

New Polymer Activation System Yields Significant Operational Cost Savings at Integrated Steel Mill



BACKGROUND

An integrated steel mill treats gray water from the blast furnace (BF). The cleaning system recycles water through a thickener where it is cleaned for reuse back into the process. Variation in BF suspended solids challenged thickener operation where the torque increased to a point where the rake broke, costing the mill \$500,000 USD in repairs. In addition, flocculant usage had been increasing, thus increasing chemical costs.

The BF recycle system used a dual polymer system where a cationic flocculant is dosed continuously at 1 ppm followed by an anionic flocculant which dose varies based upon loading from the furnace. Historically, the cationic to anionic flocculant dosage ratio was 1:4 ppm. Sludge quality and consistent treatment has always been a challenge due to variable influent solids loading. The current treatment program used a static mixer to feed the flocculant.

CURRENT METRICS

- TSS Control
- Maximum 30 ppm Total Suspended Solids (TSS) for BF thickener effluent
 - Sludge removal
 - Improve sludge handling
 - Asset preservation
 - Do not exceed 30% torque in the thickener

SOLUTION

The mill placed Nalco Water's proprietary Advanced Polymer Activation System Liquid (ADPAS-Liquid) technology into service. Virtual training was provided the week prior to equipment arrival. ADPAS Liquid is designed to make-down liquid polymers from concentrated form to final dilution levels, delivering high polymer activation in a small footprint. This advanced high-rate polymer inversion system combines preheated water and polymer in a high-energy circuit to produce a complete and continuous polymer solution. The equipment's hydraulic circuit rapidly disperses the



continuous (oil) phase in the dissolving water, freeing the discontinuous (polymer) phase for immediate dissolution and activation.

Installation and start-up of the unit was straightforward. The unit was installed on the anionic polymer line to the blast furnace thickener.

Key parameters were set up and optimized: primary dilution settings, flow rates, temperature, chemical draw down and calibration.



ADPAS Liquid has been designed with the following benefits:

- High shear circulating zone – enables higher level of polymer activation
- Primary dilution water is passed through an instantaneous hot water heater – eliminates seasonal temperature variations
- Oval Gear Meter – provides verification of product delivery and provides a continuous flow reading reducing the need for doing routine draw downs
- Web-enabled allows for remote log in and performance adjustments – the user is not required to be physically present

Performance metrics were established.

At minimum, the objective was to reduce flocculant usage while keeping or improving Total Suspended Solids (TSS) in the effluent. Sludge quality was also of importance to the mill. Preventing sticky sludge from occurring was another key benefit to this customer as it reduces the efficiency of removal.

RESULTS

The six-week trial began on September 1. Jar tests performed ahead of the trial indicated the anionic flocculant dosage should be set at 2 ppm. However, during the trial the team was able to optimize the flocculant further. The best performance of the thickener was observed when the flocculant was fed at 1 ppm.

A baseline measurement using the current static mixer system was run. Polymer activation was determined between 30 to 40%. With ADPAS Liquid, polymer activation was 100%.

The ADPAS Liquid system made a more active flocculant which provided several benefits at this mill. First, a 75% reduction in flocculant usage produced the best performance out of the thickener.

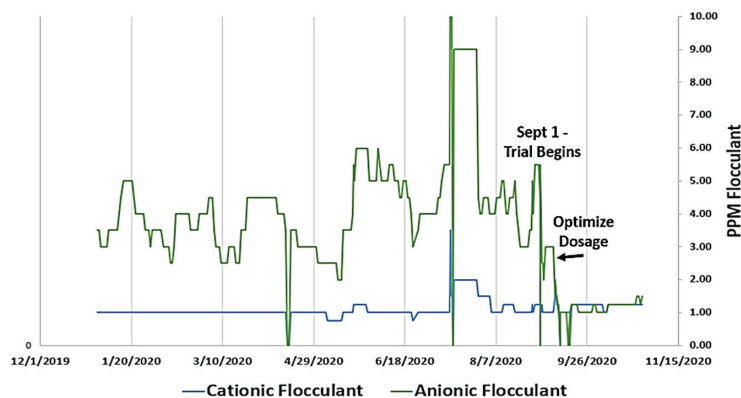


FIGURE 1. Polymer Optimization with the ADPAS Liquid System

CONCLUSION

The sludge produced from the thickener is pressed in a plate and frame dewatering device. There was a reported increase in performance of the dewatering device during the trial. The sludge was less “sticky” which resulted in the cake being more easily released from the plates. Consequently, this decreased the amount of time required by the operators to clean the plates which increased the efficiency of the process. The result being that more sludge is able to be processed per day. When the solids loading is high, this crucial increase in efficiency allows the dewatering system to maintain optimum rake torque. Controlling the torque is very important to prevent “burying the rake” which could result in catastrophic damage costing around \$500,000 in repairs. The flocculant from ADPAS Liquid during this trial produced a sludge that was easy to manage and minimized the rake torque.

The ability to remotely log in to the ADPAS system to make immediate, real-time adjustments in dosage contributed to the overall operating efficiency of the thickener unit. During this trial, the operators saved over 20 hours otherwise lost to unit adjustments.

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