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ALUMINA AND BAUXITE

Red Mud

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AUTOMATIC CONTROL OF DRUM FILTERS OPERATION

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Abstract

Red mud is the principal waste of Bayer process and must attempt to quality parameters, such as caustic concentration, to not damage disposal environment. In Hydro Alunorte, drum filtration is used for dewatering and washing red mud with filter cloths that retains the cake formed by red mud, recovering part of caustic soda, which returns to the process. The aim of this work was to reduce the consumption of filter cloth with improvement of operation and maintenance by drum filters. After a study of equipment performance, process parameters were adjusted and an automatic control of the drum filter operation was developed, with a complex control loop. The recovery of caustic soda increased and were observed gains on filter cloths durability which means about 40% of reduce in operation costs.

Introduction

Currently Hydro Alunorte uses for the red mud filtration, for production lines 4 & 5; 6 & 7, fourteen filter cloths for removing 33 tons of red mud each one. It's is designed to recover most of the caustic soda cake for the process and consequently reduce the harmful to the environment.

This type of equipment is seeking a better filtration efficiency of mud with increasing solids retention rates. According to [3] Perry et al. (1963), report that filters continuous rotary drum vacuum handling more tons of solids than any other combination filter.

With the considerable increase in the consumption of filter cloths, Hydro Alunorte initiated a study to evaluate technically and economically optimizations in the process to reduce operating costs in Area 34.

A selection from the same furnisher to purchase screens and screens against cloths occurs due to better assessment of economic viability.

Control parameters in areas were adjusted as level basin, decreasing rotating the filter, control loops for condensate flow proportional input mud and execution of routine washing basins of filters to find the desired results.

Immediately after intervention in the control parameters conducted under controlled conditions, were observed quite relevant results which extension of the test that provided a filter for the whole area. This article presents the results obtained with plan test with all these adjusts and development of control loops to reduce to increase the recovery caustic soda that will be reported below.

Development

Some considerations must be made for the production of alumina in Hydro Alunorte, as describeed in [2]. It has 7 production lines that together achieve 6,300,000 tons per year of alumina. With four washing mud chains, each with four washers in series, Alunorte processes 4.4 million tons of mud [1].

The lines of production (4 & 5 lines; 6 & 7 lines), which process the MBP bauxite and producing the largest amount of mud must operate in an increasingly effective and efficient in order not to interrupt the production chain.

The main control loops were implanted in Areas 34:

1) "Net Wash" that corresponding to automatic control more effectively improved for washing the red mud. The condensate flow proportional input mud (1:1). After this modification, the caustic content of the cake fell considerably according to the results of laboratory.

1.1) Description of "Net Wash" control: The flow of condensate to the washing of the mud is determined by the volumetric flow rate of slurry entering the filter. Flow rates vary between 25 and 35 m^3 / h of condensate, according to the Set Point adopted by the engineering team process. Thus, the greater the flow of mud, the amount of condensate will reach its limit of maximum control, to the caustic concentration of the sludge results in discarded values <= 15% caustic concentration of the underflow of the last stage of mud washing.

This value is accepted to disposal of red mud solids in the tailings pond (DRS) and for treating water containment basin in utilities areas.

2) "Automatic Control for washing basin" was developed after consideration of the lack of compliance in routine task execution wash basin in Filters.

2.1) Description of "Automatic for Washing basin" control:
Selection Key "Manual" on the screen to control the operation was blocked to prevent any diversion of focus from routine. It created a counter alarming 22 hours with a message on the screen process for the operator in the control room that the the filter bowl should be washed. If the task is not fulfilled up to 24 hours of filter operation, the power is automatically cut the same and returning occurs only after execution of the task by the operator of the field.
The conditions for the filter in operation were: flow of condensate and zeroed mud and water wash basin > 10m ³ / h. To facilitate the visibility of the counter control operators also was credited onscreen.

The impacts of control were very beneficial to the quality parameters of mud discarded (less harm to the environment, due to lower levels of productivity and higher caustic filters).

When the wash basin is fulfilled ensures lesser amount of aggregated material in the bottom of the basin, allowing the drainage of mud. Thus, the operation will ensure greater filterability.

Results

The results of the adjustments in the main control parameters in Area 34 in 2012 were mentioned above are shown below. It was used tools as: Boxplot and comparison of means and variances in Excel.

Principal Parameters Adjusts

It was believed that the greater the rotation of the filter mud, the higher the removal of mud from the circuit. However, the formation of the filter cake along becomes deficient, given that there is sufficient time for the slurry is as efficiently washed. The purpose of slowing the rotation of the filters directly interfered in the composition of the cake, thereby facilitating the reduction of caustic content in the mud. Furthermore, the quantity of torn tissue is significantly reduced when compared to the first quarter.

Immediately below are the results of interventions made in the rotations of the filters in area 34.

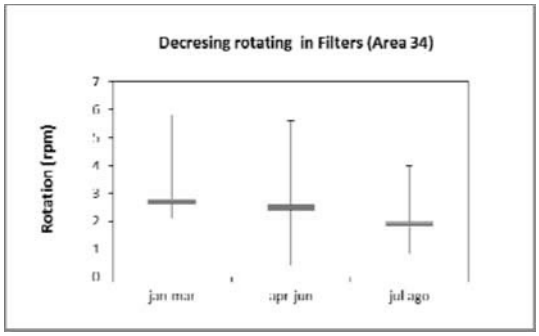

Figure 1. Decreasing rotating in Filters (Area 34).

Another parameter which yielded significant results was the reduction of the levels of the basins of the filters. When the amount of material in the bottom of the basin is low, the pressed cake is easier to not add more impurities after washing.

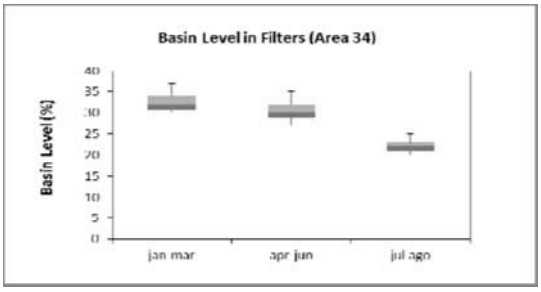

Figure 2. Basin Level in Filters (Area 34).

As shown in the graphs below in Box Plot, drastic reduction of the Set Point basin level (range 30% to 20%). This contributed to the decrease in the deposition of sand in the plots of cloth. Therefore, the friction between the roller and the drum filter cloth leads to weakness and, consequently, in tearing, loss of caustic from process to the environment and increased operating costs.

The implementation of automatic control for washing basin and jointly reducing the level of the same, allowed noticeably larger withdrawal mud filters indicating that the changes benefit the process. It is showed in Figures 3 and 4 below.

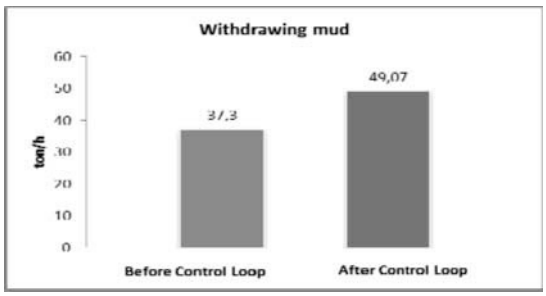

Figure 3. Withdrawing mud (Area 34)

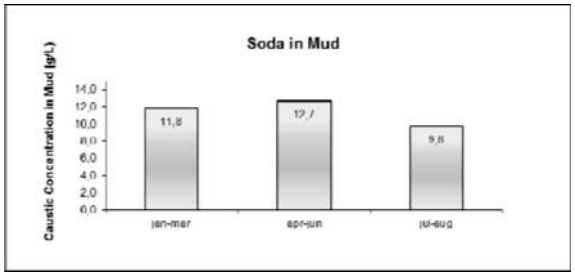

Figure 4. Soda in mud (Area 34).

It is noteworthy that the assessment for reducing operating costs in areas 34 in Hydro Alunorte are medium term, because the areas undergo a series of renovations and intensification of maintenance, but effective. With the availability of filters guaranteed, all modifications may take effect faster and also durable.

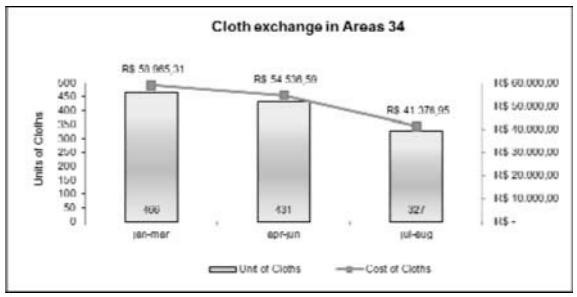

Figure 5. Cloth exchange in Areas 34.

With adjustments to the parameters linear regression seeks a 40% reduction in operating costs in the area until the 3rd quarter of next year, thus completing a year of adaptation process fixes and enhancement routines, as can be seen in Figure 5.

It is proposed that in a very near future there are no more spending surpluses with trade cloth emergency, but only in the general maintenance of the filters.

Conclusion

The evaluation in Area 34 can consider that all settings and controls meshes implanted in area 34 that had contributed to the reduction in costs about 40% for filter cloths mud without affecting the efficiency of the equipment or process quality.

References

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