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Research Article

ASSESSMENT OF PHYSICO-CHEMICAL PARAMETERS OF SOIL OF MUTHANNAN KULAM WETLAND, COIMBATORE, TAMIL NADU, INDIA

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Abstract

Soil serves as a more reliable index for productivity than water qualities. The productivity of any pond depends largely on the quality of bottom soil that is "store house of nutrients." The present paper deals with the study of physicochemical parameters like organic carbon, pH, Electrical conductivity, Nitrogen, Phosphorus, Potassium of soil from Muthannan Kulam,Coimbatore (March 2013- May 2013). Analysis for the above parameters indicated contamination of the soil quality due to some anthropogenic activities.

Key words: Soil analysis; parameters; Muthannan kulam; anthropogenic.

Introduction

Soil acts as a thin layer of earth's crust which serves as a natural medium for the growth of plants and it is the unconsolidated mineral matter influenced by genetic and environmental factors. Soil differs from the parent material in the morphological, physical, chemical and biological properties.

Wetlands can be distinguished from uplands and other ecosystems by examining certain characteristics that relate to features such as water, soils, and biota, and to function such as hydrology, biogeochemical cycling, habitat and food webs. These characteristics and features are displayed in the layers (horizons) of the soil profile and it develop as a result of the interaction between the five soil forming factors are the nature of the parent material, climate, organisms, topography, and time.

Wetland soils are formed as the result of periodic to continuous inundation and soil saturation leads to anaerobic soil conditions and reduced decomposition, which results in the buildup of organic matter. As organic matter content in soil in-creases, bulk density decreases due to reduced particle density of the organic material compared to mineral soil (Craft, 2000). The growth and abundance of different aquatic flora and fauna are greatly dependent upon the presence of essential nutrients in water body in adequate and balanced quantities. The capacity of soil to retain water for aquatic flora and fauna and the ability of soil to provide various nutrients for biological production are assessed through the analysis of important soil constituents such as pH, specific-conductivity, total alkalinity, calcium, magnesium, chloride, nitrate-nitrogen, phosphate-phosphorus, sulphate, sodium and potassium. Most of the dying out component of our environment is being contaminated by human activities like rapidly urbanization, industrialization population explosion, agricultural waste and anthropogenic activity in and around pond (Coskun *et al*., 2006).

Materials and methods

Study area

Muthannan kulam is located at Coimbatore District, Tamil Nadu, India. This wetland is situated west of Tadagam road and south of Thondamuthur – Coimbatore road (Fig. 1). It is the next wetland after the Selvampathy and receives excess water from the Selvampathy. This wetland is located at 10° 59.457' N latitude and 76° 56.701' E longitudes.

Fig. 1: Study area – Muthannan kulam

The bulk of sandy loam black soil samples were collected from wetlands of Muthannan kulam, Coimbatore. Soils

were shade dried, sieved and analyzed for initial soil characteristics. Jars loaded with soil were used for the incubation study to assess the organic carbon, pH, Electrical conductivity, Nitrogen, Phosphorus, potassium. The soil textural class was sandy loam and consists of calcareous lime status. The experiments were carried out using the standard methods (Ministry of Agriculture, 2011)

Soil organic carbon

Soil organic carbon (SOC) was estimated by modified Walkley and Black method. Weighed 1.0 g of the prepared soil sample in 500 ml conical flask. Added 10 ml of 0.1667M $K_2Cr_2O_7$ solution and 20 ml concentrated H_2SO_4containing Ag_2SO_4. Mixed thoroughly and allow the reaction to complete for 30 minutes. And diluted the reaction mixture with 200 ml water and 10 ml H_3PO_4. Added 10 ml of NaF solution and 2 ml of diphenylamine indicator. Titrated the solution with standard 0.5M $FeSO_4$ solution gives brilliant green colour and a blank without sample is run simultaneously.

pH

Calibrated the pH meter, using 2 buffer solutions, one should be the buffer with neutral pH (7.0) and the other should be chosen based on the range of pH in the soil. The buffer solutions in the beaker was taken and inserted the electrode alternately in the beakers containing 2 buffer solutions and adjust the pH. Weighed 10.0g of soil sample into 50 or 100 ml beaker, added 20ml of $CaCl_2$ solution .Allowed the soil to absorb $CaCl_2$ solution without stirring, and then thoroughly stirred for 10 seconds using a glass rod. Stirred the suspension for 30 minutes and recorded the pH on the calibrated pH meter.

Electrical conductivity (EC)

40 g soil was taken into 250 ml Erlenmeyer flask, added 80 ml of distilled water, stopper the flask and shake on reciprocating shaker for one hour. Filter through Whatman No.1 filter paper. The filtrate is ready for measurement of conductivity. The conductivity electrode washed with distilled water and rinsed with standard KCl solution. Poured some KCl solution into a 25 ml beaker and dip the electrode in the solution. Adjusted the conductivity meter to read 1.412 mS/cm**,** corrected to 250 C. The electrode was washed and dipped in the soil extract. Record the digital display corrected to 250 C. The reading in mS/cm of electrical conductivity is a measure of the soluble salt content in the extract, and an indication of salinity status of this soil. The conductivity can also be expressed as mmhos/cm.

Total Nitrogen (Kjeldahl Method)

1g sample of soil was weighed and Placed in Kjeldahl flask and added 0.7 g copper sulphate, 1.5 g K_2SO_4 and 30 ml H_2SO_4. Heated gently until frothing ceases. Boiled briskly until solution is clear and then continue digestion for at least 30 minutes. Removed the flask from the heater and cooled, added 50 ml water and transfer to distilling flask. Accurately 20–25 ml standard acid (0.1M HCl or 0.1M H_2SO_4) was taken in the receiving conical flask so that there will be an excess of at least 5 ml of the acid. Added 2-3 drops of methyl red indicator. And also added enough water to cover the end of the condenser outlet tubes. Added 30 ml of 35% NaOH in the distilling flask in such a way that the contents do not mix. Heated the contents to distil the ammonia for about 30-40 minutes. Removed receiving flask and rinsed outlet tube into receiving flask with a small amount of distilled water. Titrated excess acid in the distillate with 0.1M NaOH. Determined blank on reagents using same quantity of standard acid in a receiving conical flask.

Available phosphorus (Olsen's method)

Added 50 ml of the bicarbonate extractant to 100 ml conical flask, containing 2.5 g soil sample. Added 1 g activated carbon. Shaken for 30 minutes on the mechanical shaker and filter. Read the blue colour after 10 minutes on the spectrophotometer at 660 nm wavelength after setting the instrument to zero with the blank prepared similarly but without the soil.

Available Potassium

Extraction: Added 25 ml of the ammonium acetate extractant to conical flask fixed in a wooden rack containing 5 g soil sample. Shaken for 5 minutes and filtered. Determined potash in the filtrate with the flame photometer. Preparation of the Standard Curve: Set up the flame photometer by atomizing 0 and 20 µg K/ml solutions alternatively to 0 and 100 reading. Atomized intermediate working standard solutions and recorded the readings.

Result and discussion

Physico chemical soil analysis of Muthannan kulam is shown in Table-1. Soil pH is an important consideration for farmers and gardeners for several reasons, including the fact that many plants and soil life forms prefer either alkaline or acidic conditions or the pH can affect the availability of nutrients in the soil (Patil, 1991). The pH value is measured for all locations and its value ranges from 7.25 to 8.71. The pH value of Muthannan kulam soil recorded a value of 7.45 which is neutral. Soil EC is an easily measured yet reliable indicator of soil quality, crop performance, nutrient cycling, and biological activity and can serve as a quick indicator of plant-available nitrate-N (Doran, 2005; Eigenberg *et al*., 2002; Johnson *et al*., 2005; Patriquin *et al*., 1993). The EC value is ranges from 1.14 to 5.26 ds m^{-1}.The EC value of Muthannan kulam soil recorded a value of 1.43 dS m^{-1} which is slightly saline. The total nitrogen recorded during the study as high value 188 kg ha^{-1} due to domestic purposes around the study area shown in Fig. 3. Similar observations were reported by (Kalaiarasu and Pandeeswari, 2012).

The nitrate content of soil blazoned that maximum nitrate values recorded in summer season and minimum nitrate values recorded in rainy season (Mahajan and Billore, 2014). The available potassium content of Muthannan kulam revealed higher value of 1266 kg ha^{-1}. Potassium

levels tend to be higher in soils with a neutral to acidic pH number and it leads to water pollution even though plant vegetation is adequate due to all anthropogenic activities shown in (Fig. 2).

Table 1: Physico chemical soil analysis of Muthannan kulam

Parameter	Value	Unit	Comments
Organic carbon	(%)		
pH	7.45		Neutral
EC	1.43	dS m^{-1}	Slightly saline
Available N	188	kg ha^{-1}	High
Available P(Olsen's)	29.0	kg ha^{-1}	High
Available K	1266	kg ha^{-1}	High

Fig. 2 Anthropogenic activities in Muthannan kulam

Fig. 3: Domestic sewage opening into Muthannan kulam

Conclusion

The present study demonstrates that the physicochemical parameters like pH is neutral, Electrical conductivity are slightly saline in the study period. Whereas the concentration of nitrogen, phosphorus and potassium is high due to the anthropogenic activities like domestic sewage, uncontrolled construction works, converting the ponds into agricultural areas, accumulation of heavy metals and hydrocarbons etc., in and around Muthannan kulam. This causes depletion in the soil as well as changes the soil permeability causing the soil to become impervious which blocks water infiltration, reduces soil stability, and cause effects to the environment. Public awareness is required to know about the natural resource management and biodiversity.

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