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METALLURGICAL REPORT

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BENEFICIATION OF TEA TREE GULLY CLAY.

by
A. D. SMITH
SENIOR METALLURGIST.

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BENEFICIATION OF TEA TREE GULLY CLAY.

Summary.

1. The raw clay is cream coloured and is not measurably improved in reflectivity by washing or bleaching.

2. The quartz content of the clay was reduced from ten per cent to a trace, and the muscovite content from twenty per cent to sixteen per cent.

3. A recovery of 85 per cent of the kaolinite was made by cyclone and microcyclone separation. Final washed clay was 55 per cent by weight of the raw clay.

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General.

Washing tests were carried out on a sample of Tea Tree Gully clay as part of the "White Clay Investigations" programme.

Sample.

Approximately ten cwt. of clay was obtained from the deposit being mined by Earthenware Industries Ltd. and Adelaide Potteries Ltd.

Washing.

The clay was agitated in 150 lb. lots at 30 per cent solids for two hours to effect separation of the clay particles. The clay slurry was then pumped to a 7½ inch diameter Dorrco hydrosizer operated with a rising velocity of 0.23 feet/min. Feed rate was 40 lb. solids/hour.

Overflow from the hydrosizer flowed along riffled launders to trap the fine quartz and mica not removed in the hydrosizer. Launder sand and hydrosizer underflow were combined to form primary tailings.

Overflow from the launders was fed to a microcyclone which made a further separation of quartz and mica from kaolinite. Overflow from the microcyclone was the final washed clay and underflow secondary tailings.

The per cent weight of the products and the distribution of kaolinite are shown in Table No. 1 The recovery of kaolinite was 67 per cent in 55 per cent by weight of the feed.

TABLE No. 1

Weight of Products and Distribution of Kaolinite.

Product	Weight per cent	Kaolinite per cent.	Kaolinite per cent distribution
Raw Clay	100	70	100
Hydrosizer overflow	68	75	75
Primary tailing	32	55	25
Secondary tailing	13	15	8
Washed Clay	55	85	67

Chemical analyses of raw and washed clay and X-ray analyses of all products are shown in Tables No. 2 and No. 3 respectively.

X-ray analyses show that the clay has a high mica content and that washing and cyclone separation are not very effective in separating this mica from the kaolinite. The muscovite in the microcyclone overflow must be of extreme fineness.

TABLE No. 2

Chemical Analyses of Raw and Washed Clay.

	Raw Clay.	Washed Clay.
Silica, SiO_2	55.46%	50.52%
Alumina, Al_2O_3	27.29	30.69
Ferric oxide, Fe_2O_3	2.02	2.10
Ferrous oxide, FeO	0.07	nil.
Magnesia, MgO	0.32	0.46
Lime, CaO	0.16	0.16
Soda, Na_2O	0.76	0.68
Potash, K_2O	1.48	1.30
Water at 100°C, H_2O	1.32	1.07
Water over 100°C, H_2O	9.36	10.73
Carbon dioxide, CO_2	-	-
Titanic oxide, TiO_2	2.05	2.09
Phosphoric anhydride, P_2O_5	-	-
Sulphur trioxide, SO_3	0.02	0.02
Chlorine, Cl	0.10	0.02

TABLE No. 3

X-ray Analyses of Raw Clay and Products.

Product	Quartz per cent.	Kaolinite per cent	Muscovite per cent.	Felspar Per cent
Raw clay	10	70	20	-
Hydrosizer overflow	6	75	15	-
Primary tailing	18	55	25	trace
Secondary tailing	30	15	50	2
Washed clay	2	85	10	-

It will be noticed in Table No. 3 that the secondary tailing is much higher in quartz and muscovite than the primary tailing, which indicates the superiority of cyclone separation over hydrosizer separation. (The primary tailing was produced by the latter separator).

A washing test was carried out on a small sample of raw clay using a 3 inch Dutch State Mines cyclone in place of a hydrosizer. Tailing produced with this separator contained 60 per cent quartz and only five per cent kaolinite compared with 18 per cent quartz and 55 per cent kaolinite in tailing produced by hydrosizer separation.

Retreatment of the cyclone overflow in a microcyclone produced a secondary tailing containing 30 per cent quartz and 10 per cent kaolinite and a final washed clay product containing only a trace of quartz. The muscovite content of the washed clay was still high.

Approximately 85 per cent of the kaolinite was recovered in a clay product equal to that produced by the hydrosizer and microcyclone. Recovery by the latter method was 67 per cent.

X-ray analyses of the products from this test are shown in Table No. 4.

TABLE No. 4

Cyclone and Microcyclone Separation

Product	Quartz per cent	Kaolinite per cent	Muscovite per cent	Felspar percent	*Accessories percent
Raw clay	10	70	20	-	-
Cyclone underflow	60	5	25	1	9
" overflow	5	65	30	-	-
Microcyclone underflow	30	10	50	-	10
" overflow	trace	83	16	-	-

* Accessories consist mainly of rutile, iron oxide, and a little zircon.

Particle Size of Raw Clay and Clay Products.

The particle size distribution of clays was determined by agitating clay samples at low pulp density in a dilute solution of sodium silicate to disperse the clay, and then measuring the decrease with time of the pulp density of free settling clay by means of a Bouyoucas hydrometer. From these results, the particle size diameters were calculated. Results are shown in table No. 5.

TABLE No. 5

Particle Size Distribution

Particle diameter. Microns.	Raw Clay.	Hydrosizer overflow	Microcyclone overflow.
+ 20	5	3	3
- 20 + 15	4	1	2
- 15 + 10	6	6	4
- 10 + 5	16	8	11
- 5 + 2.5	12	20	9
- 2.5	57	62	71

Colour.

Washing did not improve the colour of the clay. Both the raw clay and the final product had a reflectivity value of 82 per cent compared with pure magnesium carbonate.

Bleaching tests were carried out using up to 20 lb. per ton of sodium hydrosulphite and sodium sulphite at temperatures up to 70°C without any measurable improvement in the colour of the clay.

A. D. SMITH

SENIOR METALLURGIST

ADS:MPC.