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Textural analysis of soil and sediment samples & estimation of total organic carbon in and around Central university of Jammu campus in Bagla village, district –Samba (Jammu),Jammu and Kashmir

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Abstract

Soil is a normally unconsolidated and loose mixture of mineral and organic particles, which occurs naturally and covers the outer surface of the earth. Soil is formed as a result of mutual and interactive impacts of pedogenic processes. The present study deals with textural analysis of soil and sediment samples & estimation of total organic carbon in and around campus of Central University of Jammu located in Bagla village district Samba. The study was carried out with the objective to determine the textural properties of the most weathered sediment in the weathering profile exposed along the road cut section in the upcoming campus of Central University of Jammu and to study the influence of weathering processes in generating fertile sediments. The soil and sediment samples were collected in and around Vijaypur block of district Samba in the locality Bagla (Rahya suchani). With the given latitude- 34.09°N & longitude-74.79°E are the geo- coordinates of the Bagla (Rahya Suchani). The soil and sediment samples were collected from five different locations which were analysed for six different parameters i.e. soil organic carbon, soil organic matter, soil moisture, soil pH, soil conductivity, textural analysis. The Grain size distribution pattern of the sediments indicates that the most weathered sample are derived from transportation action where Aeolian processes is not playing a key role, texturally the most weathered

sediments of the weathering profile(coarse sand) classified into coarser sand deposits and generally sediments are poorly sorted in nature not making rich in fertility status. However, high level of organic activity leading to high biological diversity in the soil. The soil pH indicates the alkaline nature of soil. The soil pH which was reported above 7 for the entire sample indicates alkaline nature of soil. The study area is classified in a lower rainfall regime which was supported with the results of soil moisture recorded to be less than 20% for all the sampling location.

Key Words: Texture, SOM, Aeolian, Weathering profile.

Introduction

Soil is one of the most important component of the environment. Soil is uppermost layer of the earth's crust. The study of soil is known as Pedagogy. Soil has two main properties i.e. physical and chemical properties. Physical properties of the soil are soil texture, colour, odour etc. and chemical properties are soil organic carbon, soil organic matter, soil pH, electrical conductivity. Pedogenic processes are also in turn affected by paedogenesis factors, and, the constituents of soils are formed under influence of climate and vegetation by the course of time and in different topographic conditions. Various soils are generated by mutual impacts of the abovementioned pedogenic factors and also human intervention and depend upon intensity and extent of the aforementioned effects. The geographical distribution of soils also differ in terms of variations in pedogenic factors, and consequently, different soils with variant properties and attributes and different talents and capacities, and occasionally, with different restrictions are formed. Texture, or size distribution of mineral particles (or its associated pore volume), is one of the most important measures of a soil because finely divided soil particles have much greater surface area per unit mass or volume than do coarse particles. Total organic carbon is the amount of carbon found in an organic compound in the soil.

Objectives

- To determine the textural properties of the most weathered sediment in the weathering profile exposed along the road cut section in the campus of Central University of Jammu.
- To determine the fertility status of the soil by ascertaining the level of soil organic carbon and soil organic matter.
- To study the influence of weathering processes in generating fertile sediments.

Methodology

For Soil Organic Carbon, Walkley Digestion Method was used. A weighed amount (0.50 gm) of the soil samples with of a variable quantity of organic carbon was treated with 10 ml of 0.25 N potassium dichromate solution ($K_2Cr_2O_7$) followed by addition of 30 ml of concentrated

sulphuric acid. The mixture was gently swirled and left at room temperature for 3-4 hours and then, 100 ml of distilled water was added to the mixture. The excess of dichromate was back-titrated potentiometrically with the standard 0.25 N ferrous ammonium sulphate ($(\text{NH}_4)_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$) solution. Blank titration of the acidic dichromate with ferrous ammonium sulphate solution was performed.

For Soil Moisture, **Gravimetric Method** was used in which 50gm of wet soil sample in the beaker of 100ml. Then total 16 samples were collected from different area of Bagla. Then the samples were taken in the oven for finding out the soil moisture content at 105°C temperature. The soil samples were kept for atleast 24 hours in an oven.

For Soil Conductivity, APHA 2012 22nd Edition. The conductivity of soil was measured with the help of digital conductivity meter. The conductivity meter was calibrated before use with standard potassium chloride solution (0.01M). The solution of soil to water was prepared in the ratio 1:2.5. The results were expressed in $\mu\text{mho}/\text{cm}$ at room temperature of approximately 25°C.

For SOIL pH, APHA 2012 22nd Edition. The pH of soil was measured with the help of digital conductivity meter. The conductivity meter was calibrated before use with standard potassium chloride solution (0.01M). The solution of soil to water was prepared in the ratio 1:2.5.

Textural Analysis

Grain size is studied for variety of reasons. It is fundamental property and descriptive measure of sediments and sedimentary rock (Lindholm, 1987). It is also important in understanding the mechanism operative during transportation and deposition, as well as the distance of sediment transport. Sieving Method was used for textural analysis of soil. Sieving is commonly used in the determining the grain size distribution of the coarse-grain sediments. In Sieving method, 50 grams of sample was placed in the uppermost sieve in a set of stacked sieves (size ranging from 2mm to 0.063mm). The stack of sieves was arranged in an order so that the coarsest sieve is at the top with the finer below (with pan at the bottom to catch any sediment that passes through the lowest and finest sieve). The stacks of sieve were shaken continuously for 30-35 minutes. Sediments of different sizes that had collected on each sieve and the pan was removed and weighed. Before placing the next sample the sieve was cleaned properly with the water and ethyl alcohol. (Gradistat software version 4.0 for sample statistics to study grain size distribution)

Results & Discussions

The results of the study which was carried out in Vijaypur block, District Samba in and around Central University Jammu campus is shown in Table no. 01.

TABLE NO. 1

LOCATION»»»» PARAMETERS ⇓	Central University Campus, Bagla	Near V.C. Office, CUJ, Bagla	Tarera, Bagla	Peer Baba, Bagla	Agricultural field, Raya Morh
Soil Organic Carbon	0.32%	N.D.	0.78%	0.040%	0.46%
Soil Organic Matter	0.55%	N.D.	1.39%	0.070%	0.79%
Soil Moisture	18.6%	12.12%	9.94%	15.25%	9.06%
Soil pH(1:2.5Soil Water Extract)	7.42	7.2	7.0	7.56	7.52
Soil conductivity (1:2.5Soil Water Extract)dS/m	0.048	0.191	0.035	0.0229	0.278

SAMPLING LOCATION 1: CENTRAL UNIVERSITY CAMPUS, BAGLA (TOP 6cm)

TEST	METHOD/PROTOCOL	RESULT
Soil Organic Carbon	Walkley digestion method	0.32%
Soil Organic Matter	Walkley digestion method	0.55%
Soil Moisture	Gravimetric method	18.6%
Soil pH(1:2.5 Soil water extract)	APHA 22 nd Edn:2012	7.42
Soil Conductivity (1:2.5 Soil Water Extract) μ S/cm	APHA 22 nd Edn:2012	48.2

SAMPLING LOCATION 2: NEAR V.C. OFFICE, CUJ, BAGLA (TOP 6cm)

TEST	METHOD/PROTOCOL	RESULT
Soil Organic Carbon	Walkley digestion method	N.D.

Soil Organic Matter	Walkley digestion method	N.D.
Soil moisture	Gravimetric method	12.12%
Soil pH (1:2.5 Soil water extract)	APHA 22 nd Edn:2012	7.2
Soil Conductivity(1:2.5 Soil water extract) μ S/cm	APHA 22 nd Edn:2012	191.0

SAMPLING LOCATION 3: TARERA, BAGLA (TOP 6cm)

TEST	METHOD/PROTOCOL	RESULT
Soil organic carbon	Walkley digestion method	0.78%
Soil organic matter	Walkley digestion method	1.39%
Soil Moisture	Gravimetric method	9.94%
Soil pH (1:2.5 Soil Water Extract)	APHA 22 nd Edn:2012	7.0
Soil Conductivity(1:2.5 Soil Water Extract) μ S/cm	APHA 22 nd Edn:2012	35.49

SAMPLING LOCATION 4: PEER BABA, BAGLA (TOP 6cm)

TEST	METHOD/PROTOCOL	RESULT
Soil Organic Carbon	Walkley digestion method	0.040%
Soil Organic Matter	Walkley digestion method	0.070%
Soil Moisture	Gravimetric method	15.25%
Soil pH(1:2.5 Soil Water Extract)	APHA 22 nd Edn:2012	7.56
Soil Conductivity (1:2.5 Soil Water Extract) μ S/cm	APHA 22 nd Edn:2012	22.90

SAMPLING LOCATION 5: AGRICULTURAL FIELD, RAYA MORH (TOP 6cm)

TEST	METHOD/PROTOCOL	RESULT
Soil Organic Carbon	Walkley digestion method	0.46%

Soil Organic Matter	Walkley digestion method	0.79%
Soil Moisture	Gravimetric method	9.06%
Soil pH(1:2.5 Soil Water Extract)	APHA 22 nd Edn:2012	7.52
Soil Conductivity(1:2.5 Soil Water Extract) μ S/cm	APHA 22 nd Edn:2012	278.1

1. SOIL ORGANIC CARBON & SOIL ORGANIC MATTER

The level of Soil organic carbon in the most weathered sample of the weathering profile varies between 400mg/kg to 7800mg/kg. However the level of Soil organic matter varies between 700mg/kg to 13900mg/kg. The sample near the Peer Baba showed the lowest value of organic carbon and organic matter. However, the sample near Tarera showed the highest value of both Soil organic carbon and Soil organic matter. The Soil organic carbon and soil organic matter were not detected in the sample near V.C. Office indicating lower extent of weathering and organic activity as compared to other locations of the present study area.

2. SOIL MOISTURE, SOIL pH, SOIL CONDUCTIVITY

Soil moisture ranges between 9.06% to 18.6%. The sample collected from the Agricultural field showed the lowest value of 9.06%. However, the sample collected from Central University of Jammu Campus figured the highest value of 18.6%. In all the samples, the level of soil moisture was below 20% giving an indication of semi-arid to arid climatic setup.

The soil pH and soil conductivity were estimated in the ratio of 1:2.5 soil water extract. Soil pH varied between 7.0 to 7.56. The sample collected from Tarera and Near V.C. Office value was alkaline in nature. The pH value indicates that the study area is not coming under sub-tropical to tropical climate regime. However, the presence of alkaline soil shows the presence of high saturation of base cations due to an accumulation of soluble salts. The soils are characterized by the presence of carbonate which was well tested in the field itself where effervescence was seen with the addition of mild acid. The dominance of alkaline soil in the study area reveals the dominance of sedimentary lithology (Lime stones) near the surface providing calcium carbonate to the soil.

The value of soil conductivity which was estimated in the ratio 1:2.5 for all the location varies between 0-0.3 dS/m indicating the non-saline nature of the samples. The level of conductivity indicates coarse to loamy sand with non-saline nature for all the locations which were analyzed to ascertain the fertility status.

Five weathering profiles were sample and the most weathered sample from top 6cm to 10cm were analyzed for Soil organic carbon, Soil organic matter, Soil moisture, Soil pH, Soil conductivity. However, textural analysis for grain size estimation was performed for the topmost weathered samples.

The grain size distributions for samples are calculated using different statistical methods (Boggs, 1987) which are shown in figure 2A-2E. Generally the samples are poorly sorted except for one location that is Tarera where it is well sorted .However, the mean sizes of the sample are coarse sand except for Peer baba location where the mean size is fine sand. By dominance of coarse sand and poorly sorted nature of sediments reveals that the wind action and selective transport of material is not prevalent except for Tarera where wind action along with selective transport might be responsible for well sorting of the sediments.

The percentage of coarse sand at location 1 - Central university of Jammu campus was 8.6%

The percentage of coarse sand at location 2-Near V.C. office was 18.2%.

The percentage of coarse sand at location 3-Tarera was 9.9%

The percentage of coarse sand at location 4-near Peer baba was less as compared to fine sand. Here, the percentage of fine sand was 40.8% where the coarse sand was only 4.5%.

Weathering is a key factor to determine the sediment chemistry. Climate, tectonics, topography and source rock composition control the weathering processes and collectively they govern the nature of the sediments produced. The coarse nature of the sediment along with poorly sorted nature indicates that the topmost weathered sample are as such as not capable of retaining the mineral nutrients which are much needed for the plant growth and crop productivity because these nutrients are retain in the finer to very finer fractions. In our present study in none of the locations we have reported very finer sand fraction.

Conclusion

Texturally the most weathered sediments of the weathering profile (coarse sand) classified into coarser sand deposits and generally sediments are poorly sorted in nature. Grain size distribution pattern of the sediments indicates that the most weathered sample are derived from transportation action where Aeolian processes is not playing a key role. The soil pH which was reported above 7.0 for all the samples indicates the alkaline nature of the soil. Sedimentary lithology (limestone) which is prevalent in the study area provides high content of calcium and carbonate to the most weathered sediment which ultimately is responsible for making ground water calcium rich. The level of conductivity indicates the non-saline nature of the soil as the conductivity value was below 1 dS/m. The high level of soil organic carbon in 3 locations indicates high level of organic activity. The high level of soil organic carbon and soil organic matter leads to cater biological diversity in the soil. Soil organic carbon at the level of 7800mg/kg was reported from the location 3 Tarera of the study area. The results of soil moisture concludes a low rainfall regime (semi-arid to arid) climatic setup as the level of moisture in all the location sample was below 20%.

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