Kyanite Flotation Experiments
Prepared for Group 3-Wed

New Data Based on Old Data Laboratories

07 April, 2021

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1 Feed Characterization

1.1 Size Distribution

The size distribution data collected for the feed is tabulated in Table 1. The resulting fraction in each class and fitted size distributions are shown in Figure 1. The Gaudin-Schumann and Rosin-Rammler distributions are parameterized as shown in Equations (1) and (2) respectively. The fitting parameters are shown in Table 2.

Table 1: Observed Size Distribution Data

Sieve (Mesh)	Sieve Opening (mm)	Sample Weight (g)	Fraction Retained	Fraction Passing
16	1.180	0.002	0.0000	1.0000
30	0.600	0.491	0.0020	0.9980
50	0.300	89.412	0.3570	0.6410
100	0.150	96.604	0.3858	0.2552
200	0.075	50.877	0.2032	0.0521
Pan	0.000	13.044	0.0521	0.0000
Totals:				
		250.430	100.0000	

$$Y = \left(\frac{X}{k}\right)^m \tag{1}$$
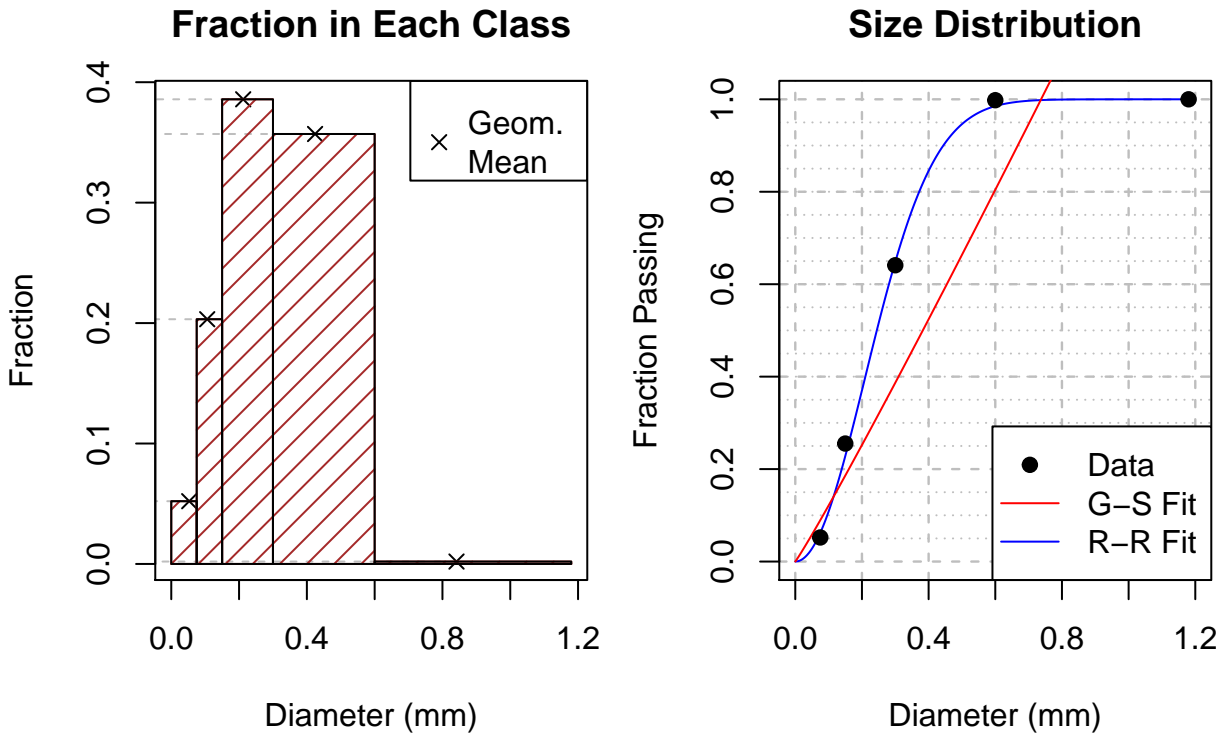
$$Y = 1 - e^{-\left(\frac{X}{k}\right)^m} \tag{2}$$

Figure 1: Size distribution data plotted with fited lines.

Table 2: Size Distribution Fitting Parameters

	Gaudin-Schumann	Rosin-Rammler
k	0.737	0.293
m	1.056	2.013

1.2   Grade

Feed grade is shown in Table 3. The values in Table 3 were generated by back calculating feed grade for each test, and then taking the average. Therefore, the grade displayed in Table 3 should only be used to characterize the feed, and ***should not be used for performance and efficiency calculations***.

Table 3: Makeup of Feed

Substance	Grade (%)
Al	3.97
Fe	2.34
SiO_2	58.58

2   Procedure

The procedure was conducted as requested. The initial sample was split using a Jones Riffler, and then each of the tests displayed in Table 4 was conducted. XRF analysis was used for assays. Samples were placed in cups for XRF analysis and not pelletized.

3   Lab Findings

3.1   Quantitative

Results for a given test are shown in Table 4. Initial mass and assay for each feed sample was not taken, but instead were back-calculated.

Table 4: Experimental Design and Collected Data

Test Number	Attrition Scrubbing	Fatty Acid Dose (lb/ton)	Sample Mass (g)				Al Grade(%)			Fe Grade(%)			SiO$_2$ Grade(%)		
			CON	TAIL	UF	Total	CON	TAIL	UF	CON	TAIL	UF	CON	TAIL	UF
1	NO	0.5	62.22	460.84		523.06	6.93	3.79		9.67	1.51		17.54	71.49	
2	NO	1.0	112.36	407.76		520.11	4.82	1.60		7.10	1.27		52.99	66.01	
3	NO	1.5	168.29	336.85		505.14	12.25	1.40		5.45	0.54		36.49	68.30	
4	YES	0.5	97.89	375.28	3.14	476.31	9.42	1.08	8.37	4.49	0.98	17.59	18.02	61.24	15.55
5	YES	1.0	242.00	273.38	4.07	519.45	4.75	2.49	10.20	4.38	1.47	25.77	36.90	53.50	23.31
6	YES	1.5	163.89	323.77	7.81	495.47	15.75	0.93	4.00	3.99	0.59	22.39	38.97	83.69	21.25

3.2   Qualitative and Misc.

3.2.1   No Attrition Scrubbing Tests

Froth was grey at the beginning of flotation. An obvious color change from grey to red occurred when the froth depleted. Flotation time for the 0.5, 1, and 1.5 lb/ton tests was 30 s, 55 s, and 65 s respectively.

3.2.2   Attrition Scrubbing Tests

At the beginning of flotation, froth was grey. As the froth was exhausted, the color of the froth changed to a white color. Average flotation time for these tests was 45 seconds.

3.2.3   Images

Images are available in the attached folder. A selection of the images available are displayed below.
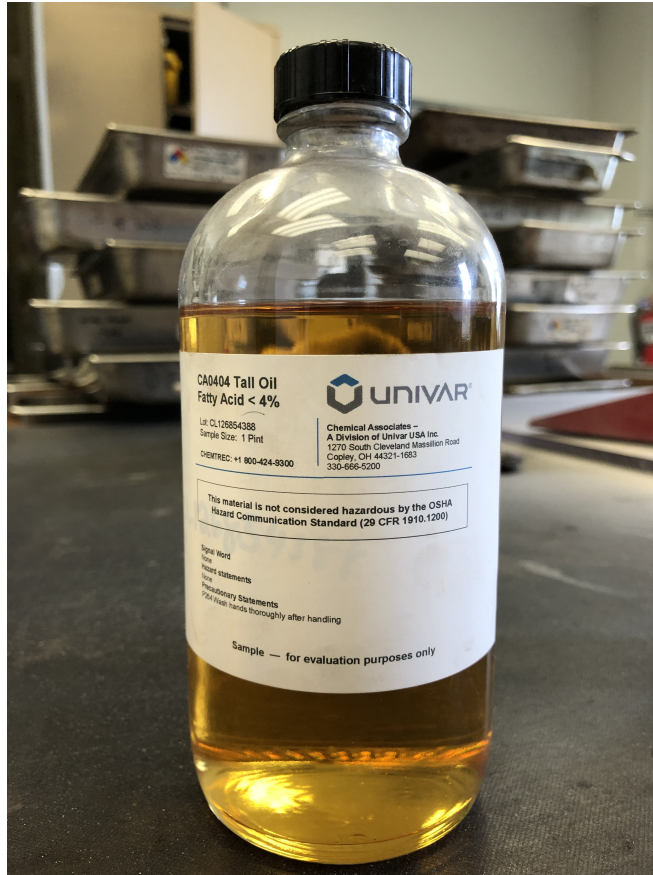

Figure 2: Kyanite feed ore

Figure 3: Fatty acid used in testing

Figure 4: Impeller used for attrition scrubbing