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Electro and Physico Chemical Properties of Indian Clay Loam

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With 1 Figure

Summary

The electro and physico-chemical studies of Indian (Delhi) clay loam reveal that the clay mineral present in it is mainly illites.

Introduction

Electrometric methods, specially, potentiometric and conductometric titrations, have found universal applications on soils and clays. In this connection mention should be made of the contributions of MUKHERJEE[1)2)], MITRA[3)4)], MARSHALL[5)6)], CHATTERJEE[7)] and others.

In our previous communication[8)] we have studied the clay mineral present in Indian sandy loam soil and in this paper, we communicate the results of electro-chemical titrations of the Hydrogen clay of an Indian soil which is a clay loam with a view to have an information of the clay mineral present in it. The Physico-chemical properties of the soil has also been studied.

Experimental

The soil sample was collected from Delhi (Delhi-Gurugaon Road). It was dried, powdered and sieved through a mesh to remove the coarsers particles. 25 gms. of the sieved material was treated with 0.5 N—HCl to remove free carbonates. The mixture was washed by repeated decantations with water and thorough shaking. The washed sediment was treated with 6% H_2O_2 to oxidise the organic matter and allowed to settle for 24 hours. The residue is washed thoroughly till free from chloride ions.

[1)] J. N. MUKHERJEE et.a., Indian J. Agric. Sc. **6**, 517 (1936).
[2)] J. N. MUKHERJEE and R. P. MITRA, Nature **154**, 824 (1944).
[3)] J. N. MUKHERJEE and R. P. MITRA, J. physic. Chem. **47**, 543 (1943).
[4)] R. P. MITRA, Bull. Indian Soc. of Soil Science No. 4, **41** (1942).
[5)] C. E. MARSHALL, J. physic. Chem. **46**, 1077 (1942).
[6)] C. E. MARSHALL, Z. Kristallogr. **10**, 3 (1945).
[7)] B. CHATTERJEE, J. Indian chem. Soc. **12**, 81 (1949).
[8)] K. C. MITTAL and O. P. BANSAL, J. Fur. Prakt. Chemie **3**, 27 (1963).

The residue was then dispersed in 1000 c.c. distilled water in the presence of 10 c.c. N—NaOH and was shaken in a mechanical shaker. The suspension was transferred to a jar and kept overnight. This was Na-clay which was pipetted out after 24 hours and evoporated to dryness. The dry residue was treated with 0.5 N—HCl and washed thoroughly till free from chloride ions. The H-clay thus obtained was dispessed in water by mechanical shaking for 8 hours and then allowed to settle for 24 hours. The suppernatent fraction was collected as H-clay.

To carry out the titrations the bottle titration technique was employed for potentiometric and conductometric titrations. A fixed volume (20 cc) of the acqueous suspension containing known amount of the H-clay, was taken in each of a set of 20—25 pyrex bottles provided with ground glass stoppers. Increasing amounts of the titrant was added to these bottles, and total volume was kept constant at 30 c.c. by adding water. They were then kept in a CO_2-free atomosphere by sealing them with wax, for about 24 hours, so that equilibrium conditions might be attained.

At the end of the period the specific conductance and pH of the contents of each bottle were measured.

The specific conductivities were plotted against the milli-equivalencts of NaOH added at every step. Similarly pH values were also plotted and the points of equivalence by the conductometric titrations were compared with the points of inflections in the pH curves.

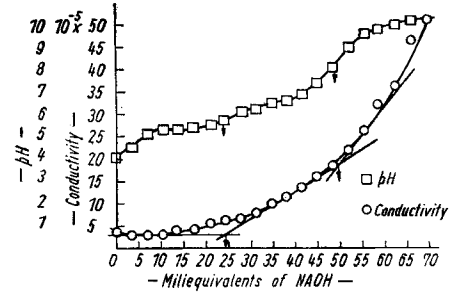

Fig. 1

Discussion

The potentiometric curve shows two inflection points, one at pH 5.6 and the other at pH 8.2. The base exchange capacities of these inflection points are 24 and 49 m.e. of NaOH. The conductometric curve also shows two points of inflections.

The nature of the curve resembles with that of illites obtained by MARSHALL and KRIMBILL[9]). The SiO_2/R_2O_3 ratio for the clay fraction for this Indian clay is 2.47, also corresponds to that of illites as the slica sesquioxide ratio for illites lies between 2 and 3 as calculated by GRIM[10]).

The base exchange capacity of the clay fraction of the clay loam is slightly greater then the range given by illites (10—40 m.e.) which also shows that the clay mineral present in Delhi clay loam is mainly illites. This

[9]) C. E. MARSHALL and C. A. KRIMBILL, J. physic. Chem. **46**, 1077 (1942).

[10]) R. E. GRIM, Clay mineralogy, MC. Graw Hill book Company INC, PP. 372 (1953).

fact is also confirmed by X-ray studies which reveal that illite mixed with some montonrillonite is present in the clay loam.

The sandy loam studied by MITTAL and BANSAL resembles with this clay loam as the mineral present in both of them is illite. The slight difference in some physical properties may be attributed to the difference in clay percentage of the soil and the silica content of the clay fraction.

Observation

Physico-chemical properties of the Soil.

Liquid Limit	41.00
Plastic Limit	26.50
Plastic Index.	14.50
Sticky Point.	33.50
Clay %	33.70
Silt %	42.50
Sand %	23.80
pH	7.20
Conductivity.	0.28×10^{-3} mhos.
Shrinkage Limit.	35.00
Shrinkage Ratio.	1.76
Volumetric shrinkage	19.70

Chemical Properties of H-clay of the Soil.

SiO_2 %	48.16
Al_2O_3 %	19.45
Fe_2O_3 %	11.80
SiO_2/R_2O_3	2.39
SiO_2/Al_2O_3	3.26
SiO_2/Fe_2O_3	10.81
B.E.C.	42 m.e.

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