

66-19-P

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MINIMUM REAGENT LEVELS IN FELDSPAR FLOTATION  
July 1966 Progress Report

Lab. No. 2052-K - Book 183, p. 1-14 and 43-48  
by  
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Object

An unsponsored project was undertaken to collect additional information about minimum levels of tallow amine acetate and hydrofluoric acid which can be used in batch flotation of feldspar from quartz. The September to December 1959 Progress Reports contain a large amount of data on the use of low reagent levels with the Spruce Pine alaskite ores. In this project Lab. No. 2052-K from The Kings Mountain Mica Company tailings was used.

When the minimum reagent levels were determined, tests were made to examine the effect of stage conditioning hydrofluoric acid and amine acetate. Tests were also made by thick pulp conditioning with hydrofluoric acid, followed by amine acetate addition to the cell rather than conditioner.

Procedure

The standard procedure used in the flotation is recorded in the Appendix. After minimum levels of reagents were established, variations from the standard procedure were made as follows: reduced water to conditioner to allow conditioning at 65 percent solids, poured into cell, brought water level to mark, added amine acetate and conditioned in cell for specified time.

Results

Tables 1 and 2 give the data which establishes the minimum reagent levels of 0.10 pound per ton of tallow amine acetate and 0.15 pound per ton hydrofluoric acid\*.

Table 3 gives results of stage conditioning with hydrofluoric acid at thick pulp for four minutes with amine acetate at minimum satisfactory level and hydrofluoric acid below minimum level. Test No. 17 used standard procedure and Test No. 20 the stage conditioning. Stage conditioning had no beneficial effect at this level.

Table 4 gives results of stage conditioning hydrofluoric acid at thick pulp and varying the time of conditioning with amine acetate in the cell. The results show that this procedure will not lower the minimum satisfactory amine acetate level.

\* Based on 100 percent hydrofluoric acid

Table 1

Minimum Amine Acetate Level  
(Hydrofluoric Acid 1.0 lbs/ton)

Test No.	lbs/ton Amine	Feldspar Float Product		Quartz Machine Discharge	
		% Weight	% Alkali	% Weight	% Alkali
1	0.10	24.7	13.85	58.0	0.23
11	0.10	25.0	14.20	59.5	0.13
2	0.075	21.2	14.51	60.4	0.66
3	0.075	19.7	14.44	63.1	0.85

Table 2

Minimum Hydrofluoric Acid Level  
(Amine Acetate 0.10 lbs/ton)

Test No.	lbs/ton HF	Feldspar Float Product		Quartz Machine Discharge	
		% Weight	% Alkali	% Weight	% Alkali
11	1.0	25.0	14.20	59.5	0.13
5	0.4	25.5	13.90	58.5	0.09
6	0.3	25.2	14.31	56.4	0.12
7	0.2	25.7	13.98	57.7	0.10
12	0.15	23.5	14.52	58.3	0.12
17	0.10	19.2	13.60	64.5	1.47

Table 3

Stage Conditioning With Hydrofluoric Acid Below Minimum Level

<u>Test No.</u>	<u>lbs/ton HF</u>	<u>Feldspar Float Product</u>		<u>Quartz Machine Discharge</u>	
		<u>% Weight</u>	<u>% Alkali</u>	<u>% Weight</u>	<u>% Alkali</u>
17	0.10	19.2	13.60	64.5	1.47
20	0.10	18.7	13.53	61.8	1.54
			N.D.		0.020
			N.D.		0.020

Table 4

Stage Conditioning Hydrofluoric Acid\* With Amine Acetate Below Minimum Levels

<u>Test No.</u>	<u>lbs/ton Amine</u>	<u>Amine Cond. Time</u>	<u>Feldspar Float Product</u>		<u>Quartz Machine Discharge</u>	
			<u>% Weight</u>	<u>% Alkali</u>	<u>% Weight</u>	<u>% Alkali</u>
8	0.075	4 min.	20.1	14.44	60.8	0.96
9	0.075	30 sec.	18.6	14.62	60.3	1.20
10	0.075	15 sec.	20.8	14.10	59.1	0.84
13	0.075	1 min.	18.5	14.00	64.5	1.20
						0.042
						0.034
						0.026
						0.040

\* 0.15 pound per ton

### Conclusions

Minimum reagent levels of 0.10 pound per ton of tallow amine acetate and 0.15 pound per ton of hydrofluoric acid were established for The Kings Mountain Mica Company ore which has a size range of essentially minus 28 plus 150 mesh. Efforts to reduce the minimum level by thick pulp conditioning with hydrofluoric acid and by stage conditioning resulted in no significant lowering of acceptable reagent level.

### Recommendations

The work completed in this report was the second stage of an exhaustive investigation of the tallow amine acetate-hydrofluoric acid procedure for separation of feldspar from quartz. The first stage was conducted on Spruce Pine ore and is reported in detail in the September to December 1959 Progress Reports. Results confirm that minimum reagent levels in batch work are much lower than those in actual practice in the plant.

Additional work along with liaison between plant and laboratory is recommended to determine the major reasons for variation in minimum batch level consumption and actual plant usage.

Additional variables to study include degree of desliming, effects of mill water, screen analysis and size distribution of flotation feed and products, degree of dewatering between floats, type and amount of aeration, efficiency of conditioning, reagent concentration in grams per liter of conditioning pulp and float pulp, and pulp density in float cell.

Appendix

Standard Metallurgical Procedure

Scrub 1000 grams of ore for 7.25 minutes at 74 percent solids with 1.0 pounds per ton sodium hydroxide in Wemco Mineral Master at 1360 rpm. Dilute to 10 percent solids in plastic bucket, agitate by hand, allow to settle thirty seconds, decant to approximately 70 percent solids. Some decanted water is returned to bring sample to 65 percent solids. Add 620 ml fresh water, agitate with hand, decant at once. The decanting procedure listed above was designed by Mr. Philip Neal to reproduce as nearly as possible the conditions of the screw classifier at Kings Mountain Silica Company plant.

Carefully transfer sample to 2000 ml stainless steel beaker, add 2.5 pounds per ton sulfonated petroleum oil, 1.25 pounds per ton sulfuric acid (pH of conditioner 2.6) and water to 63 percent solids. Condition 5 minutes and transfer to 500 gram Denver sub-aeration glass cell, add 0.1 pounds per ton F-65 frother, agitate 5 to 10 seconds without air and open air valve. Remove froth product with paddle, and place in oven to dry. Dewater and return machine discharge to 2000 ml beaker, bring to 52 percent solids with 1.0 pounds per ton of hydrofluoric acid, required amine acetate and water from cell. Condition 4 minutes, transfer to cell, add 0.05 pounds per ton F-65 grother, turn on air and float feldspar. Remove froth with paddle, dewater, dry and weigh. Dewater, dry and weigh quartz machine discharge.