Determination of the Some Chemical Parameters of Soil From Monywa University Campus

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Abstract

The main aim of this paper is to analyze soil from the Monywa University Campus, Monywa Township Sagaing Region. The soil samples were collected from the four selected areas (sample 1= Damaryone, sample2 = Building B, sample 3= chemistry department, sample 4 = man chummery) in June, 2017. From this research work, the percentage of some chemical constituents and N and P values of soil could be determined. Elemental contents of soil samples were also determined by using EDXRF Spectrophotometer.

Keywords: Monywa University Campus, soil, chemical constituents, elemental content

Introduction

Soil, the materials make up a complex chemical and biochemical system.Without soil, there would be no plants; without plants there would be no food; without food animals could not survive. Thus, soil is the beginning of the soil-plant animal food chain. The organic portion of the soil consists of the remains of plants in various stages of decay. There is a lot of life in soil. Generally bacteria, fungi, and small animals, and earth warms, are abundant. Soil function of a typical productive soil is approximately 5% organic matter and 95% inorganic matter.

Like humans, plants require some essential macronutrients such as carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, calcium, magnesium and sulphur. Of these, carbon, hydrogen, and oxygen are obtained from the atmosphere and from water and the rest come from the soil. In modern agriculture, the natural fertilizers (soils) are widely used. It is very fruitful for crops such as rice, peanuts, corn, tomatoes and other crops and vegetables.

Therefore, soils were collected from four sampling sites in Monywa University Campus Monywa Township Sagaing Region to determine the chemical constituents. From these results give that these soil may be or may not be use suitable for plantation.

Experimental

Materials, Methods and Instruments

The chemical used were common analytical grade reagent. They were produced from British Drug House (BDH), London and Merck. Qualitative and quantitative elemental analysis could be done by common laboratory apparatus and EDXRF spectroscopy. All analytical determinations, instrumental analyses, and

monitoring of the process systems were carried out at the Department of Chemistry, Monywa University.

Study Area

Monywa University is in Monywa Township, Sagaing Region. This area is located at the intersection of latitude 22°13′ N and longitude 95° 16' E.

Figure (1) Sampling site of soil samplesin Monywa University Campus

Sampling and Preparation of Soil Samples

Four samples from different sites in Monywa University Campus were collected in September 2017 for analysis. Soil sample 1 was collected near University Religious Hall, sample 2 was collected in frnot of the Building B, sample 3 was near chemistry department and sample 4 was collected in man chummery. All soils were taken from a depth of about one feet of the surface. In the laboratory, the samples were spread out in shallow trays to dry in the atmosphere. When the samples were dried, those were sieved through a 2 mm sieve to remove larger particles of vegetable matters and stones. The residue from the sieve was rubbed up in a motor with a pestle and was again sieved. The samples passing the sieve were used for subsequent analysis. (Brady, N.C & R.W. Ray, 1996).

Determination of Some Physical Parameters of Soil Samples

The temperature and pH of soil samples were determined by thermometer and pH meter. Colour of the samples were recorded by visualization. Odor of the samples were also manuralized. Conductivity of the samples were determined by conductivity meter. Experimental data were listed in Table (1).

Determination of Moisture Content

Constant weight of weighing bottle was first determined. Then, air-dried soil sample (5.0 g) was accurately weighed in a porcelain crucible and heated in an oven at 105 ºC for 3 hr. It was cooled in a desiccator and then weighed. The process of

heating, cooling and weighing was repeated to obtain a constant weight. From the loss in weight, the percentage of moisture of the sample under analysis was calculated.

Determination of Soil Texture

Reagent

10% sodium pyrophosphate solution

About 10 g of sodium pyrophosphate was dissolved in distilled water and made up to 100 cm^3.

Procedure

10 g of sample was weighed accurately and placed in a 500cm^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 15 min. Then it was cooled. After cooling, the contents were transferred to a 1000 cm^3 graduated 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 4 min, the solution from 9 cm depth was pipetted 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 4 hr 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 μm sieve and the clay and silt were washed with water. The percentage of sand was then calculated.

Determination of Some Elemental Contents of Soil Samples

The elements that contain in prepared organic fertilizers were analyzed by the Energy Dispersive X-ray Fluorescence (EDXRF) spectrometer, at Department of Chemistry, Monywa University. The resulting data were mentioned in Table (2).

Determination of Available Nitrogen (Alkaline Permanganate Method)

Soil sample (20.00 g) was transferred into 500 mL distillation flask and 20 cm^3 of distilled water was added, followed by 100 cm^3 of 0.32% $KMnO_4$ and 100 cm^3 of 2.5% NaOH solutions. Both reagents were freshly prepared. The contents were distilled into a known amount (10 cm^3) of 0.01M H_2SO_4 until 30 cm^3 of distillate were collected. Then the excess of acid was titrated against 0.02 M NaOH solution by using methyl red as an indicator. A blank determination was carried out as above. The percentage of nitrogen was calculated.

Determination of Available Phosphorus (Olsen's Method)

Firstly calibration curve was constructed using potassium dihydrogen phosphate.Pure potassium dihydrogen phosphate (0.2195g) was dissolved in a little quantity of distilled water and made up to 1 dm^3 with 0.5 M $NaHCO_3$ solution. This stock solution contained 50 microgram of P/cm^3. The standard phosphorus solution was prepared from this stock solution.

The stock solutions containing 2, 4, 6, 8, 10, 12 and 14 microgram phosphorus were pipetted out into the 25 cm^3 volumetric flasks. Molybdate reagent (5 cm^3) was added and washed down the stem of the flask and mixed. Dilute stannous chloride

solution (1 cm^3) was added and made up to the mark. After 10 min the intensity of the colour developed was read in each case in the Fisher electrophotometer by using red filter (or 650 nm). The electrophotometer reading were used to construct a curve against the quantity of phosphorus present as microgram in each standard.

Sample (5.00 g) was taken in a conical flask and 1.0 g of carbon black was added. Then, 100 cm^3 of 0.5 M $NaHCO_3$ solution were added to the flask and shaken for half an hour. It was filtered through Whatman No.1 filter paper. The filtrate was colourless. Next, 5 cm^3 of the filtrate was pipetted out into a 25 cm^3 volumetric flask and 5 mL of molybdate reagent were added and washed down the stem of the flask and mixed. Dilute stannous chloride solution (1 cm^3) was added and made up to 25 cm^3. The contents were mixed thoroughly. After 10 min the colour intensity was read in the Fisher electrophotometer by using red filter (or 650 nm). The value (microgram of phosphorus) was read from the standard curve. The percentage of available phosphorus as P_2O_5 was calculated.

Results and Discussion

The Results of Physicochemical Properties of Soil samples

Experimental results of physicochemical parameters of selected soil samples were shown in Table (1).

Table (1) The Results of Physicochemical Properties of Selected Soil Samples

No.	Parameters	Sample (1)	Sample (2)	Sample (3)	Sample (4)
1	pH	8.7	8.2	8.6	7.9
2	Moisture (%)	3.55	3.46	3.56	3.67
3	Conductivity (mS/cm)	1.267 (at 30.1°C)	1.326 (at 29.9°C)	2.240 (at 29.9°C)	0.757 (at 29.6°C)
4	Colour	brown	brown	brown	deep brown

According to these data such as deep colour, moisture content, high pH and conductivity, the four selected soil samples were suitable for agriculture. Nutrients become soluble and plants can readily extract them in these condition.

The Results of Some Elemental Content of Soil Samples

The results of elemental content of selected soil samples were mentioned in Table (2) and Figure (1).

According to these results, there are seventeen kinds of elements in these four samples. In sample 1 Al, Mn, Sr, Ni and V values are highest in all samples. Fe, K, Cu, Y and Zn contents are highest in sample 2. In sample 3 Ca, Cr and Rb are highest values. The content of Si, Ti, S and Zr values are highest sample 4.

Table 2 The Results of Elemental Content of Selected Soil Samples

Element Analytes	Results (%)			
	S1	S2	S3	S4
Si	44.187	45.804	47.998	**48.080**
Fe	27.227	**27.955**	23.129	24.633
Al	**10.515**	10.304	9.131	10.382
Ca	7.222	5.013	**9.368**	5.601
K	7.072	**7.279**	6.535	7.262
Ti	2.095	2.153	2.162	**2.192**
Mn	**0.624**	0.582	0.538	0.622
S	0.317	0.302	0.392	**0.422**
Sr	**0.249**	0.193	0.189	0.207
Cr	0.095	0.101	**0.181**	0.099
Cu	0.095	**0.097**	0.084	0.078
Ni	**0.075**	0.069	0.068	0.071
Rb	0.016	0.018	**0.040**	0.033
V	**0.090**	0.000	0.088	0.075
Y	0.041	**0.042**	0.027	0.033
Zn	0.082	**0.088**	0.070	0.071
Zr	0.000	0.000	0.000	**0.139**

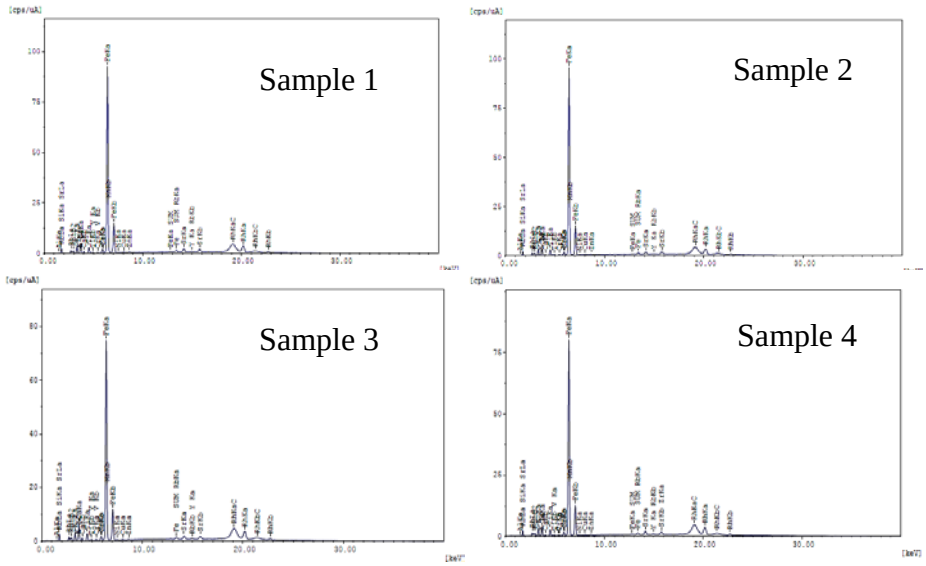

Figure (2). EDX spectra of Sample 1- 4.

The Results of Nitrogen and Phosphorous Values of Four Soil Samples

The results of N and P values of the selected soil samples were illustrated in Table (3).

Table (3) The Results of N and P values of Four Soil Samples

No.	Components	(%)				Rating			
		S1	S 2	S3	S 4	S1	S 2	S3	S 4
1	N	0.011	0.0056	0.011	0.0046	High	Low	High	Low
2	P	0.005	0.0008	0.0006	0.0007	Very high	Low	Low	Low

Classification

	Very high	high	medium	low	very low
N	> 0.012%	0.009-0.012%	0.006-0.009%	0.003-0.006%	< 0.003
P	> 0.004%	0.003-0.004%	0.001-0.003%	0.0005-0.001%	< 0.0005
K	> 0.037%	0.025-0.037%	0.013-0.025%	0.0012-0.013%	< 0.0012

The data revealed that the amount of N and P in sample 1 is suitable for vegetable plantation, the sample 2 and 4 is unsatisfied for agriculture, and sample 3 is suitable for leaf crop and fruit plants.

The Results of Texture of Soil Samples

Experimental results of the texture of selected soil samples were shown in Table (4) and Figure (2).

Table (4) Textures of Two Soil Samples

Soil Type	S1 (%)	S 2 (%)	S3 (%)	S 4 (%)
Sand	16.96	17.28	70.35	24.84
Silt	22.48	25.51	7.28	15.32
Clay	60.56	57.21	32.37	59.84

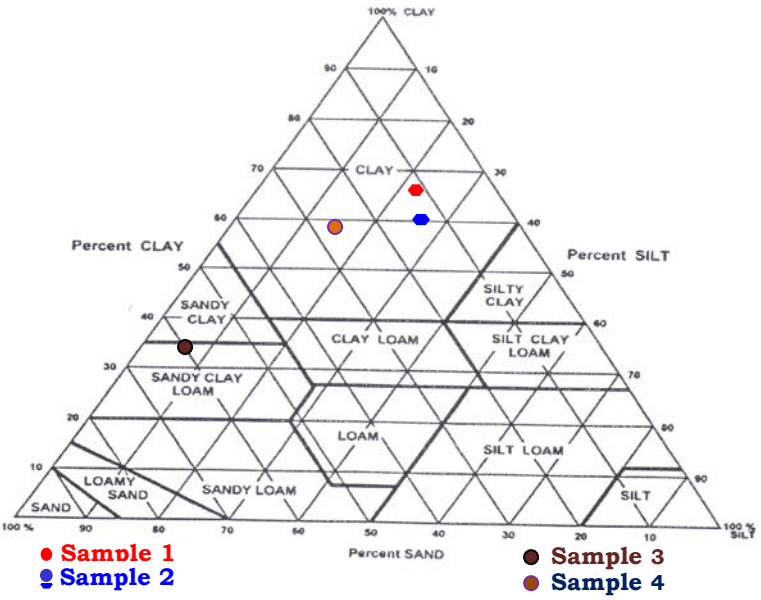

Figure 2 Texture triangle for classification of soil

According to the results of textures of the samples, sample 1,2, and 4 are Clay type and sample 3 is Sandy clay loam type. Sample 1,2,4 types are very high water holding capacity and midium quality of nutrient holding capacity. Therefore, those soils cannot be suitable for growing vegetables and other plants. But, these soil types are used for plantation suitable soil preparations are required. Sample 3 is the sandy clay loam type. So it is suitable for agriculture.

Conclusion

In this research work, the samples were collected from Monywa University Campus Monywa Township. Some physicochemical constituents of soil samples were determined. According to pH values, all samples are alkaline. The moisture content of the soil samples are medium values. Therefore, organic carbon and humus are also very low values. Colour of the soils is brown, so these soils are suitable for natural fertilizer. By the determination of N and P values, it is observed that the values are in high condition. From the results of texture type, soil sample 1,2,4 are clay type, sample 3 is sandy clay loam type. According to elemental results of both samples, which are absent of any toxic metals. This research contributes some information for the assessment of chemical constituents of soil samples in our campus. From these findings, the soil samples in Monywa University campus are unsuitable for cultivation of vegetables and other crops but sample 3 soil type.

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