

Bauxite Residue Dewatering by Pressure Filtration: a Versatile and Customizable Solution for Dry Stack Disposal

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Abstract



Tailing dry stacking can nowadays be considered a proven technology for bauxite residue disposal. An increasing number of aluminum refineries are converting the traditional tailings ponds into filter press cake dry stacking. This trend is favored by a series of advantages, such as reduced risk of external dam wall failure and, consequently, red mud spill, lower environmental footprint and higher soda recovery. The red mud proceeding from the Bayer process is the underflow of the last thickener of CCD system. The physicochemical characteristics of this red mud and, consequently, their dewaterability properties, can be significantly affected by several parameters and, in particular, by the bauxite ore composition. For this reason, pressure filtration is the suitable technology to get high and consistent performances, due to its versatility. In view of the long-term experience in mining tailings filtration, Diemme® Filtration, part of the Aqseptence Group, designed filter presses specifically to treat different red mud types in order to provide an effective dewatering system for a wide range of bauxite ores. In this work we are presenting a series of real case studies, involving Diemme® Filtration filter presses installations, demonstrating how the physicochemical characteristics of the residue affects its filterability and how the filtration system can be consequently optimized in order to achieve the target required by the customer.

Keywords: Filter press, dry stacking, red mud disposal, characterization, cake filtration.

1. Introduction and Aim of the Work

The disposal of red mud is still one of the main challenges of bauxite refining industry. [1] It is estimated that, every year, >150 tonnes of residual bauxite are produced, considering that a ton of alumina generates 1.5 tonnes of waste. Red mud is usually produced by a CCD plant, where the bauxite residue is washed in order to improve the recovery of soda, reducing the alkalinity of the material. The characteristics of the resulting residue slurry, which is extracted as underflow from the last thickener of the CCD, highly depend on the type of bauxite ore and on the process conditions. Many efforts are directed to the improvement of the waste disposal methods, [1, 3-4] with a series of well-defined aims:

- Reduction of the dangerous environmental impact of red mud;
- Recovery of soda, with consequent economic advantages;
- Revaluation of the residue through the employment of alternative methods to disposal.

There are different methods traditionally used for the treatment of red mud, for instance neutralization with discharge into the sea, lagooning and filtration.

Filtration is surely the system that permits achievement of the aforementioned goals more than any other method. [2] Among all the current available technologies, the most promising one is the filter press due to the high achievable performances. Filter press filtration provides the ability to obtain very high dewatering levels, producing dewatered slurry cakes with residual

moisture values as low as 30-20% w/w, which are compact and perfectly transportable and stackable. Compared to the traditional filtration technologies (i.e. vacuum drum filters or hyperbaric filters), this represents an important step forward and has led to a significant increase of the number of plants that have been using filter press technology during the last years (see Figure 1).

By means of this technology, the soda recovery can be maximized considering that, besides the high dewatering degree, it is possible to carry out a deliquoring phase through the in-situ cake washing.



Figure 1. Example of filter press cake dry stacking with residual moisture lower than 30%

This versatility makes the filter press design and sizing phase critical. In fact, the technology and all the process variables are defined on the basis of the targets to be achieved. The result is a customized dewatering technology able to provide the required results at the lowest cost.

Therefore, from this point of view, careful attention must be drawn to the testing and piloting phases, which precede the elaboration of the commercial proposal and start from the study and characterization of the product to be treated, up to the filtration tests which are aimed at defining the process parameters.

The Diemme[®] Filtration R&D Laboratory of Aqseptence Group Srl has the right equipment to meet these needs. Two case studies are described below highlighting that products coming from different plants, despite a series of analogies, have substantial differences which determine a different filtration behavior. In view of this, different pressure filtration technologies must be used for the treatment of these products. Both cases refer to red mud filtration projects, for which Diemme[®] Filtration filter presses have been chosen.

2. Physicochemical Characteristics of Red Mud

The below-introduced cases refer to red mud types coming from two different technologies. The main characteristics are reported in the following comparative Table 1.



Figure 8. Refinery – Outside Building.

Final remarks are different in case of red mud B:

- This product has an high filterability, with rather quick feed time, that determines shorter filtration cycles, in comparison to case A;
- The lower specific resistance of the cake provides for more efficient desaturation, ensuring the achievement of a residual moisture $\leq 28\%$.

In this case, we have selected a filter press model with membrane plates and cake blowing.

5. References

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