

## Study of Settling Behavior in High Rate Decanters

Vinod Kumar Verma<sup>1</sup> and Midde Rama Satyanarayana<sup>2</sup>

1. Senior Manager (R&D)

2. Senior Manager (R&D)

National Aluminum Company Limited, Koraput, India

Corresponding author: vinod.verma@nalcoindia.co.in

### Abstract



In the Bayer process, production of alumina tri hydrate is controlled by availability of clear liquor for crystallization. Production of clear liquor is affected with decanter operation and filter performance. Decantation is used to separate bulk of the solids where flocculant is added to slurry to achieve rapid settling of solid particles. Feed conditions dictates flocculant consumption rate and overflow liquor clarity. Impact of mud characteristics and methods of controlling feed parameters are discussed in this paper. Attempt is made to study settling behavior with respect to mud composition and scheme to get desirable feed conditions was tested.

**Keywords:** Bauxite Residue Settling, Gibbsite, Flocculant, Desilication.

### 1. Introduction

Bayer Process uses caustic liquor to dissolve alumina from bauxite. Digested alumina stays in liquor phase which needs to be separated for further processing. Gravity decantation is used to separate bulk of the solids and supernatant liquor is further clarified with pressure filters to get clear liquor which is then subjected to crystallizers for precipitation of alumina tri hydrate. Hence decantation is a key step which dictates performance of filtration unit and process flow rates in alumina refinery.

NALCO refinery at Damanjodi is using high rate decanters (HRD) to achieve fast separation with compact mud generation. This study is conducted to find key operating parameters which are affecting settling performance. Effect of elemental & phase composition on settling is studied. Based on the outcome of this study, a modified dilution scheme is tested with jar settling test.

### 2. Impact of solids composition on settling

HRD feed solids were analyzed for mineral composition with XRD and elemental composition with XRF. It was understood that high Goethite content results in poor settling. High silica bauxite is also supposed to retard decanter performance.

Sample analysis during normal operation suggests that Goethite to Hematite ratio in range of 0.5 to 0.7. During troubled times also, Goethite to Hematite ratio was not varying much and staying in normal range. XRF analysis revealed that Al<sub>2</sub>O<sub>3</sub> was sometimes higher than normal during episodes of poor settling. Flocculant dosage were analyzed against Al<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub> and Na<sub>2</sub>O and presented at Figure and Table 1.

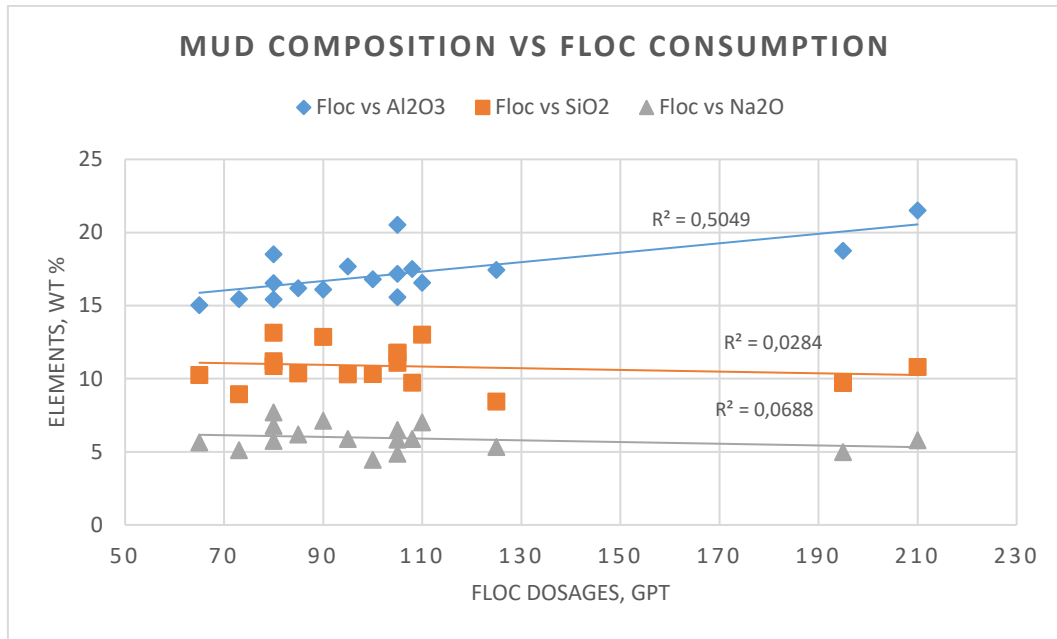


Figure 1. Flocculant dosages against elemental composition.

Table 1. Elemental & phase analyses of feed solids

Floc Dosage, g/T	XRD Analysis			XRF Analysis				
	Hematite	Goethite-Al	G/H	Al2O3	Fe2O3	TiO2	SiO2	Na2O
125	39.83	26.73	0.670	17.43	56.29	4.09	8.44	5.33
85	48.03	29.81	0.620	16.18	54.60	4.08	10.36	6.18
73	52.67	32.18	0.610	15.43	57.17	4.21	8.93	5.10
105	51.17	33.89	0.660	15.57	53.60	3.87	11.79	6.49
65	56.40	31.06	0.550	15.01	56.25	4.17	10.24	5.64
80	50.59	33.84	0.670	15.41	53.97	4.00	11.20	6.76
80	46.19	27.62	0.600	16.54	50.17	3.48	13.13	7.68
110	49.39	28.70	0.580	16.55	50.66	3.85	13.00	7.00
90	52.99	31.10	0.590	16.10	50.92	4.02	12.86	7.12
100	50.17	33.33	0.660	16.79	55.56	4.56	10.32	4.44
105	33.00	22.31	0.680	20.52	51.80	4.26	11.07	4.86
80	32.87	17.31	0.530	18.51	52.36	3.84	10.86	5.74
210	18.36	10.62	0.578	21.50	50.86	4.66	10.80	5.79
195	36.13	16.84	0.466	18.74	53.58	4.40	9.69	4.97
95	28.62	15.11	0.528	17.68	53.67	3.87	10.30	5.87
105	34.09	19.98	0.586	17.16	52.55	4.09	11.74	5.83
108	33.69	21.52	0.639	17.50	52.78	4.16	9.73	5.86

XRF analysis of mud samples indicates positive correlation between Alumina in mud and flocculant requirement at HRD. Flocculant dosages were found to be independent of Silica & Soda in mud which suggests that bauxite Silica or reactive Silica doesn't interfere in settling.

#### **4. Conclusion**

The effect of gibbsite present in mud is considerable. It was observed that presence of gibbsite in mud results in poor settling behavior. Goethite to hematite ratio remained fairly stable in all the studied samples. This ratio is function of ore quality which remains steady if ore from single deposit is used. Impact of other elements including silica were negligible on decanters performance. Jar settling test indicates that additional feed dilution helps in achieving better settling with lower flocculant dosages. Scheme to achieve optimum feed solids without affecting post-desilication performance is worked out.