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MAGNETIC CONCENTRATION OF WASH PLANT TAILINGS AND OTHER SAMPLES FROM THE IRON ORE COMPANY OF CANADA, SCHEFFERVILLE, QUEBEC

by

P. D. R. MALTBY

MINERAL PROCESSING DIVISION

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SUMMARY OF RESULTS

Three samples of wash plant overflows of lean blue ores were treated by the Jones Wet Magnetic Separator with varying results. The best result, obtained with one sample on a continuous run of three hours at 20 amp, was a concentrate assaying 57.9% Fe containing 50.6% of the iron. A 100-lb blend of the three samples was treated to give a concentrate at 15 amp assaying 58.4% Fe containing 34.7% of the iron.

A small sample of "Iron Formation" Jeffrey magnetic separator tailing was treated at 10 amp to give a concentrate assaying 60.3% Fe, containing 75.9% of the iron. A sample of Jeffrey tailing of a calcine from magnetic roasting gave a concentrate at 5 amp assaying 32.7% Fe, containing 86.6% of the iron.

With satisfactory operating conditions, the Jones separator appeared capable of treating up to 260 lb/hr of the tailings. During some tests, a build-up of magnetics on the plates reduced capacity, but use of a screen to remove tramp oversize and higher water pressures to 60 psi may help overcome this problem.

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INTRODUCTION

Shipment

A total of 4800 lb of wash plant tailings from the Iron Ore Company of Canada was shipped to the Mines Branch on October 18, 1960. The shipment consisted of three samples, T 14748, T 14754, and T 14756, each contained in two drums. This material was all wash plant tailings, classifier overflows of lean blue ores, from the Company's mines near Schefferville, Quebec. Additional special samples were delivered later.

Purpose of the Investigation

Mr. H. E. Neal, Research Division of the Iron Ore Company of Canada, requested that the samples be treated by the Jones Separator as soon as it arrived and was installed. It was hoped to make a 55% Fe concentrate or better on each sample, and to carry out continuous test runs to determine throughput and operating characteristics of the separator. Mr. R. J. Isherwood, an Iron Ore Company engineer, was present during all the tests.

DETAILS OF THE INVESTIGATION

Batch Tests

Representative samples were cut out for preliminary batch testing to determine the correct amperage settings required. 1000 g of feed was used in each case, the middling and tailing (for example, from the 10 amp test), being combined and retreated at the next higher amp setting, except in Table 3 for sample T 14756 where the test was done at 10 amp only.

TABLE 1

Batch Test on T 14748

Product	Weight %	Analysis % Sol Fe	Distn % Sol Fe
15 amp conc	29.0	61.1	45.9
20 amp conc	7.6	55.4	10.9
20 amp midd	17.8	25.1	11.6
20 amp tail	45.6	26.8	31.6
Feed*	100.0	38.6	100.0

*calculated

TABLE 2

Batch Test on T 14754

Product	Weight %	Analysis % Sol Fe	Distn % Sol Fe
3 amp conc	2.2	51.6	3.1
3 amp slime**	23.4	47.1	30.1
10 amp conc	13.7	56.2	21.0
15 amp conc	11.2	53.4	16.3
15 amp midd	17.4	23.3	11.2
15 amp tail	32.1	20.9	18.3
Feed*	100.0	36.6	100.0

*calculated

**Slime resulted from decanting the 3 amp concentrate and filtering separately.

TABLE 3

Batch Test on T 14756

Product	Weight %	Analysis % Sol Fe	Distn % Sol Fe
10 amp conc	28.5	59.6	44.6
10 amp midd	33.6	35.0	30.8
10 amp tail	37.9	24.6	24.6
Feed*	100.0	38.1	100.0

*calculated

From the results of the batch tests it was decided to run continuous tests for 3 to 4 hours on T 14748 and T 14756, since the results on T 14754 did not give a concentrate of required grade.

Continuous Tests

The sample to be treated was weighed, dumped into a settling cone and pumped out as required into an agitator. By using two agitators, one feeding the separator, and being filled at the same time from the other, it was possible to run continuously. Feed density of about 20% solids was maintained. Weighed samples were taken at set intervals on the head, middling and tailing, the concentrate weight being obtained by difference. To prevent scale from the agitators plugging the magnet plates, a screen was inserted between the feed pump and the separator to trap oversize. However, this screen was not used in the first test which led to build-up on the plates and subsequent drop in capacity.

The first sample to be treated was T 14748. The run lasted 3 hours at an average feed rate of 133 lb/hr. The setting was 20 amp, the water pressure ranging from 35 to 45 psi. Although it was intended to feed at 20% solids, the actual feed was 16% solids until the final 30 min. During this last period at 22% solids, capacity increased to 170 lb/hr.

Results of the test are shown in Table 4.

TABLE 4

Continuous Test on T 14748

Product	Weight %	Solids %	Analysis % Sol Fe	Distn % Sol Fe
20 amp conc	30.0		57.9	50.6
20 amp midd	27.1	3.9	31.0	24.5
20 amp tail	42.9	7.2	19.9	24.9
Feed*	100.0	19.6	34.3	100.0

*calculated

On completion of the run, the magnet plates were examined, the weight of residue being 172 g. An analysis of this residue is shown in Table 5.

TABLE 5

Magnet Plate Residue T 14748

Fraction	Weight %	Analysis %		Distn % Sol Fe
		Metal Fe	Sol Fe	
+65 M	5.0	1.02	41.9	3.4
-65 M	95.0		62.2	96.6
Davis Tube conc (-65 M)	54.3	0.02	67.0	58.5
Davis Tube tail (-65 M)	40.7		58.0	38.1
Residue*	100.0		61.2	100.0

*calculated

A continuous run was next done on T 14756 with similar conditions as before. A total time of $3\frac{1}{4}$ hr elapsed at a feed rate of 231 lb/hr. The increased capacity was due to: (1) prevention of tramp

oversize from entering the feed hopper by use of a screen, (2) less magnetite in the sample, (3) keeping the feed hopper almost full to prevent a vortex being formed by the impeller and (4) the higher feed density of 23% solids. The results of the run are shown in Table 6.

TABLE 6

Continuous Test on T 14756

Product	Weight %	Solids %	Analysis % Sol Fe	Distn % Sol Fe
15 amp conc	21.2		60.2	32.9
15 amp midd	32.9	6.5	36.8	31.2
15 amp tail	45.9	11.6	30.3	35.9
Feed*	100.0	22.7	38.5	100.0

*calculated

On completion of the test, the magnet plates were cleaned, the total weight of residue being 77 g, assaying 63.9% Fe.

Due to the trouble experienced with slimes while filtering the Jones products, a sample of T 14748 was deslimed using a small cyclone at 20 psi feed pressure. The deslimed product was then treated at 20 amp with the results shown in Table 7.

TABLE 7

Test on Deslimed T 14748

Product	Weight %	Analysis % Sol Fe	Distn % Sol Fe
Cyclone slimes	8.1	56.3	12.0
20 amp conc	31.2	57.0	46.6
20 amp midd	25.5	27.4	18.3
20 amp tail	35.2	25.0	23.1
Feed*	100.0	38.1	100.0

*calculated

Table 8 shows the results of screen tests on the deslimed head sample and concentrate produced from it at 20 amp.

TABLE 8

Screen Tests on Deslimed T 14748

Mesh	Deslimed Head Sample Weight %	20 amp Concentrate		
		Weight %	Analysis % Sol Fe	Distn % Sol Fe
+150	0.7	1.0	35.8	0.6
+200	3.1	3.5	47.2	2.9
+325	14.1	22.8	54.2	21.9
-325	82.1	72.7	58.0	74.6
Total	100.0	100.0	56.5	100.0

Tests on the wash plant tailings were completed by running a blend of the three samples, made up of 2 parts of T 14748 and 1 part each of T 14754 and T 14756. About 100 lb of the blend was run at 22% solids at a feed rate of 261 lb/hr. No residue was collected from the magnet plates at the end of the test. Results are shown in Table 9.

TABLE 9

Test on Blend of Wash Plant Tailings

Product	Weight %	Solids %	Analysis % Sol Fe	Distn % Sol Fe
15 amp conc	23.0	2.3	58.4	34.7
15 amp midd	30.0		38.3	29.6
15 amp tail	47.0		29.5	35.7
Feed*	100.0		38.8	100.0

*calculated

Special Samples

Two small samples were brought by Mr. Isherwood for batch testing on the Jones separator. One sample, T 14746, was said to be Jeffrey tailing (minus 200 M) of Iron Formation, while the other sample was Jeffrey tailing (minus 100 M) of a calcine from magnetic roasting. The results of the test on T 14746 are shown in Table 10. Feed weight taken was 720 g.

TABLE 10

Separation of Sample T 14746

Product	Weight %	Analysis % Sol Fe	Distn % Sol Fe
5 amp conc	32.1	62.2	52.5
10 amp conc	15.8	56.3	23.4
10 amp midd	14.7	19.0	7.4
10 amp tail	37.4	17.0	16.7
Feed*	100.0	38.0	100.0

*calculated. The combined concentrates in Table 10 assay 60.3% Fe.

The results of testing the calcine tailing are shown in Table 11. Feed weight taken was 680 g.

TABLE 11

Separation of Calcine Tailing

Product	Weight %	Analysis %		Sol Fe
		Sol Fe	Tot Fe	
5 amp conc	79.0	32.7	33.4	86.6
5 amp midd	11.6	22.7		8.8
5 amp tail	9.4	14.6		4.6
Feed*	100.0	29.8		100.0

*calculated

CONCLUSIONS

From the test results, concentrates of better than 55% Fe were obtained on wash plant tailing samples using the Jones separator. A sample of "Iron Formation" Jeffrey tailing gave promising results while a calcine tailing sample was upgraded only slightly.

It was found that, after a few preliminary adjustments, the Jones separator would handle up to an average of 231 lb/hr of wash plant tailings continuously with satisfactory results for over three hours. Some residue remained on the magnet plates at the end of two runs, but the use of a screen to trap tramp oversize reduced the amount considerably. It is felt that the use of a water pressure of 60 psi would help overcome this problem, and on a small run with an ore of similar properties, the writer has found that this is so. During the investigation, the separator produced similar grades and recoveries on batch and continuous tests.

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