Available online at www.derpharmachemica.com

Scholars Research Library

Der Pharma Chemica, 2014, 6(1):407-410
(http://derpharmachemica.com/archive.html)

ISSN 0975-413X
CODEN (USA): PCHHAX

Mineralogical studies of red and black soils in Wardha region

Y. G. Thakre[1], M. D. Choudhary[1] and R. D. Raut[2]

[1]Dept.of App. Chemistry, B. D. College of Engineering Sevagram, Dist. Wardha
[2]Dept.of Chemistry, J. B. College of Science, Dist. Wardha

ABSTRACT

The surface layer of soil consisting of the mixture of mineral and organic matter reflects the nature and properties of the soil. X-ray Diffraction is the best tool for the identification of minerals present in soil. Red and Black soil samples were collected from different places of Wardha region. Analysis of these samples was carried out by X-Ray diffraction. Investigation indicates that red soil of Wardha region contains gibbsite, augite, anorthite, hematite, goethite, ilmentite, pyrite, quartz and black soil contains smectite, quartz, illite and kaolinite minerals.

Keywords: X-ray diffraction, minerals, properties of soil.

INTRODUCTION

The knowledge of the mineralogical composition of soil clay is essential requirement to the proper understanding of soil development as well as improvement of management practices for economic crop production. The type of clay mineral present in soil has a great impact on availability of nutrients to the crops. Soil mineralogy is determined routinely because of its strong influence on soil behavior, its use in soil classification, and its relevance to soil genetic processes. Soils commonly contain primary minerals, which are formed from magma and provide insight into characteristics such as parent material provenance, uniformity, and weathering rates. Soils also contain secondary minerals, which are formed from weathering processes, and may have crystallographic characteristics that strongly influence the physical and chemical properties of soils. Soil minerals have gained importance in soil science because it plays an important role in determining soil physical and chemical properties[1].

MATERIALS AND METHODS

The XRD of red soil samples and black soils samples of Wardha region were recorded on Philips PW-1700 Automatic X-ray diffractometer with Cu-Kα Radiation having wavelength 1.54A0 at VNIT Nagpur. The red and black soil samples were scanned for mineral identification at angle 20 (θ).

The mineral peaks produced by software package were compared with those in mineral powder diffraction file ICDD 2002 compiled by the joint committee on powder diffraction standard (JCPDS) and published by international center for diffraction data.

RESULTS AND DISCUSSION

The Mineral identification in soil is based on d-spacing values obtained from the X-ray diffractograms. The X-ray diffractogram of red and black soil samples are shown in figure 1 to 4 respectively. The mineralogical composition of red soil and black soil is identified by comparing the d-spacing values obtained from X-ray diffractograms with the standard d-spacing values given by Joint committee on powder diffraction standard (JCPDS) and published by International center for diffraction data.

The d-spacing values of red soil sample no. 1 is obtained from diffractogram presented in figure are 4.90108, 2.97097, 2.7246, 2.52383, 2.44943 and 1.81657 respectively. The nearby standard d-spacing values as per the JCPDS data are 4.85, 2.99, 4.04, 2.69, 2.7, 2.52, 2.43, 1.82 and the corresponding minerals present with these d-spacing values are Gibbsite, Augite, Goethite, Ilmentite, Pyrite and Quartz. So the minerals present in red soil sample no. 1 are Gibbsite, Augite, Goethite, Ilmentite, Pyrite and Quartz.

The d-spacing values of red soil sample no. 2 is obtained from diffractogram presented in table-1 are 4.8899, 2.9646, 4.0695, 2.7, 2.51875, 2.4494, 1.8165 respectively. The nearby standard d-spacing values as per the JCPDS data are 4.85, 2.99, 4.04, 2.69, 2.7, 2.52, 2.43, 1.82 and the corresponding minerals present with these d-spacing values are Gibbsite, Augite, Anorthite Goethite, Ilmentite, Pyrite and Quartz. So the minerals present in red soil sample no. 2 are Gibbsite, Augite, Anorthite ,Goethite, Ilmentite, Pyrite and Quartz.

The d-spacing values of Black soil sample no. 3 is obtained from diffractogram presented in table-2 are 3.56411, 2.93219, 4.48538, 2.73215, 3.34127, 2.44958, 1.83122 respectively. The nearby standard d-spacing values as per the JCPDS data are 3.57, 2.99, 4.49, 2.7, 3.34, 2.43, 1.82 and the corresponding minerals present with these d-spacing values are Kaolinite.Augite.Montmorillonite,Goethite,Illite,Pyrite and Quartz.

The d-spacing values of Black soil sample no. 4 is obtained from diffractogram presented in figure are 3.57134,2.96587,4.49245,3.33659,2.43521,1.80471respectively The nearby standard d-spacing values as per the JCPDS data are 3.57,2.99,4.49,2.7,3.34,2.43,1.82 and the corresponding minerals present with these d-spacing values are Kaolinite.Augite.Montmorillonite,Goethite,Illite,Pyrite and Quartz.

Hematite and goethite is associated with plant nutrient like iron, hence these minerals impart the characteristics red colour to the soil [2]. Quartz is non clay mineral and more abundant in all red soil samples whereas calcite is not available. Similar findings were observed by Bhuman and et al [3].Smectite mineral is not detectable in red soil samples .Smectite is dominant clay mineral in black soil. Smectite soils are able to retain more water [4]. Interaction of soil mineralogy and physico-chemistry plays important role in soil productivity. Secondary minerals constituting the clay fraction of soils govern most of the chemical processes including fixation, ion exchange and complexation which are key interaction between any material added to the soil and the soil components[5].These minerals also affect numerous microbial activities indirectly through their effect on physicochemical and chemical properties of soil [6].The minerals in the clay fraction of soils play a crucial role in determining their major physical and chemical properties. smectite, chlorite, illite, kaolinite and vermiculite are the main clay minerals in arid and semi-arid regions[7,8,9,10]. The clay in soil has adsorption capabilities result from a net negative charge on the structure of minerals. This negative charge gives clay the capability to adsorb positively charged species. Their sorption properties also come from their high surface area and high porosity[11]. Kaolinite has capacity to absorb not only inorganic but also organic molecules[12]. Kaolinite is derived from nearly all types of igneous, metamorphic and sedimentary rocks if rainfall is frequent and water flow and hydrolysis are sufficiently strong under tropical to subtropical climate[13]. This is due to their large specific surfaces and the resulting ability to adsorb cations [14]

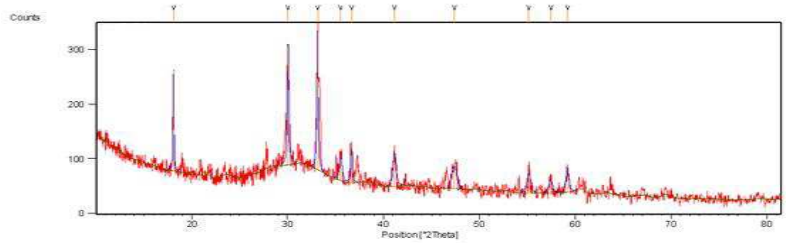

Figure 1- XRD of Red Soil sample no.1

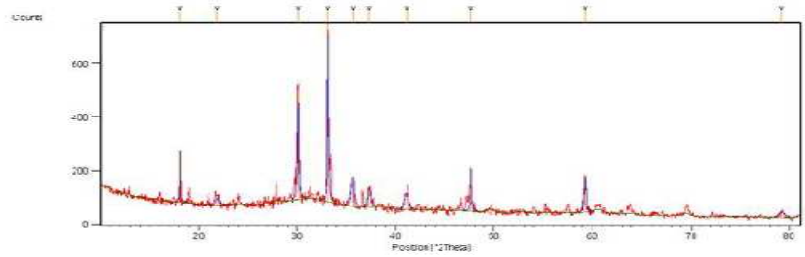

Figure2- XRD of Red soil sample no.2

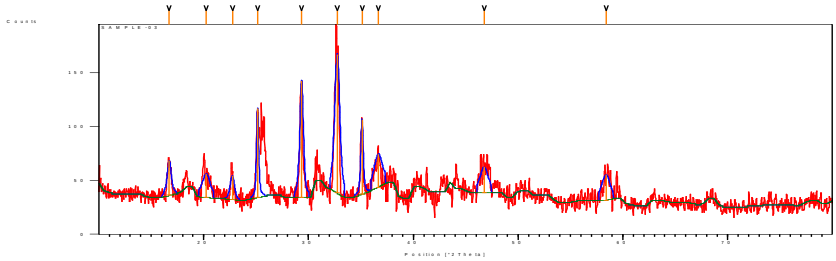

Figure3- XRD of Black soil sample no.1

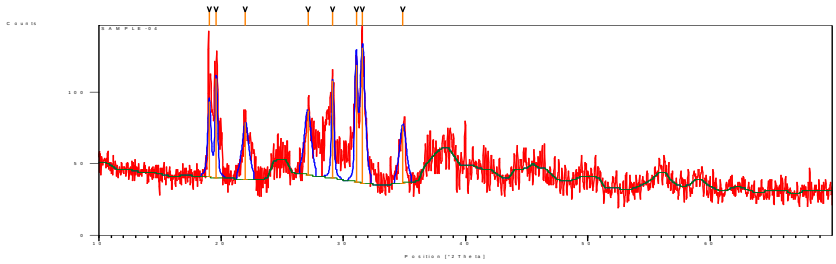

Figure4- XRD of Black soil sample no.2

T able1 and 2-Mineralogical composition of red and black soil of Wardha region

Minerals	Standard d-spacing Values(Å)	Observed d-spacing values of Red soil Sample(Å)	
		1	2
Gibbsite	4.85	4.9010	4.8899
Augite	2.99	2.9709	2.9646
Anorthite	4.04	-	4.0695
Hematite	2.69	2.65223	2.69214
Goethite	2.7	2.72461	2.71425
Ilmentite	2.52	2.5238	2.5185
Pyrite	2.43	2.4494	2.4099
Quartz	1.82	1.8165	1.8244

Minerals	Standard db spacing Values(Å)	Observed d-spacing values of Black soil Sample(Å)	
		1	2
Kaolinite	3.57	3.56411	3.57134
Augite	2.99	2.93219	2.96587
Montmorillonite	4.49	4.48538	4.49246
Hematite	2.69	-	-
Goethite	2.7	2.73215	-
illite	3.34	3.34127	3.33659
Pyrite	2.43	2.44958	2.43521
Quartz	1.82	1.83122	1.80471

CONCLUSION

From the above study it is concluded that the composition red and black soil from Wardha region are different from one another. Clay minerals are known to play an important role in affecting the nutrient uptake by crops. This mineralogical study is related with Physico-chemical properties of soil and responses to fertilizers have been initiated.

Acknowledgment
The authors are thankful to The Principal, Bapurao Deshmukh College Of Engineering Sevagram, Dist. Wardha, Maharashtra for their kind co-operation during this work.

REFERENCES

[1] M.J. Wilson,, Soil smectites and related interstratified minerals: recent developments. *Proceedings of the International Clay Conference*, Denver **1987**, 167-173.
[2]A.J. Herbilion,,R.Frankart,L.Vielvoye.,,*Journal of clay mineral* **1981**,16,195-204.
[3] C. Bhuman and P.L.C Grubb, *Journal of clay mineral*.**1991,**26,-358.
[4] K.M.Dontsova,D.L. Norton, C.T..Johnston,.and Bighan J.M*Soil Sci. Soc.Am.J.***2004**,68,1218-1227.
[5]G. Faure, *Principles and applications of inorganic geochemistry*, (New Jersey, Prentice Hall, Inc Upper Saddle River.), **1991**.
[6] G.. Stotzky, *Modern Soil Microbiology*, (New York, Marcel Dekker, INC. Madison) **1997**
[7] A.Abtahi, *J.Soil Sci. Soc. Am.* **1980**,329 -336.
[8] J.L.Boettinger and R. J. Southard. *J. Soil Sci. Soc. Am.* :**1995**,59,1189-1198.
[9] F.Khormali, and A. Abtahi.. *Clay Miner***. 2003**,38,511 -527.
[10] H.R.Wliaie,A. Abtahi, and R. J. Heck. *Geoderma*. **2006,**134, 62-81.
[11]M.Alkan ,O.Demirbas ,S. Celikc apa andM. Dogan *J. Hazardous Mater*. **2004**, 116,135-136
[12]Preeti Sagar Nayak B K Singh,*Bull. Mater. Sci*.,.3, June **2007**,30 Vol.No.3,235–238.
[13]J.P.De Visser, Clay mineral stratigraphy of Miocene to Recent marine sediments in the central Mediterranean. Geological Ultraiectina,; **1991,**75**,**1026
[14] H.Bradl, *Encyclopedia of Surface and Colloid Science* , **2002** , 1-13.