AA01 - Improvement of Mud Circuit Efficiency while Processing East Coast Bauxite of India

Abhijeet Bandi[1], Kausikisaran Misra[2], N. Nagesh[3], Uttam Kumar Giri[4] and Rama Chandra Nahak[5]

1. VP (Red Side, Process)
2. GM (Technical)
3. Unit Head & President
4. DGM (White Side, Process)
5. AGM (SH, Mud Wash)

Utkal Alumina International Limited, Doraguda, Odisha, India

Corresponding author: Abhijeet.bandi@adityabirla.com

Abstract

With the ever-decreasing quality of Bauxite being processed in Bayer plants and the drive for increasing production, the stress on the mud circuit of modern plant is greater than ever. To facilitate the same, modern day thickeners have evolved from the earlier conventional settling tanks to the high rate decanters (HRD) and deep cone washers (DCW). These high rate decanters and deep cones meet the objective to process bauxite residue with high compaction, with minimal residence time in order to improve the separation efficiency.

Usage of synthetic polymers enhances the solid –liquid separation. Choosing a right flocculant for the regional bauxite to be processed, enables reduced variations in the circuit. Customized flocculant application is imperative to achieve the desired settling rate for a compact underflow and clear supernatant liquor.

At UAIL (Utkal Alumina International, Ltd), the Indian east coast bauxite (Baphlimalli Mines) is digested at medium temperature to extract alumina and the bauxite residue is processed through a Counter Current Decantation (CCD) circuit consisting of HRD's and DCW's before the residue is dry discharged to the residue disposal area via Pressure Filters.

This paper highlights the efficient bauxite residue processing at UAIL, by debottlenecking the mud circuit to enable processing of low THA bauxite (than design). Substantial gains achieved in terms of sustaining higher production rates, reduced chemical soda losses, and optimal flocculant consumption. This paper also describes the impact of introducing dry residue disposal and management for the refinery.

Key Words: Bauxite residue, Bayer's process, decantation, flocculant, tri-hydrate alumina & pressure filtration.

1. Brief Process Description

Utkal alumina refinery, located at Doraguda, in Rayagada district of Odisha, India is a 100 % subsidiary of Hindalco Industries Ltd., of the Aditya Birla Group. The project activities commenced since 2008, while the mining activities started in 2012. State of the art Rio Tinto Alcan Technology (RTA) was adopted to produce 1.5 Mio Tons of smelter grade alumina with a 95% plant availability. Cogen unit (3*30 MW, 2 running, 1 standby) supplies the power and steam. The plant has 2 operating trains of 0.75 Mio Tons / annum.

The plant was designed based on the bauxite source available at the Baphlimalli mines, situated appx. 20 km from the refinery site. The bauxite is transported through a long-distance conveyor

(LDC) spanning 18.2 km from the mines to the refinery stock yard. Around 600,000 MT of bauxite can be stacked at the plant stock yard. A stacker is in place to handle the bauxite at the yard, and a reclaimer is provided to reclaim the bauxite from the yard and feed to the system. This arrangement ensures uniform quality of bauxite being fed to the refinery on a daily basis.
Primary crusher at mines end reduces the size of the mined bauxite to -150mm (90 %), while the secondary crusher at the refinery end reduces the size further.3 rod mills (2 running, 1 standby) are used to grind the bauxite. The bauxite is fed from the independent mass flow silo through an apron feeder and a belt conveyor to the feed hopper, where the SFL is mixed for wet grinding. Bauxite grinding is facilitated by 80 % attrition and 20 % impact in the rod mills. This is a wet, open circuit grinding. The ground slurry is further transferred to PDS tanks through IBSH (indirect Bauxite slurry heaters). The residence time across the PDS is 16-20 hours. From the last PDS tank the bauxite slurry is charged to the 1st Digester of each train.

In the digesters SFL (strong feed liquor) is fed through a series of liquor heaters. Four liquor heaters use regenerative flash vapor, and across the remaining 2 liquor heaters, live steam of 4 bar and 12 bar is used to further raise the temp.

Both the SFL and bauxite feed slurry are charged to the digester via a mixing Tee. 4 numbers of digesters are provided to complete the reaction time. The digested slurry is flashed across a series of 4 flash vessels and finally pumped via the blow off pumps to the Mud separation & washing unit.

The Alcan High rate decanters are used to primarily separate the sodium aluminate liquor (PGL) from the residual solids. The HRD's are equipped with advanced rake mechanism, customized flocculant dosing lines, Mud sensors, and underflow pumps with recirculation and transfer lines. The overflow of the HRD's termed as PGL is pumped to the polishing filters. Diaster filters Gaudfrin make are installed to filter the PGL [1, 2].

The underflow from the HRD's is processed through series of DCW's (deep cone washers), wherein counter current flow of wash water and residue is arranged to wash the mud and maximize soda recovery from the bauxite residue before it is pumped via Geho pumps to the Red Mud Filtration (RMF) unit.

The DCW's are equipped with advance rake mechanism, E-duc (Feed well auto dilution arrangement), customized floculent dosing, Mud sensors, scale trap. The underflow pumps are provided with transfer and recirculation provisions.

Wash water used for mud washing is charged to the last stage, to generate the 1st washer overflow used to dilute the HRD feed slurry. Filtrate from the RMF unit, and process condensate is used as wash water.

The PGL from the security filtration area is cooled across the Plate Heat Exchangers (PHE's) in the HID (heat interchange dept.), whilst the SPL (spent liquor is heated) and pumped to evaporation unit to concentrate.
A part of cooled PGL is used to reslurry the fine seed and charged to agglomerator, while the major part is used to reslurry the coarse seed and charge to the 1st growth tank.

Each precipitation train comprises of 1 Agglomerator and series of growth tanks. Interstage coolers are installed on growth tank to enhance cooling across the precipitation circuit.

The precipitated slurry is classified in two stages of cyclones. Part of fines is recirculated to agglomeration, and the coarse seed is fed to coarse seed deliquoring filters and the cake is reslurried back with PGL to the 1st growth tank.

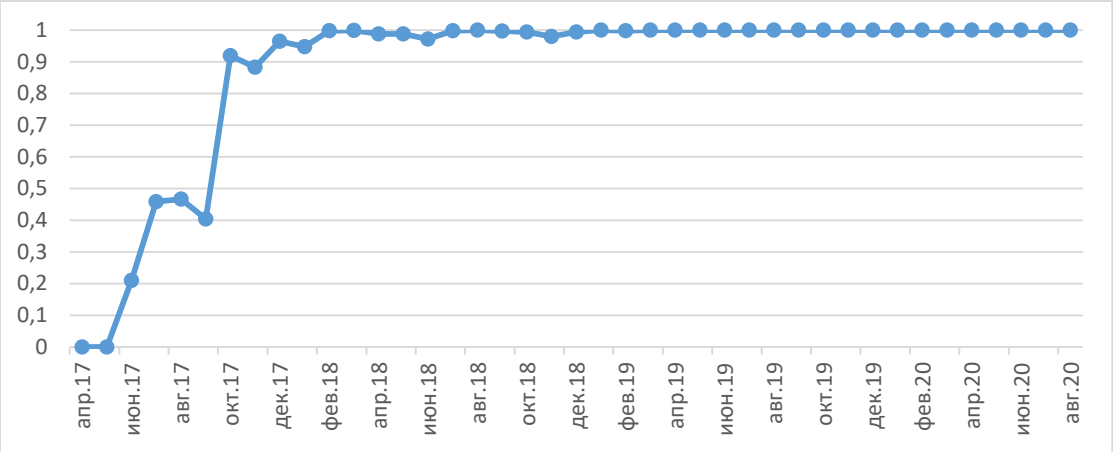

Figure 9. Residue processing time through pressure filters.

5. References

1. Alcan Red Side Process Manual, Vol-23, *Technology Document.*
2. *Utkal Greenfield Project Training Manual* – Mud Separation (Area 240), Mud Washing (Area 241), Mud Pumping and Storage (Area 242, 243).
3. Internal Capital Proposal Note for debottlenecking of Mud circuit for 1.5 Mio Tons alumina production with < 38% THA, CP/PROV/02/R/UAIL/15-16.
4. L.J. Conelly and P.F. Richardson, Coagulation and flocculation in Mining Industry, *"Solid Liquid Separation and Mixing in Industrial Practice"*, Pittsburgh Section of AIChE, 1984, October 10.
5. Pierre Ferland, John Malito, Everett Philips, Effects of temperature and method of solution preparation on the performance of typical red mud flocculant, Reprint 866.
6. Guy Peloquin, Guy Simard, *Improved Thickener for Red Mud, Proceedings of the 6th International Alumina Quality Workshop*, Brisbane, Australia, 2002, September 8-13.
7. R.B. Kahane and C. Mcrae, *Improved Bauxite Residue Settler Performance, Fourth International Alumina Quality workshop*, Darwin, 1996, June 2-7.
8. *Operation Instruction of Jingjin filter press contents* - O&M Manual.