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Analysis of the Soil Properties of an Industrial Area in Latur

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Abstract: *In the present work, the physicochemical analysis and microbiological properties of soil in an industrial area of latur is carried out. The soil samples were collected from industrial area of latur. The parameters of soil analysis were pH, Alkalinity, Sulphate content, total solids, Organic matter and Microbial activity. The result of pH analysis revealed that the two samples from industrial area had noticeable pH variation from that of control. The alkalinity of the polluted samples was lesser than that of control. Sulphate content and total solids were high in polluted samples compared to control. Microbial activity is very low in acidic polluted samples, where in control it was very high. Due to the presence of heavy metals the total solid content of polluted soil was high. Due to the acidity of the polluted soils the organic matter and microbial activity were less.*

Keywords: Alkalinity, Microbes, Soil pH, Sulphate, Total Solids, Organic Matter

I. Introduction

Soil is one of the important and valuable resources of the nature. All living things are directly and indirectly dependent on soil for day to day needs and 95 % of the human food is derived from the earth. Making plan for having healthy and productive soil is essential to human survival. Soil is a natural body consisting of layers (soil horizons) of mineral constituents of variable thicknesses, which differ from the parent materials in their morphological, physical, chemical and mineralogical characteristics. Soil is composed of particles of broken rock that have been altered by chemical and mechanical processes that include weathering and erosion. The most possible sources of soil, water and plant pollutions are sewage sludge, residues of industrial factories and intensive fertilization. In suburban areas, the use of industrial waste water is common practice in many parts of the world [1, 2] including India [3].

Soil system is indeed very complex and dynamic undergoing continuous changes, and the rates of such changes being influenced by a number of factors of the environment [4]. Soil quality is defined as the capacity of a soil to function within the ecosystem boundaries to sustain biological productivity, maintain environmental quality and promote plant growth and animal health [5] Dumping of industrial wastes containing large amount of various chemicals which get accumulated on the top of the soil, results in loss of fertility of the soil. Such loss of fertility may lead to changes in the ecological balance of the environment. The present study is to analyse the Physico chemical and biological characters of the soil at latur MIDC ares. latur is well known for large and small scale industrial units. These factories manufacture a range of chemicals. They release number of gaseous into the atmosphere. The inorganic and organic substances present in the industrial wastes affect various soil characteristics like mineral strength and pH. The change in pH makes the soil acidic or alkaline. Increased acidity mobilizes heavy metals like Al, Cd, Zn, Hg, Mn, and Fe which inturn may affect the flora and fauna of the area to a great extent.

II. Materials And Methods

The soil samples were collected from two sites at the premises of the factories of latur. The following features of the soil were analysed: A soil suspension was made with soil and water in the ratio 1:2. Ten gram of soil sample was taken in a 50 ml beaker and added 20 ml of distilled water into it. The solution was stirred immediately with glass rod for 30 minutes. Again it was stirred just before taking pH reading. The pH was read using pH meter. The electrodes of the pH

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meter were washed with distilled water after each determination. For standardizing the pH meter, two buffer solutions of known pH values (pH4 and pH7) were used. Twenty gram of well dried soil was weighed out and was mixed with 100 ml of distilled water and placed in a rotary shaker for 2 hours for complete dissolution of ions. After filtration the filtrate of each sample was subjected to estimation of sulphate. Took 100 ml of sample in a 250 ml conical flask. Added 5 ml of conditioning reagent to it. Stirred the sample on a magnetic stirrer and during stirring added a spoonful of Barium Chloride crystals. Stirred only for one minute after addition of Barium Chloride crystals.

When the stirring was over, the optical density was read on a spectrophotometer at 420 nm. The concentration of sulphate was found out from the standard curve. It was plotted by employing the same procedure for the sample from 0.02 – 40.0 mg/L at the interval of 5 mg/L. An evaporating dish of suitable size was taken, dried and weighed. 50-500 ml unfiltered well shaken sample was put into it and evaporated on a water bath. After evaporation of the sample solution, dried it in an oven at 103 ^{o}C for one hour. It was cooled in a desiccator and the final weight was found out.

Total solids,

mg/L = (a-b) x1000000/ V

Where, a = final weight of the dish in gram

b = initial weight of the dish in gram

V = volume of sample evaporated in ml

Five gram of dried soil was weighed and transferred to a dried 500 ml conical flask. 10 ml of 1 normal $K_2Cr_2O_7$ and 20 ml concentrated sulphuric acid having silver sulphate dissolved in, it was added and mixed by gentle swirling. The flask was allowed to stand for about 30 minutes, and after reaction was over, diluted the contents by 200 ml of distilled water. 10 ml of phosphoric acid and 1ml of diphenylamine indicator were added to it. The colour changed to bluish purple. The contents were titrated with ferrous ammonium sulphate, until the blue colour changed to brilliant green. The end point was very sharp in this titration.

% Carbon = V1-V2/Wx 0.003 x 100

% Organic matter = % C x 1.72

Where, V1 = volume of $K_2Cr_2O_7$

V2 = volume of ferrous ammonium sulphate

W = weight of the soil taken

100 ml of sample was taken in a conical flask and 4 drops of phenolphthalein was added in it. If the solution remained colourless, the phenolphthalein alkalinity (PA) would be zero and total alkanity with methyl orange would be only determined. If the colour changed to pink after addition of phenolphthalein, titrated it against 0.1N HCl until the colour disappeared at the end point. Then 2 or 3 drops of methyl orange was added to the same sample and continued the titration, until the yellow colour changed to pink at the end point. This was the total alkalinity (TA).

PA as $CaCO_3$ mg\l = (A x N) of HCl x 1000 x 50 /ml sample

TA as $CaCO_3$ mg\l = (B x N) of HCl x 1000 x 50 /ml sample

Where, A = ml of HCl used only with phenolphthalein

B = ml of HCl used with Phenolphthalein and Methyl orange

Detection of microbial activity was done using dilution plate technique. The soil samples collected from polluted and control sites were transported to the laboratory, stored over night at 4 ^{0}C, air dried at room temperature and sieved prior to further use in the experiment. The polluted samples and the control sample were made into dilutions of 10^{-3}, 10^{-4}, and 10^{-5}. The total number of bacteria was determined on the nutrient agar medium. All the glass ware for the present study were washed thoroughly with detergent and water and rinsed with distilled water. The glass wares and the media were autoclaved at 121 ^{o}C and 15 lbs for 20 minutes. The inoculation was done in a Laminar Air Flow Chamber the culture media used for liquid and solid culture of bacteria was Nutrient Broth Medium. The constituents of the medium are:

- Peptic digest of animal tissue 0.5 % (w/v),
- Sodium chloride 0.5 % (w/v),
- Beef extract 0.15 % (w/v),
- Yeast extract 0.15 % (w/v),

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- PH (250C) 7.4 ± 0.2

Three gram of Nutrient broth medium was dissolved in 100 ml of distilled water. The medium was mixed well, autoclaved at 15 lbs pressure for 15 minutes and cooled to 50-55^{0}C. When used as solid agar medium, 2.0% agar (w/v) was added to the medium for agar plate preparation Nutrient Broth with 2% Agar was prepared and autoclaved in a 500 ml conical flask. 20 ml of the NBA medium was poured into each of the sterile Petri dish plates.

The plates were left undisturbed in an incubator for 8 hours and confirmed to be free of contamination. The sterile Nutrient Broth Agar plates were inoculated with the dilutions of soil samples. The dilutions were 10^{-3} , 10^{-4} , and 10^{-5} . The inoculated plates were incubated for 24 hours at 370 ^{0}C. The plates were examined for the presence of bacterial colonies. The number of bacterial colonies was counted using colony counter.

III. RESULT

In the present study, soil samples were collected from two zones of Latur industrial area. Control samples were collected from a nearby village of Latur. The pH of sample I was 3.92 (acidic), sample II was 5.10 (acidic) pH of control sample I was 7.73 (alkaline), sample II was 9.29 (alkaline) (Table 1) Sulphate concentration in sample I (0.88) and II (0.95) were high with respect their control samples (0.52, 0.55). Total solid were high in sample I (0.11) and II (0.11) with respect to the control (0.08, 0.06). Total organic matter was low in polluted samples (0.67, 0.76) and was high in control (4, 6.3). Number of bacterial colonies in polluted samples were very low, (22.12, 8.7) and in control it was high (111.2) **(Table 1)**

	Parameters	Sample I		Sample II	
		Polluted	Control	Polluted	Control
1	pH	3.92	7.73	5.10	9.29
2	Alkalinity	2.5	7.5	3	8.2
3	Organic matter mg/g	0.67	4	0.76	6.3
4	Total solids mg/g	0.11	0.09	0.12	0.07
5	Sulphate	0.88	0.52	0.95	0.55
6	Number of microbes	23.12	111.2	8.7	111.2

IV. DISCUSSION

The present study deals with analysis of the Physico- chemical and microbiological characters of the soil of Latur industrial area. Soil is a vital source which plays a critical role in terrestrial ecosystems. In the present study the soil samples from the industrial area showed an acidic pH. The control samples were either neutral or alkaline. High soil acidity plays a detrimental role in deciding the microbial flora of a region which is clearly evident from the results. An acidic soil can free many toxic metals from its combined state which in turn can make the soil toxic for both flora and fauna of the region. This may lead to severe biodiversity depletion. The sulphide content of the polluted samples was higher than that of control. The sulphide compounds present in the acid sulphate soils oxidise to sulphuric acid leading to the release of large quantities of Aluminium, Iron and other metals from the soil matrix which in turn can result in undesirable outcome [6] The present study shows that the polluted samples had high amount of total solids than the normal soil. This indicates the presence of heavy metals in the polluted soil. Heavy metals at an elevated level in the environment leads to an impairment of the metabolic activities resulting in reduced growth of the plants. Soil pollutants would bring in alteration in the soil structure, which would lead to death of many essential organisms in it. This would affect the breakdown of organic matter to release valuable nutrients, reducing the unavailability of major elements. These heavy metals can enter into the food chain and may get biologically magnified at different tropic levels. Microbial activity includes all the metabolic reactions and exchanges conducted by micro fauna and micro flora in soil [7]. Soil microbial biomass acts as an important ecological indicator and is responsible for the decomposition and mineralization of plant and animal residues present in the soil [8]. The present study shows there is reduction in microbial activity in the polluted soil compared with the normal soil. There is evidence that soil microbes and enzyme activities are sensitive to heavy metal contamination [9] the process of industrialization and urbanization leads to the

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generation of problems of local and regional environment, adversely affecting the quality of life. The rapid growth of population and technological and industrial boom have brought enormous problems and degradation of environment. Though the modern world cannot do without industrial growth, it should not be at the expense of nature and natural resources.

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