Increasing Mud Throughput Capacity of the Mud Washing Circuit through a Brownfield Project

Monique Delaney
Chemical/Process Engineer
Jamalco, Halse Hall, May Pen, Clarendon, Jamaica W.I.
Corresponding author: Monique.Delaney@jamalco.com

DOWNLOAD FULL PAPER

Abstract

Mud load management has been one of the largest production opportunity loss contributors for Jamalco due to the unique inverted cone, tangential discharge design of the mud washers as well as the bauxite quality to the refinery. With this washer design, the mud is accumulated in front of the rake at the periphery of the vessel resulting in increased mud residence time, increased rake torque pressures and reduced underflowing capabilities of each vessel. The mud throughput capacity was further limited since 2015 by the deteriorating bauxite feed quality mainly in the increased reactive silica, reduced available alumina and increased goethite content. These challenges have affected the refinery's volume control and liquor to precipitation productivity. With the limitations experienced regarding the mud washing circuit throughput, a need arose to increase the attainable mud throughput from the circuit to stabilize the refinery's total plant flow and by extension its production rates. This paper presents the system modifications undertaken at Jamalco to increase the mud throughput capacity of the washing circuit from 4300 tpd to 5200 tpd of mud using a brownfield project approach. Furthermore, it seeks to highlight the benefits and drawbacks of this approach.

Keywords: Mud washer, Brownfield, Reconfiguration.

1. Introduction

Mud load management at Jamalco has been the highest contributor to production opportunity losses over the past decade. In 2017 and 2018 alone, mud load management contributed to a total of 12 896 tonnes and 26 779 tonnes, respectively, in production opportunity losses for the refinery. At Jamalco, mud management poses a challenge for two major reasons: the inverted cone washer design within the mud washing circuit as well as the deterioration in the quality of the bauxite feed to the refinery.

Since 2015, the bauxite feed quality to the refinery, mainly as it relates to the available alumina content which reduced from 44 % in 2015 to a low of 39.6 in 2018 and the reactive silica content which increased from 1.40 % in 2015 to a peak of 3.87 % in 2018 [3]. These changes led to increased mud generation from the bauxite which pushed the refinery towards its mud capacity limit of 4300 tonnes mud/d with no increase in production rates as shown in Figure 1.

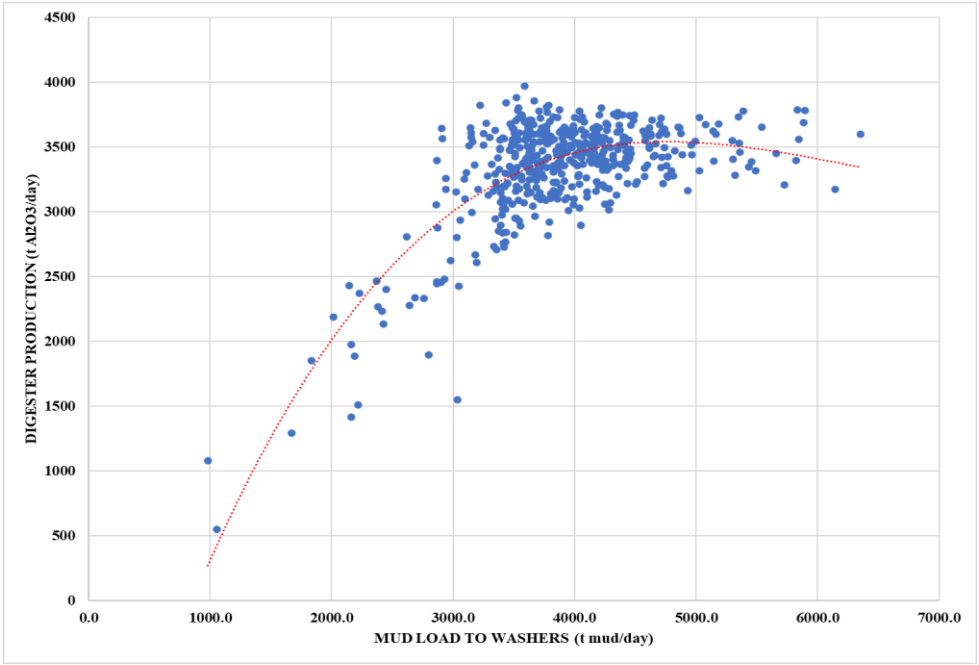

Figure 1. Relationship between the washer mud load and digester production rates [3].

At Jamalco, the unique design of the mud washers, as shown in Figure 2, is also thought to play a critical role in the stability of the mud circuit [3]. The mud washers have an inverted cone design which utilizes two mud discharge outlets (45º) apart, as shown in Figure 2, increasing the difficulty of mud movement.

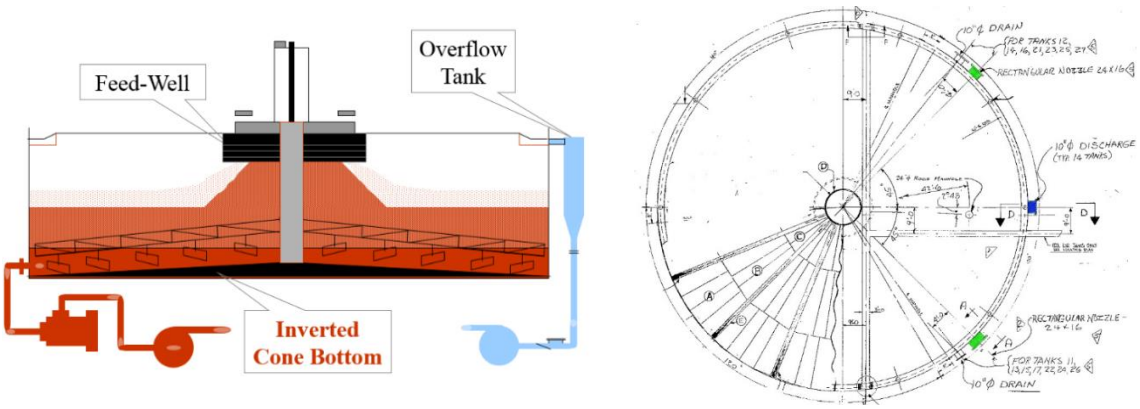

Figure 2. Schematic representation of mud washer design.

The movement of mud to the underflow discharge is solely dependent on the rotation of the rake mechanism. The mud is accumulated in front of the rake arms at the periphery of the vessel and most of the mud mass is moved from the underflow when the rake arms pass in front of the discharge points [3]. This design increases the tendency for mud to accumulate within the vessel which increases the propensity for auto-precipitation [2] and reduces the refinery's mud throughput capacity. This increase in mud load has increased washer feedwell solids thus reducing the efficacy of the flocculants [1] resulting in higher washer mud levels and lower production rates.

In this paper, the author will provide insight in the methodology used at Jamalco to increase the mud throughput capacity of the washing circuit with a brownfield approach, as well as provide evidence of the increased mud throughput and production benefits.

5. Future Plans

The capital expenditure plan focuses on the alignment of the projects to optimize and maximize the refinery's production and efficiency capabilities. Through this, the implementation of an upgraded flocculant dosing system and installation of additional deep thickeners to improve caustic recovery efforts are two key project enablers to maximize this reconfiguration of the mud washing circuit.

To further optimize the reconfigured washing circuit, initiatives such as the upgrading of the existing pumping systems to maximize the mud throughput capacity are being explored. Additionally, the implementation of systems such as in-line flocculant addition and wash water recycling for feedwell solids reduction as methods to improve the washer efficiencies and reduce the associated caustic losses have already been scoped for execution.

It is expected that these actions, coupled with bauxite exploration and blending, will facilitate the refinery's ability to handle the proposed mining plan each year and its ability to regain its nameplate capacity production.

6. Conclusions

Jamalco's operations and associated costs have been significantly hampered by its ability to handle the mud load to the washing circuit with the deteriorating bauxite feed quality. A brownfield project of reconfiguring the piping layout of the mud washing circuit has successfully aided the refinery in increasing or maintaining its production rates with higher mud generation. Several additional initiatives are underway to improve the stability of the mud washing circuit at the refinery which will bring the location closer to its optimal efficiency and production points. Initiatives such as these are proof that the future of Jamalco as a world class alumina producer is secure.

7. References

1. José Carlos M. Vieira et al., Boehmite bauxite usage at low temperature digestion a case of study at Alumar refinery, *Proceedings of 36th International ICSOBA Conference*, Belem, Brazil, 29 October – 1 November 2018, *TRAVAUX* 47, 219-228.
2. Keddon Andre Powell et al., Characterisation of alumina and soda losses associated with the processing of goethitic rich Jamaican bauxite, *Light Metals* 2009, 151-156.
3. Monique Morgan et al., Settling ability of Jamaican bauxite residue based on bauxite feed constituents and vessel design, *Proceedings of 37th International ICSOBA Conference*, Krasnoyarsk, Russia, 16 – 20 September 2019, *TRAVAUX 48*.