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BENEFICIATION OF PINE POINT CLAY.

SECOND REPORT.

by

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SECOND REPORT.

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BENEFICIATION OF PINE POINT CLAY.

SECOND REPORT.

-Abstract-

Fine clay products from previous washing tests were treated in an attempt to meet specifications for the paper industry.

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1. SUMMARY.

Cyclone overflow products from previous tests (1) were subjected to air-separation and hydrocyclone tests.

Hydraulic treatment in a multicyclone gave a fine clay 90 per cent by weight of the cyclone feed and 20 per cent by weight of the raw clay but air floating was not successful.

The fine clay from hydraulic treatment was lower in coarse grit content than previous products and falls within paper manufacturers specifications, but no definite indication of silica content in the sub sieve range was obtained.

Brightness of the clay was not improved and on this characteristic it remains outside paper making specifications.

2. INTRODUCTION.

Washing tests by means of hydrocyclones had been previously carried out on samples of Pine Point clay[1].

Washed clay was the brightest produced during the "White Clay Investigations" programme, and had a low plus 200 mesh grit content suitable for rubber and paper filler usage.

However according to a consumer's laboratory report it did not meet paper trade specifications in either reflectivity or minus 200 mesh silica content.

Further tests were made in an attempt to produce economically a clay to meet the specification of the paper trade.

3. MATERIAL EXAMINED.

Three-inch diameter cyclone overflow and 1.2 inch diameter microcyclone overflow products from previous washing tests (1) were used in test work.

4. EQUIPMENT USED.

A "Raymond" laboratory hammer mill, a "Gayco" centrifugal air separator, a "Dorr" multicyclone, and "EEL" reflectometer, were used in test work.

5. EXPERIMENTAL PROCEDURE.

Treatment, which was identical for the three-inch cyclone overflow and the microcyclone overflow, consisted of feeding either a milled dry portion to the Gayco centrifugal classifier or a dilute dispersed pulp to the multicyclone.

Products from these separations were then evaluated by means of reflectivity, grit content and chemical analysis.

6. CONDITIONS and RESULTS.

6.1 Air Classification.

6.1.1 Treatment of 3 inch Cyclone Overflow Product.

Three-inch cyclone overflow product from previous washing tests representing 30 per cent by weight of the raw clay (1) was passed through the laboratory hammer mill to break any lumps, and fed to the Gayco centrifugal air classifier,

The machine was operated to produce a fine product containing a minimum of grit.

Feed rate was 40 pounds per hour.

Weight distributions of the separation are given in Table 1.

TABLE 1.

Air Separation of 3 inch Cyclone Overflow.

Product.	Weight %.
Coarse.	6.6
Fine.	93.4
FEED.	100.0

6.1.2 Treatment of 1.2 inch Microcyclone Overflow Product.

Microcyclone overflow product from previous test work representing 23 per cent by weight of the raw clay[1], was hammer milled and treated in the air classifier under similar conditions to those used in 6.1.1

Weight distributions of the separation are given in Table 2.

TABLE 2.

Air Separation of 1.2 inch Microcyclone Overflow.

Product.	Weight %.
Coarse.	3.3
Fine.	96.7
FEED.	100.0

6.2 Multicyclone Separation.

6.2.1 Treatment of 3 inch Cyclone Overflow Product.

Three-inch cyclone overflow material in an aqueous pulp was dispersed using sodium silicate, and fed to a Dorrclone unit fitted with thirty-two 5/8 inch diameter cyclones.

Treatment conditions are given in Table 3.

TABLE 3.

Multicyclone Treatment Conditions.

Feed rate.	lb. of dry solids/hr.	200
Feed.	per cent solids.	4
Underflow.	" " "	7
Overflow.	" " "	3
Underflow pressure.	lb/square inch.	10
Overflow pressure.	"	7

Weight distributions of the separation are given in Table 4.

TABLE 4.

Multicyclone Separation of 3 inch Cyclone Overflow.

Product.	Weight %.
Underflow.	12.2
Overflow.	87.8
FEED.	100.0

6.2.2 Treatment of 1.2 inch Microcyclone Overflow Product.

Microcyclone overflow product was dispersed and fed to the multicyclone at conditions given in Table 3.

Weight distributions of the separation are given in Table 5.

TABLE 5

Multicyclone Separation of 1.2 inch Microcyclone Overflow.

Product.	Weight %.
Underflow.	9.5
Overflow.	90.5
FEED.	100.0

The products from cyclone treatment were filtered, oven dried and hammer milled.

6.3 Grit Determination.

6.3.1 Products of Air Separation.

Results of grit determinations on products from air separation are given in Table 6.

TABLE 6.

Grit Content of Air Separation Products.

Mesh. (Tyler).	GRIT CONTENT - WEIGHT %.			
	Products from: 3-inch Cyclone Overflow.		Products from: Microcyclone Overflow.	
	Coarse.	Fine.	Coarse.	Fine.
+ 200	0.3	0.08	0.25	0.10
-200 + 325.	0.15	0.12	0.13	0.12

6.3.2 Products of Multicyclone Separation.

Results of grit determination on products of cyclone separation are given in Table 7.

TABLE 7.

Grit Content of Multicyclone Product.

Mesh (Tyler.)	GRIT CONTENT - WEIGHT %.			
	Products from: 3-inch Cyclone Overflow.		Products from: Microcyclone Overflow.	
	Multicyclone. Underflow.	Multicyclone. Overflow.	Multicyclone. Underflow.	Multicyclone. Overflow.
+ 200	0.05	0.01	0.03	0.01
-200 + 325.	0.15	0.09	0.05	0.02

6.4 Reflectivity Measurement.

6.4.1 Products of Air Separation.

Reflectivity to white light of samples of air separator products are given in Table 8.

These are compared with a standard tile of nominal reflectivity 76.5 per cent.

TABLE 8.

Reflectivity of Air Separator Products.

	Products from: 3-inch Cyclone Overflow.		Products from: Microcyclone Overflow.	
	Coarse.	Fine.	Coarse.	Fine.
Per cent Reflectivity.	76	78	76	78

6.4.2 Products of Multicyclone Separation.

Reflectivity of multicyclone products are given in Table 9.

TABLE 9.

Reflectivity of Multicyclone Products.

	Products from: 3-inch Cyclone Overflow.		Products from: Microcyclone Overflow.	
	Multicyclone. Underflow.	Multicyclone. Overflow.	Multicyclone. Underflow.	Multicyclone. Overflow.
Per cent Reflectivity.	76	77	76	78

6.5 Chemical Analyses.

Chemical analyses of multicyclone products from 3-inch cyclone overflow and microcyclone overflow are given in Table 10.

TABLE 10.

Chemical Analyses of Multicyclone Products.

		Products from: 3-inch Cyclone Overflow.		Products from: Microcyclone Overflow.	
		Multi-Cyclone Underflow.	Multi-Cyclone Overflow.	Multi-Cyclone Underflow.	Multi-Cyclone Overflow.
Silica.	SiO_2	47.39	46.78	46.46	46.04
Alumina.	Al_2O_3	37.16	37.62	38.23	38.35
Ferric Oxide.	Fe_2O_3	0.71	0.69	0.62	0.66
Ferrous Oxide.	FeO.	-	-	-	-
Magnesia.	MgO.	0.16	0.06	0.12	0.12
Lime.	CaO.	-	-	-	-
Soda.	Na_2O.	1.00	0.82	0.82	0.96
Potash.	K_2O	0.62	0.62	0.64	0.68
Water at 100°C		0.46	0.54	0.47	0.46
Water over 100°C		12.86	12.94	13.17	13.18
Titania.	TiO_2	0.13	0.13	0.11	0.13
Sulphur Trioxide.	SO_3	0.04	0.04	0.03	0.04
Chlorine.	Cl.	0.07	0.03	0.08	0.03
Less oxygen equivalent.		0.02	0.01	0.02	0.01
		100.58	100.25	100.73	100.64

6.6 Particle Size Determination.

Attempts were made to determine the particle size distributions in air separator and multicyclone products using a Bouyoucos soil hydrometer. This proved impractical owing to the difficulty in obtaining complete or even consistent dispersion of the clay in an aqueous pulp.

7. DISCUSSION of RESULTS.

The Gayco machine used for air classification was not suitable for such fine material, but a centrifugal classifier designed to treat material in the sub sieve range may be effective.

Fine clay products from air separation were similar in grit content to those obtained from previous microcyclone treatment.

Multicyclone treatment of microcyclone overflow product gave a clay which was 90.5 per cent by weight of the feed, and 20.8 per cent by weight of the raw clay[1].

This fine clay was appreciably lower in plus 200 mesh and plus 325 mesh grit content than the microcyclone overflow.

White light reflectivity of clay, also referred to as "brightness", was not improved by either air or hydraulic treatment.

Chemical analyses of multicyclone products did not show any reduction in silica content.

No particle size calculations from settling tests were attempted as it was not possible to obtain satisfactorily dispersed pulps.

Although some reduction in coarse grit content was obtained by hydraulic treatment, the clay is still outside the brightness limits set by the paper industry[2].

These specifications are:

Brightness (G.E. Photovolt Unit).	85% minimum.
Grit Residue on 200 mesh B.S.S.	0.1% maximum.
xMinus 200 mesh plus 37 micron.	1.5% maximum.

xThis figure is measured by a sedimentation tests.

8. CONCLUSIONS.

Multicyclone treatment of clay obtained from previous treatment appreciably lowered the plus 200 mesh and plus 325 mesh grit figuros but brightness of the clay was not increased.

Air floating the clay did not signifioantly reduoe the grit content or increase the brightness.

Although these tests indicate that the product is still unsuitable for use as a paper filler, samples of fine product should be forwarded to prospective consumers for final evaluation.

REFERENCES:

(1) Beneficiation of Pine Point Clay. R.D. Report No. 32 by A.D. Smith.

(2) Correspondence from Supply Manager, Australian Paper Manufacturers Limited of February, 1958.