Implementation and Optimization of Filter Press in Red Mud Washing Process at Eti Aluminium

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Abstract

Red mud management is a major and ongoing issue for review within alumina refinery operations. The accumulation of large tonnages of red mud, accompanied by significant volumes of supernatant liquor which cannot be returned to the process, requires a very large disposal area. Importantly, the volume of liquor present significantly reduces the life time of the containment dam in the residue disposal area. For this reason, the red mud issue is particularly significant also because of the environmental themes linked with the dewatered material storage. To both prevent unwanted environmental results in the future and handle this process residue responsibly, an extensive research programme should be executed to find the most efficient way of minimizing any problems by using state of the art technology. ETI Aluminium has the capacity to process 550 000 tonnes of bauxite, produce 250 000 tonnes of alumina per year which generates approximately 260 000 tonnes of red mud. Red mud slurry was formerly disposed as 30 % (w/w) solids and less than 5 g/L Na_2O to red mud dam. A number of alternative dewatering technology trials were carried out by ETI Aluminium; the best performance was achieved with a horizontal press filter due to its high efficiency residue handling optimization in red mud filtration. Following these trials, ETI Aluminium invested in an automatic horizontal press filter in the red mud washing cycle. This paper describes the performance, operation and parameters of the new red mud handling process with press filter in ETI Aluminium.

Keywords: Bayer process, red mud, bauxite residue, filter press, dewatering, process optimization.

1. Introduction

Red mud management is a major and ongoing issue for review within alumina refinery operations. The accumulation of large tonnages of red mud, accompanied by significant volumes of supernatant liquor which cannot be returned to the process, requires a very large disposal area. Furthermore, the volume of liquor significantly reduces the life time of the containment dam in the residue disposal area. Therefore, the red mud causes many problems taking into account environmental concerns linked with the wet material storage. An extensive research programme should be executed to find the most efficient way to prevent unwanted environmental impacts in the future and handle this residue, using state of the art technology.

Currently, the solid content from ETI's conventional last washer thickener is about 30 % (w/w) prior to pumping to the dam. Some alternative dewatering technology trials such as deep cone thickener, vacuum filtration, decanter centrifuge and filter press were carried out by ETI. From latest technological paste thickening application point of view, 33 to 40 % solids in the underflow seems to be achievable with the existing ETİ Aluminium red mud characteristic. Also using vacuum filtration and centrifugal decanter technology, the achievable cake solids content is around 47 % and 55 % respectively. The best performance was achieved with a horizontal press filter due to its high efficiency in terms of dryness, liquor recovery rate and capacity. ETI has been expecting a high-solid content cake from the filter press that will consume less volumetric flow-rate and let more residue to dispose in a given waste mud dam as well as higher caustic recovery from the washing circuit [1].

In this paper, the physical, chemical and mineralogical characteristics of ETI red mud have been reviewed. Further, this paper describes ETI's operational experience based on performance parameters of the new red mud handling process with press filter.

2. Physical and Chemical Analyses of Red Mud

ETI red mud is a residue from the common Bayer method, processing boehmitic bauxite. Semi quantitative elemental analysis of red mud has been obtained via ARL Advant'x 2098 Quantas and is given in Table 1 [2].

Table 1. Element Analysis of red mud (wt. %).

Element	wt. %	Component	wt. %
Al	9.87	Al_2O_3	18.65
Ca	2.71	CaO	3.80
Fe	25.22	Fe_2O_3	36.03
K	0.34	K_2O	0.41
Mg	0.17	MgO	0.28
Na	6.62	Na_2O	8.92
S	0.04	SO_3	0.10
Si	7.58	SiO_2	16.24
Ti	3.03	TiO_2	5.05

Red mud XRD analyses have been performed using a Siemens XRD diffractometer. The values obtained are shown in Table 2. The main phases found are hematite and silica containing minerals. XRD analyses have been supported by XRF analysis. [2].

Table 2. Mineral phases in red mud.

Mineral Phases in Red Mud	wt. %
Hematite, Fe_2O_3	35.54
Sodalite, $Na_4Al_3SiO_3O_{12}Cl$	6.08
Cancrinite, $3NaAlSiO_4.NaOH$	6.45
Sodium Aluminosilicate hydrate, $Na_6(AlSiO_4)_6.4H_2O$	26.54
Calcite, $CaCO_3$	1.34
Gibbsite, $Al(OH)_3$	1.09
Boehmite, AlO(OH)	0.62
Diaspore, AlO(OH)	4.64
Goethite, FeO(OH)	0.54
Sodium Titanate, $Na_2Ti_6O_{13}$	1.06
Rutile, TiO_2	2.55
Tridymite, SiO_2	2.34

5. Acknowledgment

This technology has been implemented and will be monitored with cooperation between ETI and Outotec.

6. References

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