ANALYSIS OF SOIL PARAMETERS FROM MYINGYAN TOWNSHIP, MANDALAY REGION, MYANMAR

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ABSTRACT

In this research work, physicochemical analysis have been made on two soil samples collected from near Kan Pauk Village in Myingyan Township, Mandalay Region in Myanmar. The physical properties of soil samples, moisture, pH, texture, bulk, density, total dissolved solids and electrical conductivity. Furthermore, the percentages of chloride, sulphate, calcium, magnesium and organic carbon were determined by the use of various titration methods. The mineral contents in two soil samples were determined by using Energy Dispersive X-ray Fluorescence (EDXRF) method.

Keywords : physicochemical analysis, pH, texture, electrical conductivity, titration, EDXRF

1. INTRODUCTION

Soil is the thin layer of material covering the earth's surface and is formed from the weathering of rocks. It is made up mainly of mineral particles, organic materials, air, water and living organisms. Most plants get their nutrients from the soil and they are the main source of food for humans, animals and birds. The living things on land depend on soil for their existence. Soil is a vital part of the natural environment. It is just as important as plants, animals, rocks, landforms, lochs and rivers. It influences the distribution of plant species and provides a habitat for a wide range of organisms.

Soils are essential for life, in the sense that they provide the medium for plant growth, habitat for many insects and other organisms, act as a filtration system for surface water, carbon store and maintenance of atmospheric gases. Soils provide plants with essential minerals and nutrients. Soil particles can be classified by the chemical composition (mineralogy) as well as their size. The particle size distribution of a soil its texture, determines many of the properties of that soil, but the mineralogy of those particles can strongly modify those properties.

Soils have many different properties, including texture, structure or architecture, water holding capacity and pH (whether the soils are acid or alkaline). These properties combine to make soils useful for a wide range of purposes.The proportion of solid material in soil determines the amount of oxygen, water, and nutrients that will be available for plants. Since smaller particles stick together when wet, soil with a lot of clay holds water well, but drains poorly. Clay particles also pack together tightly, allowing for little air space. The plant roots suffer from a lack of oxygen.

Sand particles also pack together tightly, allowing for little air space. The plant roots suffer from a lack of oxygen. Sand particles do not hold water or nutrients well. The best soil for plant growth is one in which all three types of particles; clay, silt, and sand are in balance. Such a soil is called loam. [4],[6],[9],[11],[12]

1.1 Study Site

The soil samples (1 and 2) were collected from near Kan Pauk Village in Myingyan Township, Mandalay Region, on November, 2016. The sample which was taken from the top of the surface was designated sample 1. The sample which was taken from a depth of twelve inches of the surface was designated sample 2.

Fig: 1 Location Map of Samples Collected Area

2. MATERIALS AND METHODS

2.1 Preparation of Soil Sample

The samples (1 and 2) were broken up into small lamp and spread out in the shade for air-dry. Gravels and roots were discarding from the samples. After drying, each sample was grounded and sifted through a sieve with round holes 2 mm in diameter. The samples passing the sieve were mixed together very thoroughly and used for analysis.

2.2 Mineral Contents in Soil Samples by EDXRF Method

The mineral contents of the grinded and sifted of the soil samples were determined by EDXRF spectrophotometer at Department of Physics, University of Mandalay.(Spector XEPOS EDXRF Spectrometer, Germany)

2.3 Moisture

2 g of sample was placed in porcelain basin and weight accurately. It was allowed to dry in electric oven at 105°C. Then it was cooled in desiccator. It was done to constant weight. [1]

2.4 Hydrogen Ion Concentration (pH)

Soil pH is the most widely measured soil parameter. This pH measurement determines the degree of acidity or alkalinity in soil materials suspended in water. 20 g of sample was weighed accurately and placed into a conical flask. Then 50 cm^3 of distilled water was added (sample: water ratio, 1: 2.5) and shaken for half an hour. The pH was measured by using pH meter. [5]

2.5 Electrical Conductivity

The conductivity of the sample extract (sample: water ratio, 1: 2.5) was directly determined by the conductivity meter.[5]

2.6 Soil Texture

10 g of sample was weighed accurately and placed in 500 cm^3 conical flask and some amount of distilled water was added. The flask was heated till boiling 10 cm^3 of 10 % sodium pyrophosphate solution was added to disperse the soil colloids and heating was continued for about fifteen minutes. Then it was cooled. After cooling the contents were transferred to a 1000 cm^3 measuring cylinder and the solution was made up to the mark with distilled water and then kept overnight to allow the soil colloids to settle. The next day, the contents were stirred for about four minutes, the solution from 9 cm depth was pipette with 25 cm^3 pipette and then it was transferred to a porcelain basin and evaporated on a water bath. From this residue, the percentage of clay and silt were calculated.

After four hours of the stirring the solution was pipetted with 25 cm^3 pipette from 4 cm depth and evaporated. From this residue, the percentage of clay was calculated. Then the percentage of silt was obtained by difference. To determine the amount of sand, the remaining solution was poured into 50 cm sieve and clay and silt were washed with water. The percentage of sand was then calculated. [2],[3]

2.7 Determination of Total Dissolved Solid

Constant weight of the porcelain basin was first determined. The 50 mL of the sample was placed into the porcelain basin and it was evaporated on sand bath. After complete evaporation of the water from the residue, the basin was transferred to in oven maintained at 103-105°C. Then it was dried to constant weight. [2],[3]

2.8 Bulk Density

The sample was placed in a measuring cylinder (5 mL) of known volume and weighed. The density of the sample was calculated by using the usual formula. [7]

2.9 Exchangeable Calcium and Magnesium

2.5 g of sample was weighed accurately and placed in a 500 cm^3 shaking bottle containing 250 cm^3 of 1 M sodium chloride solution. The bottle was shaken for three minutes and kept overnight and then filtered. To determine calcium and magnesium, 25 cm^3 of filtrate was pipetted into conical flask and then 5 cm^3 of ammonium buffer solution (pH = 10) was added. The Eriochrome Black T was used as an indicator. It was titrated with 0.02 M EDTA solution until the color changed to blue.

To determine calcium, 25 cm^3 of filtrated was pipetted into conical flask and then 2 cm^3 of 10 % sodium hydroxide solution was added. Murex ide was used as indicator. It was titrated with 0.02 M EDTA solutions; the end point color was violet. [10]

2.10 Chloride

25 cm^3 of the sample extract (sample: water ratio, 1: 2.5) was pipetted into conical flask and 1 cm^3 of 10 % potassium chromate solution was added. Then it was titrated with 0.01 M silver nitrate solution. The color of end point was reddish brown. [13]

2.11 Sulphate

25 cm^3 of water extract was pipetted into conical flask and the flask was gently warmed to expel carbon dioxide till its content began boiling and 10 cm^3 of 0.01 M barium chloride solution was added. It was cooled to room temperature. Then 5 cm^3 of ammonium buffer solution (pH = 10) was added. Eriochrome Black T was used as an indicator. It was titrated with 0.01 M EDTA solution. The end point was blue black. [13]

3. RESULT AND DISCUSSION

3.1 Mineral Contents in Two Soil Samples

Mineral contents of two soil samples were obtained by EDXRF methods as shown in Table (1). The minerals present in sample 1 and 2 were silicon, calcium, aluminum, iron, chlorine, potassium, sulfur, titanium, strontium and barium.

Table 1 Mineral Content in Two Soil Samples

No	Elements	Relative Abundance in Sample 1 (%)	Relative Abundance in Sample 2 (%)
1	Silicon	13.050	17.220
2	Calcium	3.019	1.641
3	Aluminum	2.275	2.562
4	Iron	1.500	1.690
5	Chlorine	1.024	0.069
6	Potassium	0.883	1.224
7	Sulfur	0.804	0.033
8	Titanium	0.225	0.270
9	Strontium	0.046	0.029
10	Barium	0.039	0.054

According to the above table, the results in sample 1 and 2 contain in silicon with the relative abundance of 13.05 % and 17.22 %. The amounts of calcium, aluminum and iron are high values in two soil samples. Sample 1 is greater than that of sample 2.

3.2 Different Parameters between Two Soil Samples

The results of some analysis data of two soil samples were observed in table (2) and (3). They showed the two classes in Physical and chemical parameters in the soil samples. Some parameters were determined at Department of Chemistry, University of Mandalay and the others (*) were sent to determine the Department of Agricultural (Land Use), Mandalay.

Table 2 Results of Physical Properties of Two Soil Samples

No	Characteristics	Sample 1	Sample 2
1	Moisture (%)	*1.64	*0.54
2	pH (1:2.5)	*9.86	*9.79
3	Organic Carbon (%)	*0.53	*0.08
4	Humus (%)	*0.91	*0.14
5	Total Nitrogen (%)	*0.13	*0.06
6	Bulk Density(g/cm^3)	0.940	1.240
7	Electrical Conductivity (dS/m)	0.015	0.001
8	Total dissolvedsolids (g)	0.250	0.010
9	Texture (%)	41.65	79.00

* = Department of Agricultural Land Use [2],[3]

The moisture content in sample 1 is greater than that of sample 2. The pH value in sample 1 is greater than that of sample 2. High pH disrupts soil structure of aggregation. The bulk density in soil sample 1 is smaller than that of sample 2. The electrical conductivity in soil sample 1is higher than that of sample 2. The percentage of total dissolved solid in soil sample 1 is greater than that of sample 2. The texture of sand percent in sample 1 is smaller than that of sample 2.[3] The sample 1 may be loam and sample 2 may be loamy sand character accordance with the composition of the textural classes of soils used by the United State soil survey. [3]]The sample 1 collected from the surface of the location site and sample 2 collected from twelve inches depth under the ground. From the above table, the values of all physical parameters in sample 1higher than that of sample 2 with the exception of density.

Table 3 Results of Chemical Properties of Two Soil Samples

No	Characteristics	Sample 1	Sample 2
1	Exchangeable Cations(meq/100 g)		
(i)	Ca^{++}	*5.29	*6.27
(ii)	Mg^{++}	*7.20	*8.37
(iii)	Na^{+}	*76.99	*2.14
(iv)	K^{+}	*0.26	*0.08
2	CEC (meq/100 g)	*89.94	*16.86
3	AvailableK_2O (mg/100 g)	*12.20	*3.75
4	ESP (%)	*85.60	*12.69
5	Chloride (%)	0.909	0.539
6	Sulphate (%)	0.225	0.311

* = Department of Agricultural Land Use [6], [7], [8]

From the table, the values sodium ion,potassium ion, CEC (Cation Exchange Capacity) , available potassium oxide, ESP (Exchangeable Sodium Percentage) percent and chloride of sample 1 higher than thease of sample 2. But the amount of calcium, magnesium and sulphate in sample 2 higher than that of sample 1 were observed.

4. CONCLUSION

In this research work, the physical parameters such as pH, moistures, textures, bulk densities of samples, total dissolved solids and electrical conductivities of the samples. From the analytical data, texture of top soil is classified as loam but plants do not grow well in this area because of pH (9.86) is extremely alkaline. Moreover, the amounts of organic carbon (0.53 %) and total nitrogen (0.13 %) were very low amount. The results of CEC amount (89.94 meq/100 g) and Na^+ ions (76.99 meq/100 g) of top soil were observed at very high level. Furthermore, the amount of ESP (exchangeable sodium percentage) 85.6 % was found to be extremely high in sample 1. According to the results of analysis data, two soil samples are not suitable for growing plants and nutrients are not available to plants in these areas. From ESP (exchangeable sodium percentage) data, top soil sample contains significant amount of natron which is a naturally occurring mixture of $Na_2CO_3.10H_2O$and $NaHCO_3$, small amount of sodium chloride and sodium sulphate. So it may be used to make natural soap for local use.

ACKNOWLEDGMENT

We are greatly indebted to Dr Thida Win, Rector, University of Mandaly, for her permission to write the research journal. We deeply express my gratitude to my Professor and Head Dr Yi Yi Myint, Professors, Dr Khaing Khaing Kyu, Dr Lwin Mu Aung and Dr Hla Myoe Min, Department of Chemistry, University of Mandalay for their interest, valuable guidance and encouragements throughout this research work.

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