Poll Res. 40 (4) : 1567-1573 (2021)

ISSN 0257–8050

OBSERVATION OF PHYSICO-CHEMICAL PARAMETERS OF SOIL FROM ERODE CANAL IN ERODE DISTRICT, TAMIL NADU, INDIA

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(Received 19 September, 2021; Accepted 26 October, 2021)

ABSTRACT

Soil, which constitutes a significant portion of the earth's surface, serves as a source of food for a wide variety of living organisms. The soil provides a source of nutrient and support for plants. Soil physico-chemical parameters serves as a fundamental tool for assessing the status of the soil and also serves as the foundation for biological activity. In this research article, we have analysed the physico-chemical parameters of soil samples, collected from nine different locations along the Erode canal. From the result of physico-chemical investigations, we could able to find the nutrients present in the soil. The soil samples were found to be neutral to alkaline in nature. In our observations, there is a variation in physico-chemical parameters like pH, EC, Temperature, Manganese, Potassium, Phosphorous, Iron etc., was observed. There is a change in yhe level of Manganese, Potassium and Iron was noticed. The nature of the soil was found to be of the sandy clay type.

KEY WORDS : pH, EC, Temperature, Manganese and potassium

INTRODUCTION

Soil analysis and interpretation emerged out, because of the necessity to assess the quality of soils suitable for plant growth, to identify nutritional deficiencies in plants and to identify issues related to monitor the plant fertiliser requirements, and to identify harmful chemicals in plant-based meals. Micro and macro nutrient application is necessary in soils to boost agricultural productivity. Agriculture is nowadays has transformed from conventional to more intensive updated techniques utilising chemical fertilisers and pesticides in conjunction with irrigation infrastructures (Sahu, 2016).

Soil analysis is nothing but a collection of chemical procedures, which shows the amount of plant nutrients present in the soil, but also the chemical, physical, and biological aspects of the soil that are necessary for plant growth. Chemical soil analysis also determines the levels of essential plant nutrients, such as nitrogen (N_2), Phosphorus (P_2O_5), and Potassium (K_2O), as well as the pH, humus content, total $CaCO_3$, available lime, organic matter, total sulphur (S), and trace elements, as well as other physical characteristics like permeability, density, pH – value, conductivity and temperature.

Fertility of the soil is governed by its N (Nitrogen), P (Phosphorous), K (Potassium), organic and inorganic matter content and conductivity. The physical features of the substances in soil are moisture content and specific gravity. The chemical features are Nitrogen (N) (universal plant growth regulator), Potassium (K) is essential for flowering of plants. Potassium also involved in movement of water across plant cell and to add carbohydrate component in plant tissues and involved in enzyme activation. Phosphate(P) is essential for root growth in plants. Calcium(Ca) is a necessary component of the plant cell wall (Vilas, 2018).

MATERIALS AND METHODS

Geographical location of study area

Erode Canal is mostly used for irrigation purpose by

farmers. Erode canal lies in the vicinity of Erode in Tamil Nadu. The canal traverses from west to east across the city and flows into River Cauvery. The Cauvery river is one of the famous river of Tamilnadu, both historically and holistically and also mainly used for irrigation purpose by farmers. It runs for a length of about 29 km. We have collected the samples from nine locations. The nine locations were 1) Kathiram Patti 2) Rayapalayam, 3) Nanjanapuram, 4) Karapparai check dam, 5) Thindal, 6) Sengodampalayam, 7) Nalliyampalayam, 8) Surampattivalasu, and 9) Perumpallam Anicut. The soil samples were obtained using normal procedures. The physico chemical analyses were carried out in the laboratory. The places where soil samples were analysed were given in the below Map Figure 1.

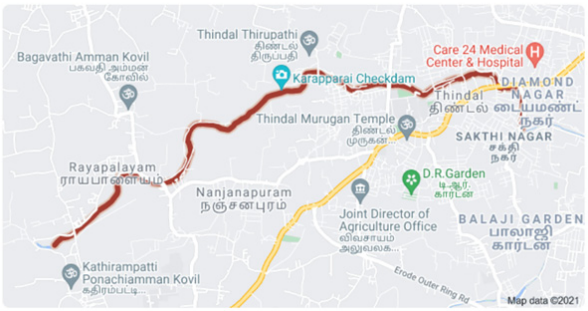

Fig. 1. Location of Erode Canal, Tamil Nadu

Physico chemical parameters analysed

Sampling and analysis of soil- The sampling is done from nine different geographical places as stated above, from Erode Canal, Tamil Nadu. The samples were subjected to basic physicochemical analysis for following parameters;

Physical parameter : Temperature, pH, Texture, Electrical conductivity (dS/m)

Chemical parameter : Calcium carbonate, Nitrogen, Phosphorus, Potassium and inorganic minerals like Fe (Iron), Mn (Manganese), Zn (Zinc), and Cu (Copper).

RESULTS AND DISCUSSION

Physical parameters (Results)

Table 1 denotes the Physico chemical parameters collected at various locations.

Temperature:

The Table 2 denotes the average and Mean temperature recorded at all nine locations and it was found to be 31.6±0.86 degree centigrade. The soil is found to be at normal temperature.

pH

The Table 2 denotes the average and mean pH at all nine locations and it was found to be 8.5±0.21. But the pH at location 3 (Nanjanapuram) was found to be 8.9, which shows slight elevation than the normal soil pH.

Electrical conductivity (deciSiemens/meter)

The Table 2 denotes the electrical conductivity of the soil, the mean and the average values of all the nine locations was found to be 0.3±0.070 deciSiemens/meter.

From Table 1 we could able to observe at Location-5 (Thindal) and at Location 7 (Nalliyam palayam) are found to be 0.4 deci Siemens/meter, which is increased than the other locations.

The Figure 1 denotes the Graphical representation of soil samples at all nine locations (Location: 1 to Location: 9).

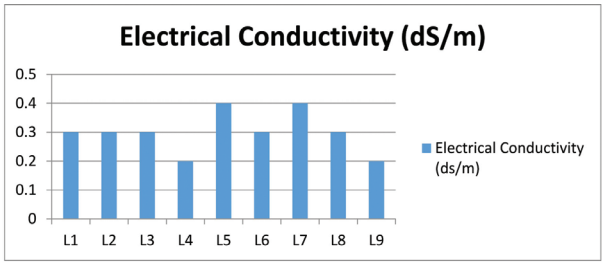

Fig. 1. Electrical Conductance of soil samples

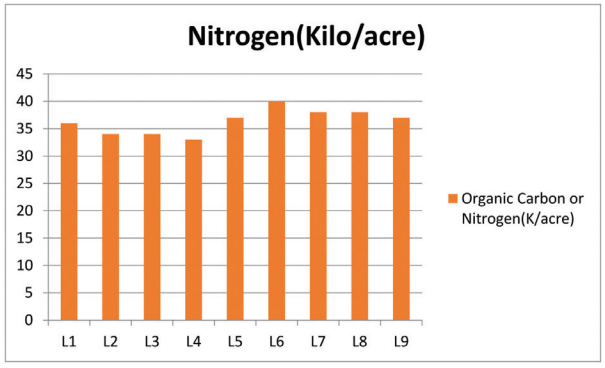

Fig. 2. Amount of Organic matter in soil samples

Soil texture: We have observed the soil texture as sandy clay type.

Chemical parameters

Table 1 denotes the chemical parameters of Macronutrients (Nitrogen, Phosphorous and Potassium expressed as Kilo/acre at all nine

locations) and micronutrients (Manganese, Iron, Zinc, and Copper expressed as kg/acre at all nine locations).

Nitrogen

Nitrogen is very much important for cell division and plant growth. Nitrogen also plays an important role in improving the food quality.

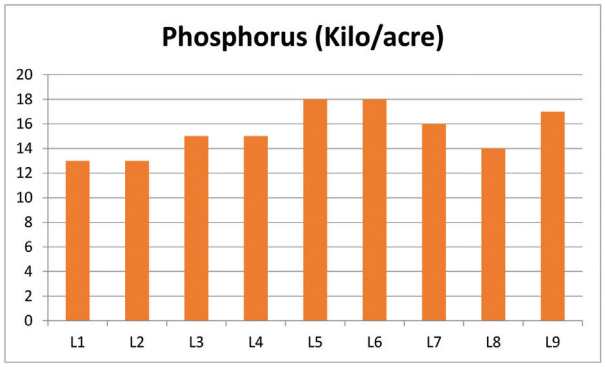

Fig. 3. Amount of Phosphorus in soil samples

In our observation from Table 2 the average and mean value of Nitrogen in soil sample at all nine locations was found to be 36.3±2.29 kg/acre. From Table 1 we could observe at location 6 (Sengodan palayam) the value of Nitrogen was found to be 40 kg/hectare which is above the average value recorded.

Figure: 2 Represents the graphical representations of organic Nitrogen in soil at all nine locations.

Phosphorous

Phosphorous is one of the important micronutrient needed for plant growth. Phosphorous is present in DNA of the plant cell. It is also needed for energy production and storage in plants cell.

Table 2 gives the average and mean values of Phosphorous at all nine locations in soil and was found to be 15.111±2.26 kg/acre**.** From Table 1 at location 5 (Thindal) and 6 (Sengodan palayam) the values was found to be 18 kg/acre and 18.1 kg/acre which is above the average values recorded. Figure 3 denotes the graphical representation of Phosphorous in soil sample at all nine locations.

Potassium

Potassium is very much essential for the physical aspects of plants. It is very much essential for the uptake of water through the plant roots. It is mainly involved in photosynthesis and plant carbohydrate.

The average and mean value of Potassium (Table 2) in soil was found to be 248±120.02 kg/acre at all locations. But at locations 3 (Nanjanapuram) (Table 1), the value of potassium was found to be elevated

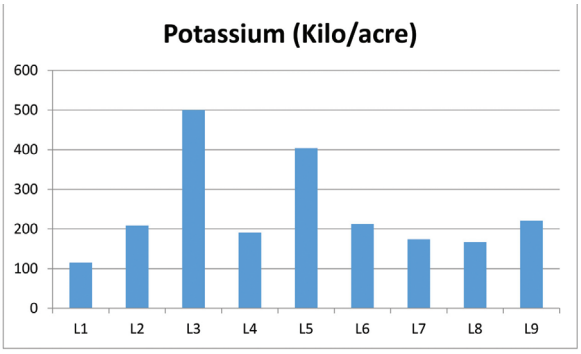

Fig. 4. Amount of Potassium in soil samples

Table 1. Shows the observation of physicochemical analysis for all nine samples.

Parameters	Unit	L 1	L 2	L3	L4	L5	L 6	L 7	L 8	L 9
Temperature	O^0C	33	32	30	31	32	32	31	32	32
Acidic/Basic properties	pH	8.6	8.6	8.9	8.5	8.6	8.1	8.4	8.5	8.7
Texture	-	Sandy clay	Sandy clay	Sandy clay	Sandy clay	Sandy clay	Sandy clay	Sandy clay	Sandy clay	Sandy clay
EC	dSm^{-1}	0.3	0.3	0.3	0.2	0.4	0.3	0.4	0.3	0.2
Calcium carbonate	%	No	Maximum	No	No	No	No	No	No	No
Nitrogen	k/acre	36	34	34	33	37	40	38	38	37
Phosphorus	k/acre	13	13	15	15	18	18	16	14	17
Potassium	K/acre	155	209	500	191	404	213	174	167	221
Fe	ppm	5.69	13.38	12.46	6.97	9.22	14.38	11.88	5.98	7.88
Mn	ppm	8.98	14.98	18.34	8.35	10.73	15.24	13.32	15.24	13.32
Zn	ppm	0.57	0.33	0.07	0.21	0.34	0.64	0.47	0.64	0.47
Copper	ppm	1.23	2.68	2.68	2.74	1.34	1.39	2.57	2.39	1.57

*K/acre———kilo/acre

L1-Kathiram Patti, L2- Rayapalayam, L3-Nanjanapuram, L4-karapparai check dam, L5-Thindal, L6-Sengodam palayam, L7-Nalliyam palayam, L8-Surampatti valasu, L9-Perumpallam Anicut.

500 kg/acre, which is very much higher than the other locations.

Figure: 4 denote the Graphical representation of Potassium in soil sample at all 9 Locations.

Iron

Iron is an important element, it helps in oxygen metabolism in plants, and it is responsible for the production of green colour in plants. Iron is needed for many enzymatic functions. The distribution of iron in soil is very much important as it helps for the plant growth and also for man survival on plants for food.

In our observation the Mean and Average value of Iron in soil (Table 2) is was found to be (9.76±3.32 ppm). But at location L-6 (Table 1), (Sengodan palayam) the value of Iron was found to be (14.38 ppm) which is slightly increased from other locations.

Figure 5 denotes the graphical representation of Iron in soil sample at all 9 locations.

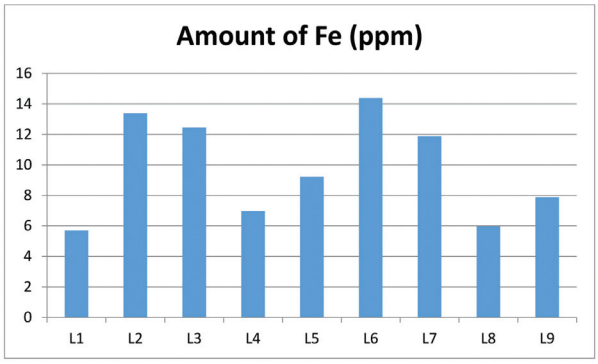

Fig. 5. Amount of Iron (Fe in parts per million) in soil sample

Manganese

Manganese is very much essential for oxidation and reduction process in plants.

The average and mean values of Manganese recorded in our observation (Table 2) in soil is (13.16±3.26 ppm). But at Location L-3 (Nanjunapuram), (Table 1) the value of Manganese in soil sample was found to be 18.34 ppm, which is increased from other locations.

Figure: 6 denote the graphical representation of Manganese in soil samples at all locations.

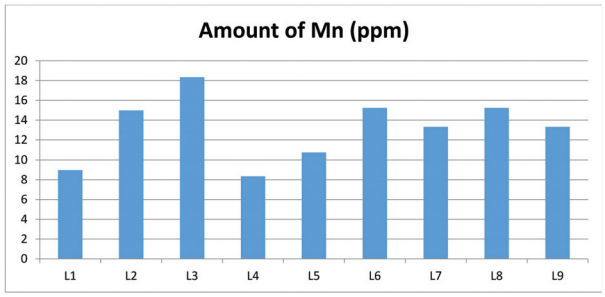

Fig 6. Amount of Mn in parts per million in soil samples

Zinc

Zinc is mainly involved in the activation of enzymes. It is also involved in the formation of chlorophyll and carbohydrates. The Average and the Mean value of Zinc (Table 2) in soil is (0.415±0.19 ppm).But at location 8 (Surampatti valasu), (Table 1), the value of zinc recorded was (0.64 ppm), which is higher than the other locations. Figure 7 denote the graphical representation of Zinc in soil samples at all 9 locations.

Table 2. Details of Average and Mean of Physical and Chemical parameters of all nine locations observed

Parameters	Mean and Standard deviations for all nine locations
PHYSICAL PARAMETER	
Temperature (°C)	31.6±0.86
pH	8,5±0.215
Electrical conductivity (deci Siemens/meter)	0.3±0.070
Chemical Parameter	
Macro nutrient	
Nitrogen (Kg/acre)	36.3±2.29
Phosphorous (Kg/acre)	15.111±2.26
Potassium (Kg/acre)	248±120.02
Micronutrient	9.76±3.2
Iron (ppm)	9.76±3.32
Manganese (ppm)	13.16±3.22
Zinc (ppm)	0.415±0.19
Copper (ppm)	2.06±0.658

Copper

Copper helps in plant photosynthetic activity. It is essential for plant metabolism. Copper is needed for plant respiration and proteins. The average and mean value of Copper (Table 2) in soil at all nine locations was found to be (2.06±0.658 ppm). But at location L-4 (Karaparai check dam), (Table 1) the value of Copper was found to be (2.74 ppm), which is slightly higher than other locations. Figure 8 denotes the graphical representation of Copper in soil samples at all nine locations.

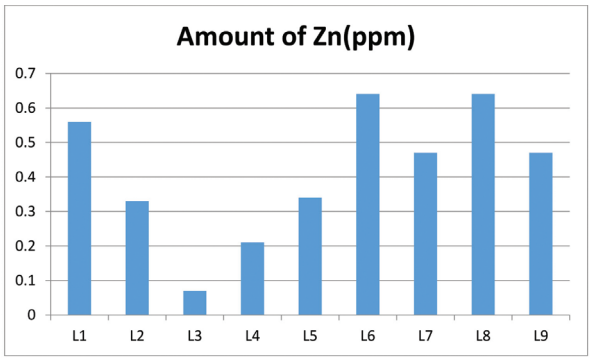

Fig. 7. Amount of Zn inparts per million soil samples.

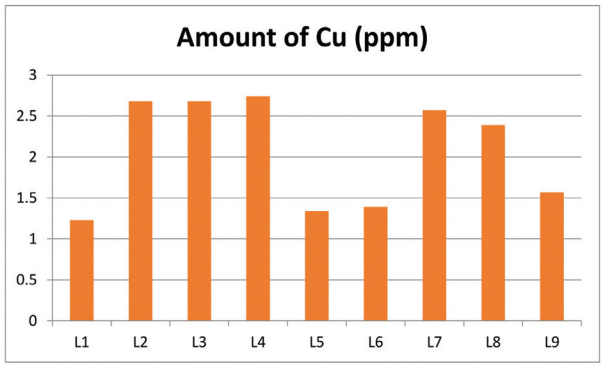

Fig 8. Amount of Copper (Cu in parts per million) in soil samples.

Calcium carbonate

Calcium carbonate was found to be maximum at Location -2 (Rayapalayam), but in other locations, Calcium carbonate in soil recorded a very low value (below the detection limit). The values of Calcium carbonate is shown in Table 1.

DISCUSSION

We would like to start our discussions on the physical and chemical characteristics of soil samples that have been examined at nine locations in and around Erode. The soil sample texture. we have collected is of sandy clay texture. Soil texture is a qualitative parameter to determine the soil structure.

We would like to discuss and compare our values of soil on physical parameters as given by (Scherer, 1996), as given below.

Soil classification	pH	EC (deci Siemens/ m)	Sodium adsorption ratio (meq/l)
Normal soil	<8.5	<4.0	<13
Sodic soil	8.5-10	<4.0	>13
Saline soil	<8.5	>4.0	<13
Saline-sodic soil	<8.5	>4.0	<13

Classification of Soil, pH, Electrical Conductivity and Sodium adsorption ratio (Scherer, 1996)

Our Comparision and observation of pH, Electrical conductivity, Temperature at all Locations (Physical parameters).

pH

The pH of the soil was found to be normal, as it lies between pH less than 8.5. The pH value of the soil is the most important parameter that affects all other properties of the soil. In our observation the pH of the soil on an average at all location is 8.5, so the soil is a normal soil.

Our observation on Electrical conductivity

Electrical conductivity is another very important soil property. Electrical conductivity also denotes the soil quality and also the presence of ions. Electrical conductivity also denotes the strength of ions. With increased ion concentration, the electrical conductance of a soil solution increases. Electrical conductivity is a very fast, easy and economical way of checking the soil status. In general, when the soil exceeds 0.25 deci Siemens /meter. Many plants experience stress due to salinity.

At location 1, 2, 3, 6 and 8 the Electrical conductivity was found to be 0.3 deciSiemens/m. At locations 4 and 9 the E.C. was found to be 0.2 deciSiemens /m.

The soil was found to be normal in Electrical conductivity at locations 1, 2, 3, 6, 8, 4 and 9 as the conductivity lies below 0.3 deciSiemens/m.

At location 5 and 7 the E.C. was found to be 0.4 deciSiemens/m. The soil in these locations the E.C is exactly equal to 0.4 deciSiemens/m, so it may also can be considered as normal.

Our observation on Temperature

The temperature of the soil was found to be normal as it lies between minus (-) 20 degree to 60 degree centigrade.

Our observation on chemical parameters

The soil becomes the final matrix for heavy metals discharged from various industries and it can become a sensitive tool and indicator for monitoring the contaminants (Nwachukwu *et al.,* 2010).

Much attention has been focussed in research in the last decades for soil pollution by heavy metals. (Zhang *et al.,* 2007). Heavy metals find their way into the soil due to ever increasing industrialisation and also the use of fertilizers due to atmospheric pollution (Mohammed, 2010).

In our observation the average level of Phosphorous and Potassium was found to be 15.111 kg/acre. and 248 kg/acre for Potassium.

The average level of Manganese and iron (micronutrient) was found to be 13.16 ppm for Manganese and 9.76 ppm for iron.

The average level of Zinc and Copper (micronutrient) was found to be 0.415 ppm for zinc and for Copper it is 2.06 ppm.

We would like to discuss our final observation of soils collected from nine locations. The level of heavy metals in our observation lies in the following order.

Manganese > Potassium > Phosphorous >Iron >Copper > Zinc

From our overall observations the micronutrients Manganese and iron was found to be highly sufficient when compared with other soil parameters. We would like to putforth our valid reason and discussion for the increase of soil nutrients Manganese Potassium and Phosphorous in our observation.

Most of the farmers in and around Erode district, often cultivate Turmeric, Sugarcane, Rice, Groundnut and banana for their major livelihood.

The main reason for the increase of Manganese, Potassium and Phosphorous in our soil sample might be, due to the often usage of artificial fertilizers and Manures for the crops that contains Manganese Potassium and Phosphorous. The nine places where, we have collected our soil samples is located near the canals and it is very nearer to the agriculture fields, in which the commercial food crops cultivations is practiced often by the farmers. The farmers often have to depend upon canals and borewell water for their irrigation purpose. The canals and borewells are already polluted by the industries and by other means.

The increase in the level of Iron and Copper in our soil sample is due to

a) Textile industries b) Leather Industries c) Automobile industries d) Pulp and paper industry e) Pharmaceutical industries located in and around Erode district.
b) The heavy metal discharged into the soil undergoes both reduction and oxidation depending on the soil condition. Heavy metals are serious polluting agents to the soil.

CONCLUSION

We would like to conclude our physicochemical observation of soil collected near Erode canal, in Erode district, Tamilnadu INDIA.

We would like to conclude in the following way

Manganese > Potassium > Phosphorous > Iron > Copper > Zinc, The level of Manganese, Potassium & Phosphorous was found to be increased due to the enormous use of fertilizers. The level of Iron and Copper was found to be increased due to industrial pollution.

The Zinc was found to be moderately decreased. The pollution in soil has to be controlled by adopting natural farming methods like using natural manures instead of using artificial chemical manures to a greater extent.

The iron and copper contamination in soil can be reduced by controlling the polluted industrial effluent into the soil by proper treatment & by applying modern methods.

The air we breath, the water we drink and the soil, where we grow plants for food is getting polluted day by day, because of increasing human selfish exploitation of nature by industrialisation and by other means has to be controlled to prevent the globe from getting polluted

The discharge of heavy metals into the soil is really a threat to earth and to living things.

ACKNOWLEDGEMENTS

I would like to thank my guide Dr Haresh M.Pandya for encouraging me in all aspects to do this research work in soil

REFERENCES

Chun-gang, Yuan, Jian-bo Shi, Bin He, Jing-fuL iuLi-na, Liang and Gui-bin Jiang 2004. Speciation of heavy

metals in marine sediments from the East China Sea by ICP-MS with sequential extraction. *Environment International.* 30(6) : 769-783.

Ibrahim Mohamed, Bocar Ahamadou, Ming Li, Changxiu Gong, Peng Cai, WeiLiang and Qiaoyun Huang 2010. Fractionation of copper and cadmium and their binding with soil organic matter in a contaminated soil amended with organic materials. *J Soils Sediments*. 10 : 973-982 DOI 10.1007/s11368-010-0199-1.

Kekane, S.S. and Chavan, D.S. 2015. A review on physico-chemical properties of soil. International Journal of Chemical Studies. *International Journal of Chemical Studies*. 3(4) : 29-32.

M. Aina, G. Matejka D. Mama, B. Yao M. Moudachirou 2009. Characterization of stabilized waste: Evaluation of pollution risk. *Environment International.* 6: 159-165.

Mohiuddin, K. M., Zakir, H. M., Otomo, K., Sharmin, S. and Shikazono, N. 2010. Geochemical distribution of trace metal pollutants in water and sediments of downstream of an urban river. *Environment International.* 7 : 17-28 2010.

Nwachukwu, M. A., Feng, H. and Alinnor, J. 2010. Assessment of heavy metal pollution in soil and their implications within and around mechanic villages. *Int. J. Environ. Sci. Tech.* 7 (2): 347-358, spring 2010.

Nwuche, C. O. and Ugoji, E. O. 2008. Effects of heavy metal pollution on the soil microbial activity. *Environment International.* 5 : 409-414.

Pooja Shrivastava and Rajesh Kumar, 2015. Soil salinity. A serious environmental issue and plant growth promoting bacteria as one, Saudi. *Journal of Biological Sciences.* 22(2) : 123-131.

Sahu, C. 2016. Physicochemical properties of soil under different land use practices located near Bhawanipatna town in Odisha, India. *International Journal of Environmental Sciences.* 6(6): 941-953.

Scherer, T., Seelig, B. and Franzen, D. 1996. Soil, Water and Plant Characteristics Important to Irrigation. *Environmental Science NDSU,* 1996 Published, (701) : 231-7881.

Seevagan, I., Kaleeswari, R.K., Backiyavathy, M.R. and Balachandar, D. 2020. Assessment of soil physical quality indicators in rice soils of cuddalore district of tamil nadu, India. *Journal of Pharmacognosy and Phytochemistry*. 9(4): 995-1001.

Tam, N.F.Y. and Wong, Y.S. 2000. Spatial variation of heavy metals in surface sediments of Hong Kong mangrove swamps. *Environmental Pollution* 110 : 195-205.

Vilas Y. Sonawane 2018. Determination of Physical Parameters and Metal Ions Concentration in Soil Samples around the Parva Village, Tq. Parbhani, Dist. Parbhani. *IOSR Journal of Engineering* 08(7): 17-19.

Zhang, X. Y., Lin, F. F., Mike T. F. Wong · X. L. Feng · K. Wang 2007. Identification of soil heavy metal sources from anthropogenic activities and pollution assessment of Fuyang County, China. *Environ Monit Assess* (2009) 154:439-449 DOI 10.1007/s10661-008-0410-7.