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R.665 Centrifuge tests on washery effluent, Cornwall Coal Company N.L.

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The problems associated with the clarification and disposal of washery effluent have been discussed in Investigations R.651 and R.654 (*Technical Reports* 17:218-233). Clarification of the recirculating water was achieved in a plant test by flocculation of the effluent with sulphuric acid, but as predicted, this proved to be a short term measure only, as the settling dams do not have the storage capacity to retain the large volume of settled flocculated pulp. Centrifuging of the flocculated effluent is seen as a possible means of providing both a rapid and efficient disposal of the fine solids, and a virtually clean water for return to the plant.

After some discussion with the Company a request was made to undertake centrifuging tests on a sample of current washery effluent and also on a sample of the same product gathered some time previously, when, it was stated the shale content of the material was considerably higher.

TEST WORK

The test work undertaken consisted of a series of batch centrifuge tests in a Clements Model A Universal laboratory centrifuge, measurement of solids recovered and per cent solids in solid S/D (centrifuge cake) and liquid (L).

The centrifuge conditions were standard for each test, the only variation between tests being in the pH of the centrifuge feed, in effect, the degree of flocculation. Sulphuric acid was used to modify pH in all cases.

A flotation test was done on each sample to roughly determine the relative amounts of coal and shale present.

With the possibility in mind of future recovery of fine coal from the plant effluent by froth flotation a centrifuge test was undertaken on the flotation tailing from each sample.

TEST RESULTS

Standard Centrifuge Conditions

rpm	3 000
Time	4 minutes
Centrifugal acceleration, approximately	1 500 m/s ²

Series 1

Registered No 733495

Plant effluent sample obtained 6/6/73

8.4% solids

Flotation test

Product	% Mass
FC (Coal)	63.4
FT (Shale)	36.6
<u>Total</u>	<u>100.0</u>

Centrifuge tests

Test No	pH	% Solids		% Solids distn	
		S/D	L	S/D	L
1 (Whole slurry)	8.5 (No acid)	48.7	1.0	89.6	10.4
2 (Whole slurry)	7.0	46.9	0.1	99.0	1.0
3 (Whole slurry)	6.0	42.9	0.04	99.6	0.4
4 (Whole slurry)	5.4	44.7	Trace	100.0	Trace
5 (Whole slurry)	4.5	44.0	Trace	100.0	Trace
6 (FT)	5.0	45.0	Trace	100.0	Trace

Series 2

Plant effluent sample obtained in December 1972

11.8% solids

Flotation test

Product	% Mass
FC (Coal)	83.4
FT (Shale)	16.6
<u>Total</u>	<u>100.0</u>

Centrifuge tests

Test No	pH	% Solids		% Solids distn	
		S/D	L	S/D	L
1 (Whole slurry)	6.0	56.0	Trace	100.0	Trace
2 (FT)	5.0	44.0	Trace	100.0	Trace

COMMENTS ON TEST RESULTS

In all cases the cake (S/D) was in a soft, plastic condition. From observations made during visits to the washery it appears that material in the slime dams, subjected to the necessary extended drying periods to make handling possible, is in a similar condition to the cake.

The centrifuge liquid (L) provides virtually clear water, which, in the event of a commercial installation, could be recirculated to the plant or run to waste.

There is a relationship between pH (flocculation) and clarity of liquid. Between pH 6 and 7 there is practically total clarification under the conditions of centrifuging used in the test work.

Cake (S/D) moisture content does not vary greatly and is not related to the degree of clarification achieved.

There is little difference in the results obtained from either sample tested. Cake moisture is lower in the whole slurry test from Series 2, but this is explained by the fact that there is a significant amount of relatively coarse coal present in this sample.

There is no apparent difference in the centrifuging characteristics of either the whole slurry or the flotation tailings.

The flotation tests are of doubtful value in determination of the relative shale contents of each sample of slurry. The material tested in Series 1 was much the finer of the two and the flotation tailing from this sample contained a good deal of what appeared to be colloidal coal matter which failed to respond to flotation. On the other hand, a good separation was obtained from the coarser sample (Series 2).

CONCLUSION

The tests have served to establish the centrifuging characteristics of washery effluent in a batch type centrifuge over a range of pH values. If similar results could be obtained from a solid bowl continuous centrifuge, it is technically feasible that the slurry could be continuously and efficiently dewatered, the centrifuge cake being directly transferred to the shale bunker, thus eliminating the present costly and inconvenient method of handling the material in slime dams.

Virtually clean water would be recovered for recirculation to the plant or for disposal.

It is recommended that, if possible, a test unit be placed on stream at the washery to further test, in practice, the feasibility of the operation. If this is done and the results are as expected, only economic considerations should prevent a commercial installation being undertaken.

In the event of a commercial installation being considered, manufacturers' advice should be sought on appropriate materials of construction to resist abrasion and the possibly slightly acid nature of the flocculated slurry.

[22 June 1973]

TEST RESULTS

Test	W/D S/D	W/D Rate	Recovery % Solids
A. As discharged	2.8	45.2 l/min	78
B. As discharged	2.8	2.0 kg/min	