Physico-Chemical and Microbiological Studies of Soil Samples in Alathur Block, Prembalur District, Tamilnadu

A. Jafar Ahamed[1*], S. Ananthakrishnan[2] and K. Loganathan[1]

[1]PG and Research Department of Chemistry, Jamal Mohamed College (Autonomous), Tiruchirappalli, TN, India.
[2]Department of Chemistry, Rover Engineering College, Perambalur, TN, India.

Abstract

The current study has been undertaken to investigate the Physico-chemical properties of the soil samples of agricultural region collected from Alathur Block Prembalur and were analyzed. The soil characterization was carried out for the parameters viz soil pH, turbidity ,total dissolved solid, total hardness, total alkalinity, calcium, magnesium, nitrate, sulphate, chloride, fluoride, phosphate, iron, biological oxygen demand and chemical oxygen demand concentration. Microbiological characteristics of the soil samples were carried out Escherichia and staphylococcus auras species were the predominant bacteria generally isolated.

Keywords: Alathur Block; Perambalur; microbes; Physico-chemical characteristics.

1. INTRODUCTION

Soil may be defined as a non-indurated accumulation of solid particles produced by the physical and chemical disintegration of bedrock which may or may not contain organic life. Soils are capable of supporting plant life and agriculture produce. The natural process soil formation is very slow. The formation of process is due to operation of several factors like parent rock material, climatic condition, topography of region etc. India is a vast country its deservers natural environment has engendered various types of soils. A number of classifications have been suggested for the soil of India. It have been grouped into the following types red soil, black soil, lateritic soil alluvial soils desert soils (Venkat reddy *et al.* 2010).

India's environment is becoming fragile and environmental pollution is one of the undesirable side effects of industrialization, urbanization, population growth and unconscious attitude towards the environment. Though industrialization and development in agriculture are necessary to meet the basic requirement of people at the same time it is necessary to preserve the environment (Nidhi joshi *et al.* 2011). Soil as a component of the terrestrial ecosystem fulfills many functions including those that

are essential for sustaining plant growth. Some of the function includes partitioning of applied water into drainage and runoff, storage of the plant - available water. Supply of adequate oxygen to roots, provision of favourable conditions of seedling establishment, storage of nutrition are essential to plant growth. These functions constitute the criteria against which soil quality is assessed (Moody *et al.* 2008; Brady *et al.* 2002).

Nearly all human activities generate waste, and way in which this is handled, stored, collected and disposed of can pose risks to the environment and to public health (Zhu *et al.* 2008). Healthy soil consists of approximately 40% minerals, 23% of air, 23% of water, 6% of organic material and 8% of living organism. A study of soil profile supplemented by physical, chemical and biological properties of the soil will gave full picture of soil fertility and productivity good productive soil cropland (Galal *et al.* 2010). It is necessary to study soil microbes which perform some beneficial functions as well as some detrimental impacts to environment. The micro organism in the soil helps to improve the soil quality. In our present study to aim the base line data of soil nature and give the guideline to the sustainable development of crop production in our study area.

 * **A. Jafar Ahamed**   *Tel. no: +919003576896*
Email: agjafar@yahoo.co.in

2. GEOLOGY OF THE STUDY AREA

Perambalur is a centrals district of Tamilnadu, spread over 3, 69,007 ha. The district is bounded by Cuddalore district in the north Tiruchirappalli in the south, Thanjavur in the east and Namakkal and Tiruchirappalli districts in the west. The district lies in the southern plateau & hill zone of Agro-climate regional planning with characteristics of semi-arid climate. The soil is predominantly red loamy and black soil. The normal rainfall of the district is 908mm which is less than 946mm the normal rainfall of the state. The precipitation during northeast monsoon, southwest monsoon and remaining winter and hot summer weather period account for 52%, 34% and 14% of annual rainfall respectively. The ground water resource through tube well and well contributes nearly 68% of irrigated area command. The major crops grown in the district are paddy, groundnut, sugarcane, millets and onion.

3. MATERIALS AND METHOD

2.1 Soil Sampling

Soil samples were collected from ten different stations of Alathur block of Prembalur District soil samples were collected from the depth of 5cm to 10cm depth in the month January 2013 into labeled sterile Polythene bags and taken in ice-packed coolers to the laboratory for physico-chemical and micro-biological analysis. For chemical measurement the soil samples were air-dried and then sieved through a 20 mm sieve.

2.2 Physico-chemical Analysis of Soil

Aqueous extract of the samples were prepared by mixing 80g of the air dried samples with 100ml double distilled water in a 500ml beaker. Using hot plate magnetic stirrer the mixture was stirred for 30 minutes at 40.c and then the mixture was allowed to settle for one hour. Filtrate of soil-Water slurry (1:5 w/v) was used for chemical analysis. The same procedure was adapted for each sample. Soil pH and electrical conductivity (EC) and total dissolved solids (TDS) were determined using combined water quality multi-parameter probe Elico PE 138 (Jackson *et al*. 1973). The sum of the calcium (Ca) and magnesium (Mg) contents is the extract was determined by the Eriochrome black-T titration method and the sum to determine the Mg content. Total alkalinity (TA) was determined by titrating with 0.1 N HCl using methyl orange indicators. Chloride (Cl) content of the samples was determined by Mohr's method (United States Salinity Laboratory Staff *et al*. 1954). Turbidity of sulphate (SO_4^{2-}) were estimated using spectrophotometer. Fluoride was estimated colorimetrically by SPADNS [2-(P-Sulphophenylazo) 1,8-dihyroxynaphalene-3,6-disulphonic acid trisodium salt),$C_6H_9N_2O_{11}S_3Na_3$]. Nitrate (NO_3) was analyzed by spectrophotometric determination at 520 nm. A valve for biochemical oxygen demand (BOD) was obtained using the Winkler's titration method. Chemical oxygen demand (COD) was determined by dichromate open reflex method. Iron (Fe) and manganese (Mn) were analyzed using the atomic absorption spectroscopy (AAS).

2.3 Microbiological Analysis of the Soil Sample

The soil microbiological analyses of the samples were carried out according to the methods of Rabah (Rabah *et al*. 2008) and Oyeleke and Manga (Oyeleke *et al*. 2008a). The bacterial isolates were identified and characterize using standards Biochemical tests (Cheesebrough *et al*. 2006). The tests employed include gram stain, motility, catalyses, oxides, `methyl red nitrate, Voges-Proskaeur indole production and urease activity and citrate utilization tests.

Table 1: Physico-chemical characteristics of the soil samples

SAMPLE ID	TURBITITY	PH	EC	TDS	TH	TA	Ca	Mg	Cl	F	SO4	PO4	NO3	Fe	Mn	BOD	COD
S1	2.6	7.65	759	460	210	180	65	43	274	2	230	0.03	56	0.2	0.03	360	267
S2	3	7.52	847	510	232	215	50	48	268	2.4	156	0.01	49	0.5	0.06	455	256
S3	2.1	8.1	850	515	198	175	63	53	356	1.3	113	0.04	34	0.1	0.04	236	251
S4	2.7	8.4	772	485	187	190	65	49	195	1.9	223	0.07	29	0.2	0.6	345	185
S5	2.5	7.8	805	500	180	185	45	50	173	1	214	0	65	0.3	0.02	312	264
S6	2.8	7.9	910	580	215	195	48	49	256	2.6	196	0.01	41	0.5	0.1	387	224
S7	2.6	8.59	874	530	224	512	65	46	245	1.3	184	0.06	38	0.4	0	278	298
S8	3.1	8.21	826	510	195	134	52	43	261	3.6	178	0.7	26	0.6	0.8	320	245
S9	2.2	7.81	780	490	276	200	61	51	346	2.9	261	0	32	0.2	0.6	194	276
S10	2.6	8.15	804	502	212	183	48	48	178	0	163	0.01	46	0.1	0.5	265	147

4. RESULT AND DISCUSSION

The Physico-chemical properties of the soil samples analyzed are shown in the table1. The turbidity varies from 2.1 to 3.1 in the NTU units. In crop production pH values are very important parameter to note it varies from 7.52 to 8.59 this value shows soil is alkaline. Soil pH influences soil chemistry as well as availabilities of nutrients and toxic substance activities of certain pesticides (Pandeeswari *et al.* 2012). Under alkaline condition, solubility of minerals decreases causes the nutrient deficiencies occur.

Soil EC is an easily measured yet reliable indicator of soil quality, crop performance nutrient cycling and biological activity and can sever quick indicator of plant available nitrate – N (Johnson *et al.* 2005). Soils with EC below 400 ms/cm are considered marginally or non-saline while soil above 800ms/cm are consider severely saline. In our study area most the samples were fall in the higher saline and some of them sample consider as moderately saline. TDS value ranges from 460 to 510 mg/L these concentration varies from place to place shows the leaching of the rock salts and domestic sewages percolate into the soil.

The soil total alkalinity TA varies from 134 to 512 mg/L this variation is due to the carbonate and bicarbonate type of rock leached out into the soil. The total hardness of the soil indicate the presence Ca and Mg present in the form of $CaSO_4$ and $MgSO_4$, $CaCO_3$ or $MgCO_3$ etc., which varies from 180 to 276 mg/L.

The calcium and magnesium content in the soil solution ranges from 45 to 65 mg/L and 43 to 53 mg/L respectively. The range in the Ca and Mg in all the station were in the safe range. Increase and decrease in Ca may their uptake by living organisms and their release on decomposition. Although chloride (Cl) is classified as micronutrient plant may take up as much chloride as they do secondary elements such as sulphur [14]. The concentration of chloride is between 173 to 356 mg/L. Fluoride shows variation from 0 to36 mg/L, above is not considered as safe. Sulphate and phosphate are macronutrient elements essential for plants growth. Sulphate and phosphate ranges in our study area 130 to 261 mg/L and 0 to 0.7 mg/L respectively.

Nitrogen content in the soil system in different from it easily change from one form to another form by due to "Nitrogen cycle". The concentration of nitrate in the soil ranges from 26 to 65 mg/L. In our sampling station shows Mn and Fe content has no significant variation and were not recorded in excess amount and concentration shown in table1.

BOD is measured by decomposition of microorganism to organic substance. The amount of oxygen consumed in the dilution water ranges from 194 to 367 mg/L. The high value of BOD indicates the presence of excess of bio degradable material from domestic and agriculture sewage. COD varied from 185 to 298 mg/L shows that our sampling station has high soil pollution which is reflected to sewage discharged from the village and agriculture practices.

The bacterial cultures were isolated and indentified by pure culture technique, gram staining method and biochemical test method. Bacterial cultures were isolated from ten soil samples identified and maintained by sub-culturing them in nutrient broth. More than twenty five bacterial species were isolated and dominant species are taken for account. The result of the percentage frequency of occurrence is shown in table 2. From thtablee result Escherichia (31%) had the highest frequency of occurrences. This was followed by staphylococcus auras (25%). The lowest frequency of occurrence of 5% and 7% is pseudomonas putida.

Table 2: Frequency of Occurrence of Microorganism isolated

Bacteria isolates	Frequency of occurrence
Escherichia coil	31
Pseudomononas aeruginosa	10
Klebsiella pneumonia	12
Staphylococcus	25
Pseudomononas putida	7
Bacillus cereus	10
Staphylococcus Epidermis	5

5. CONCLUSIONS

The current study reveals that the domestic and agriculture waste causes the pollution problems in the surroundings environment of the sampling station. The Physico-chemical parameter shows the wide variation from one station to another station which

reflects the nutrient status of the station. Soil management practices after the physicochemical properties of soil and the soil microbial community may respond to these changes in way that the ability of the soil to resist soil borne diseases are due to increasing population, urbanization, industrialization and modern agricultural production. At most carrying of soil and it maintains will improve the productivity of crop and maintain the soil ecosystem.

6. ACKNOWLEDGMENTS

CONFLICTS OF INTEREST

REFERENCES

Venkat reddy, D., Engineering Geology, Vikas Publishing house pvt.Ltd. (2010).

Nidhi joshi and Ashwani Kumar, Physico-chemical Analysis of soil and Industrial Effluents of Sanganer Region of Jaipur Rajasthan, Research Journal of Agricultural science, 2(2), 354-356 (2011).

Moody, P. W. and Cong, P. T., Soil constraints and management package (scamp): Guidelines for suatainable management of tropical upland soils, Australian Centre for international Agricultural Research, Canberra ACT2601, Australia (2008).

Brady, N. C. and Weil, R. R., The nature and properties of solids, Prentice-Hall, inc. Pearson Education. Upper Saddle River, New Jersey (2002).

Zhu, D., Asnani, P. U., Zurbrugg, C., Anapolsky, S. and Mani, S., Improving Solid Waste Management in India: A source book for policy Makers and Practitioners, The World Bank Washington, DC (2008).

Galal, M., Zaiad, Physico-chemical analysis of soils in Al-Khums city, Libya, J. Appl. Sci. Res., 6(8), 1040-1044 (2010).

Jackson, M. L., Soil Chemical Analysis, Prentice Hall of India Private Limited, New Delhi (1973).

United States Salinity Laboratory Staff, Chloride by Titration with Silver Nitrate. Diagnosis and Improvement of Saline and Alkali Soils, Agricultural Handbook, Washington, DC (1954).

Rabah, A. B., Ijah, U. J. J., Manga, S. B. and Ibrahim, M. L., Assessment of Physico-chemical and microbiological qualities of abattoir wastewater in Sokoto, Nigeria, Nigerian J. Basic Appl. Sci., 16(2), 145-150 (2008).

Oyeleke, S. B. and Manga, S. B., Essentials of Laboratory Practicals in Microbiology, First edition, Tobest Publishers, Minna, Nigeria, (2008a).

Cheesebrough, M., District laboratory practice in tropical countries. Part 2, Low Price Edition, Cambridge University Press, London (2006). doi:10.1017/CBO9780511543470

Pandeeswari, N. and Kalaiarasu, S., Studies on the physico-chemical properties of the soil samples collected from different locations of tsunami affected soils of Cuddalore district of Tamilnadu, Int. J. Curr. Res., 4(7), 143-145 (2012).

Johnson, C. K., Eigenberg, R. A., Doran, J. W., Wienhold, B. J., Eghball, B. and Woodbury, B. L., Status of soil electrical conductivity studies by central states researchers, Trans. Am. Soc. Agr. Eng., 48(3), 979-989 (2005). doi:10.13031/2013.18510

Solanki, H. A. and Chavda, N. H., Physico-chemical analysis with reference to seasonal changes in soils of Victoria park reserve forest, Bhavnagar (Gujarat), Life Sci. Leaflets, 8(12), 62-68 (2012).