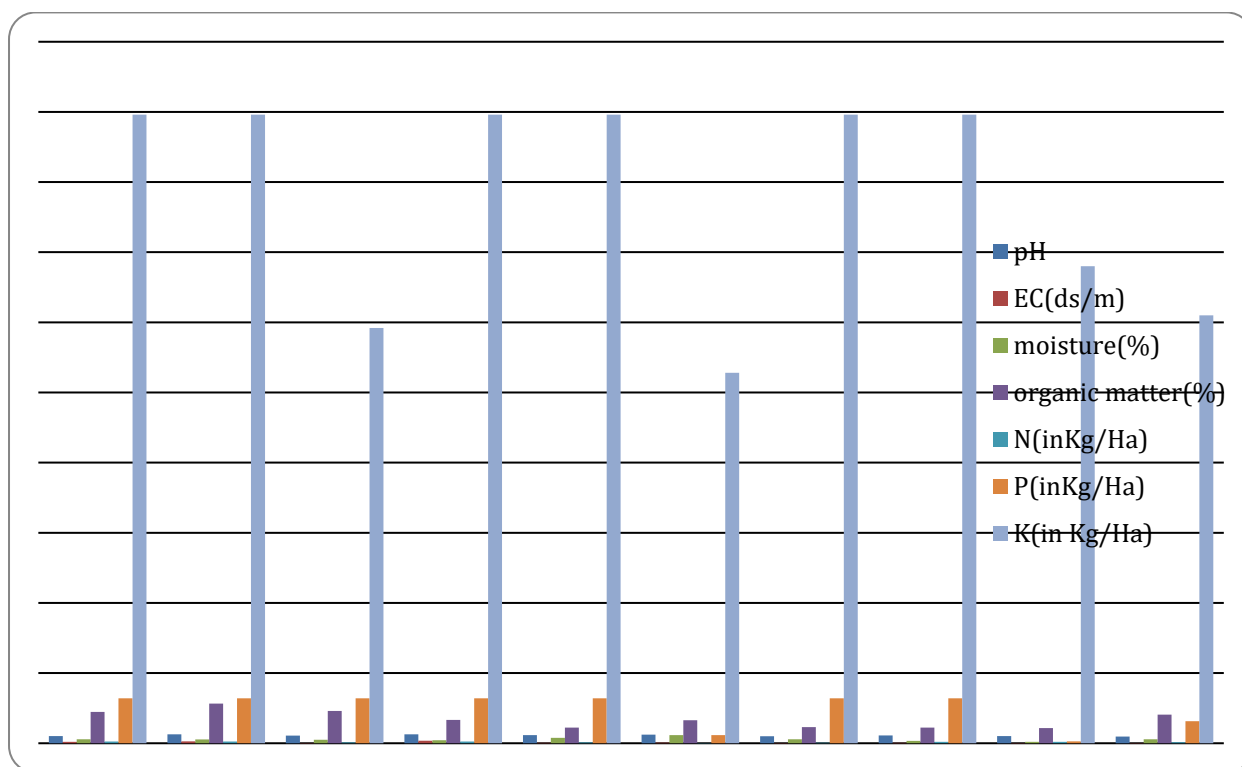


Fig. 1. Consolidated result of soil parametrs

Conclusions

The present investigation gives an insight into the probable impact of municipal solid waste on soil properties in comparison to control soil. It is apparent from experimental results that physicochemical properties of soil differ for municipal solid waste treated soil collected from different locations of dumpsite. The presence of large amount of ionic substances and soluble salts may have resulted in increased value of electrical conductivity in municipal solid waste treated soil in comparison to control samples. The samples from dumpsite show high organic content than samples from outside buffer zone [8, 9]. The values of NPK measurement also show a higher value for samples from dumpsite. After analysing data obtained from

studies of various parameters we should bear in mind that wastes should be sorted and wastes should be treated if possible [10]. When it comes to dumping of wastes a properly designed and engineered landfill should be constructed.

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