CHINA CLAY FROM SALT RANGE AREA

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Processed clay from Salt Range Area was tested for chemical composition, drying and firing shrinkage, color on firing, plasticity and particle size, porosity, absorption and specific gravity. The standard testing methods were closely followed. Results obtained indicate that the indigenous clay studied can well compete with and be substituted for imported china clay.

Clays have been mined in this country for quite some time; nevertheless they have not fully met the domestic demand of good quality china clay: many manufacturers have desired to include some of the foreign clays in their mixtures. There has recently been discovered in the Salt Range Area a deposit of china clay which is of more than ordinary interest: a study in its physico-chemical properties ensures quite promising consequences. The clay in this formation is intimately associated with coarse sand from which it is removed by washing. The sand in this formation is usually coarse and can be utilised as building sand.

Preparation of Clay for Use

A bulk sample of good quality china clay obtained from Salt Range Area has been fully investigated. The clay contained impurities in the form of finely divided particles distributed throughout. This made purification operations like screening and hand-picking ineffective; method of washing was therefore adopted and developed for the beneficiation of the clay.

The method of washing most commonly adopted is the troughing method[1,2] in which the clay, after being stirred up and disintegrated with water, is washed into a long trough along which it passes, dropping its sandy impurities in the way and finally reaching the settling vats, into which the clay and water are discharged and where the clay finally settles.

The disintegration of the Salt Range clay sample was accomplished in the Laboratory with a round trough. After removing bigger lumps of stones, the clay was soaked for some time to slake it. It was then put in the washing vessel and a stream of water was directed upon it. The sieve employed for this purpose was of 200 mesh. The water with suspended clay passed from the sieve. The clay washed with water was discharged in the settling tank. With the aid of the suction pump attached to one end complete washing was possible. When the clay had settled, most of the clear water was drawn off and the cream-like mass of clay and water in the trough was drawn in an enamelled-ware from the bottom. The total percentage of pure clay in the original sample obtained in this way is 59.6% and that of free silica is 40.4%.

Chemical Composition of China Clay Sample

The chemical composition of washed and unwashed china clay together with the composition of standard china clay[3,4] is given in Table 1.

TABLE 1.

	Unwashed sample %	Washed sample %	St. English china clay %
Loss on ignition (combined H_2O)	10.64	12.56	11.8
SiO_2 ..	55.50	50.40	47.10
Al_2O_3 ..	31.02	35.20	37.80
Fe_2O_3 ..	1.02	0.96	0.75
CaO ..	1.79	1.00	0.17
MgO ..	Traces	nil	0.18
Alkalies ..	nil	nil	1.78
Total: ..	99.97	100.12	99.58

A glance at the chemical analysis of the above sample shows that washed sample is a good quality clay, resembling English china clay sample (though containing slightly higher Fe_2O_3, a part of which can be separated by means of powerful electro-magnets or by means of dilute acid washing).

Physical Properties of Clay

Shrinkage.—All clays shrink in drying and burning, the former loss being termed as air shrinkage and the latter as firing shrinkage. Percentage air shrinkage of the piece, 5%; percentage firing shrinkage at 1000°C., 8%; percentage water absorption of the piece, 5.71%. During firing the colour of the biscuit-ware was also observed which was clear white.

Porosity.—Porosity of a clay is determined to see the behaviour of the clay towards water and heat etc. % Porosity of the piece fired at 1000°C = 30.15%.

Measurement of Plasticity.—Qualitatively, the plasticity of clay is judged by feeling it between fingers; quantitatively, it is determined by the help of a vicat-needle. A needle with known weight above-head is penetrated into the body of clay and the depth of penetration in a specific time is taken as the measure of plasticity. The plasticity of the clay was found both qualitatively and quantitatively; it proved appreciably good to render it fit for body-making.

Grain-Size Analysis of the Clay by Pipette Method.—Since in a solid reaction the rate is controlled by the surface area, particle size is obviously important. For the determination of the grain size of the clay a known amount of the sample, (500 g.) was taken and this was graded with the help of a set of sieves (10 mesh, 20 mesh, 40 mesh, 60 mesh, 80 mesh, 100 mesh, 180 mesh, 200 mesh) and then 10 g. of the clay sample passing 200 mesh was taken. To this 150 c.c. of H_2O was added and for dispersion 1 c.c. of N/10 NaOH and N/10 Na_2CO_3 were added, this being shaken in an electric shaker for about 6 hours. The volume was made in a 1500 c.c. cylinder to about 1000 c.c. and various readings at different time intervals were taken.

Results of grain size analysis of the clay by sieves and by pipette method are presented in Tables 2 and 3 respectively.

The clay so investigated was found to contain 35% particles less than one micron and about 15% more than 20 micron. Fifty per cent of clay contained particles between 1 and 20 microns. Comparing these results with those obtained by other investigators,[3,5,6], it can easily be found out that the Salt Range clay has grain sizes of that of a standard china clay.

Conclusions

Primary kaolins generally have a drying shrinkage of 3 to 5% whereas secondary white clays have a drying shrinkage between 5 and 8%. Five per cent[7] shrinkage classifies it as a good clay.

The clear white colour of the ware from the properly washed clay grades it almost equal to English china clay.

TABLE 2.—SIEVE ANALYSIS OF THE RAW CLAY SAMPLE. TOTAL WEIGHT TAKEN, 500 g.

Mesh No.	Weights retained g.	% Retention	Cumulative % retention
10	90	18	18
20	90	18	36
40	100	20	56
60	15	3	59
80	35	7	66
100	30	6	72
180	30	6	78
200	85	17	95
Passing 200	25	5	100

TABLE 3.

Dia. in microns	Wt. of particles g.	Percentage weight %
20	0.1730	86.5
10	0.1497	74.85
5	0.1219	60.95
4	0.1137	56.8
3	0.1008	50.4
2	0.0916	45.8
1	0.0697	34.85

The plasticity was quite good and when wet with the proper amount of water the clay held any shape which was given to it.

More than 30% particles of the clay are below one micron in diameter and they are plate-shaped.

Large scale utilisation of the clay in ceramic industries will be taken at a later stage. On the basis of the properties studied, the a bove

clay can successfully be used in making fine earthen wares, and it could displace all the china clay in a whiteware body. It could also be used in the preparation of glazes, and as a floatative in the raw glaze batch. Its use as a filler in the paper industry can not be ruled out.

References

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