



At an Indian alumina processing plant, Nalco Water's RRA™ flocculant replaced conventional synthetic flocculant with 32% lower consumption



SITUATION

Nalco Water has partnered with an Indian alumina producer for last two decades through supply of various specialty chemicals required in the Bayer process. When the customer decided to establish a new 1.5 MTPA greenfield refinery, Nalco Water was chosen to supply the specialty chemicals, including flocculants, antifoams, and other chemicals. The refinery was commissioned in mid-2013, and Nalco Water's 85110 flocculant was recommended by the technology supplier of the refinery. The refinery was designed based on 40% available gibbsitic bauxite, but in practice, the bauxite contained 36% gibbsite. To maintain the anticipated production levels, the refinery had to process more bauxite, which ultimately mean that more red mud would be treated in the process. As a result, the decanter and washers underwent more stress

CUSTOMER IMPACT	eROI SM	ECONOMIC RESULTS
Reduced flocculant usage	 PROFITABILITY	32% less usage of flocculant, which is a net savings of \$138K per year
Reduced make-up of caustic soda	 PROFITABILITY	Improved underflow can save net soda of 0.86 Kg/ T of mud which translates \$1.8M soda savings per year
Less water usage for flocculant make-up	 WATER	32% less use of water due to less flocculant use, which is 60,000 m3 water savings per year
Less usage of flocculant dosing units	 ENERGY	32% less use of flocculant preparation unit which equates to an energy cost savings of \$346 per year
Less evaporator duty	 ENERGY	Less evaporator duty due to 60,000 m3 less water input into the system, amounting to an energy savings of \$230K per year
Less chemical handling	 SAFETY	Reduced flocculant usage minimizes the risk of handling and exposure of chemicals
Increased mud throughput	 WASTE	2% or 100 gpl increase in washer underflow has a potential to increase mud throughput by 48,000 MT per year

eROI is our exponential value: the combined outcomes of improved performance, operational efficiency and sustainable impact delivered through our services and programs.

because of the increased mud, which caused not only more flocculant usage but also more soda loss as desired underflow compaction could not be achieved.

Usage of more flocculant generally makes red mud stickier and more difficult to flow.

The customer turned to Nalco Water to help find a way to reduce flocculant consumption and improve underflow compaction. The goal was to sustain rated capacity production, which would allow the refinery to leverage its potential and expand further.

BACKGROUND

Alumina is produced from bauxite through the Bayer process. To produce alumina, bauxite (the major raw material) is heated through a process called digestion at a high temperature along with caustic solution to extract gibbsite (alumina hydrate). This extracted gibbsite dissolves into the caustic solution leaving behind the unextracted portion, called red mud. This solid red mud is separated from Bayer liquor at the decanter stage through solid liquid separation with the help of a synthetic flocculant. Before throwing out red mud into the dam, it passes through a counter current washing to wash out the maximum soda possible. This multiple stage washing process takes place through solid liquid separation with the help of the synthetic flocculant. The liquor from the decanter then passes through filtration and is cooled in the presence of hydrate seed to precipitate as alumina hydrate. After precipitation, the caustic recycles back to the process, shown as follows:

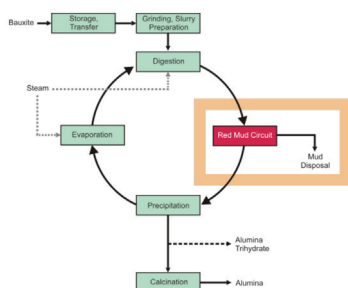


Figure 1: The Bayer Process

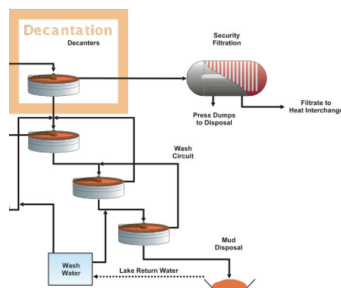


Figure 2: The Decantation Stage of the Bayer Process

SOLUTION

The customer asked Nalco Water if we could assist in providing a solution that could augment underflow compaction at a reduced flocculant dosage. Nalco Water has been developing its next-generation red mud flocculants, RRA technology, and was able to suggest a solution that could help the customer meet their goals.

RRA is a proprietary Nalco Water emulsion technology, where the polymer has a unique structural property called Rigid Rod Architecture (RRA) to enhance the red mud settling operation. Nalco Water suggested the use of 85252RRA to achieve washer underflow solid at a reduced dose compared to the incumbent. Laboratory testing and small-scale trial work began in late 2015, which resulted in full scale plant trials in early 2016. The 85252RRA program has been in place at the refinery since mid-2016. The results are depicted in Figure 3 below.

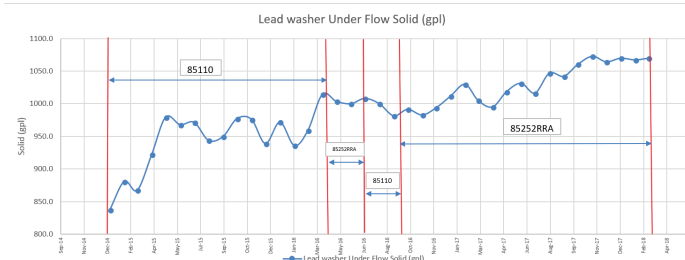


Figure 3: Program Results

RESULTS

The refinery has been able to improve its operation by achieving high washer underflow density at a reduced flocculant dosage. The increase in underflow density reduces volume of liquor in the underflow stream. If wash water in the washing circuit remains constant, then it saves a considerable amount of soda (NaOH) and reduces the same amount of make-up.

Through this solution, Nalco Water was able to achieve the following:

- Reduce flocculant usage by ~32%.
- Reduce usage of fresh water (60,000 m3 per year) for making the flocculant
- Increase underflow solid by 2% (100 gpl)
- Reduce caustic make-up by 2.99kg /T of mud (by calculation)

This refinery is now the lowest cost alumina producer in the world. By improving washer underflow compaction, reduced flocculant usage, reduced water, and reduced energy usage, the steady production rate will help the customer to achieve further cost reductions. Additionally, because of the high LME aluminum price, the cost position may improve the customer's financials.