

Performance improvements provided by Mintek's FloatStar Advanced Control System on reverse-flotation of iron ore
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Abstract

In November 2009 Mintek installed the FloatStar™ advanced flotation stabilisation system on Iron Ore Beneficiation Plant in Southern America. In September 2010 the system was upgraded to include flotation optimisation.

The circuit consisted of two parallel cleaner circuits producing final concentrate. The tailings from the cleaner section passed through a scavenger circuit. Large, well instrumented feed sumps played an important role in circuit stability, presenting a good opportunity for advanced control. Previously the plant was controlled using distributed control system (DCS) level control only. The flotation circuit processes roughly 30,000 tons per day.

The FloatStar system provided advanced control of the flotation circuit as well as of the sumps feeding the circuit. The system underwent a lengthy trial to assess the benefit that it provided. Two datasets were analysed, showing performance under advanced stabilisation and optimisation respectively. Several validation and consistency criteria were employed to ensure the quality of the analysis.

Iron recovery and iron tailings grade were used to measure system performance. The analysis showed that the system increased recovery by up to 2.7%. In addition the system decreased the iron tailings grade by between 1.2% (from 23.5% to 22.3%) and 4.3% (from 31.3% to 27.0%) during different test campaigns.

The analysis also showed that the entire FloatStar stabilisation system was active for 72.7% of the time from first activation to the end of the first data set (approximately 200 days).

From the analysis it was concluded that under similar conditions for “ON” and “OFF” tests, the system provides a clear benefit. It was also found that over the longer term, the system continues to provide a benefit. This finding suggests that the results were not simply due to a short-term advantage.

The size of the data set, as well as the magnitude of the recovery improvements lends considerable confidence to these results. Therefore, it can be concluded that the FloatStar control system provides substantial benefit to operations at this site.

Keywords: Iron ore, reverse flotation, advanced process control, FloatStar

Assessment of benefit

To assess the benefit provided by the system, both recovery and tailings grade were compared. Figure 1 shows the results of the 45-day test, conducted shortly after the Mintek stabilisation system was installed.

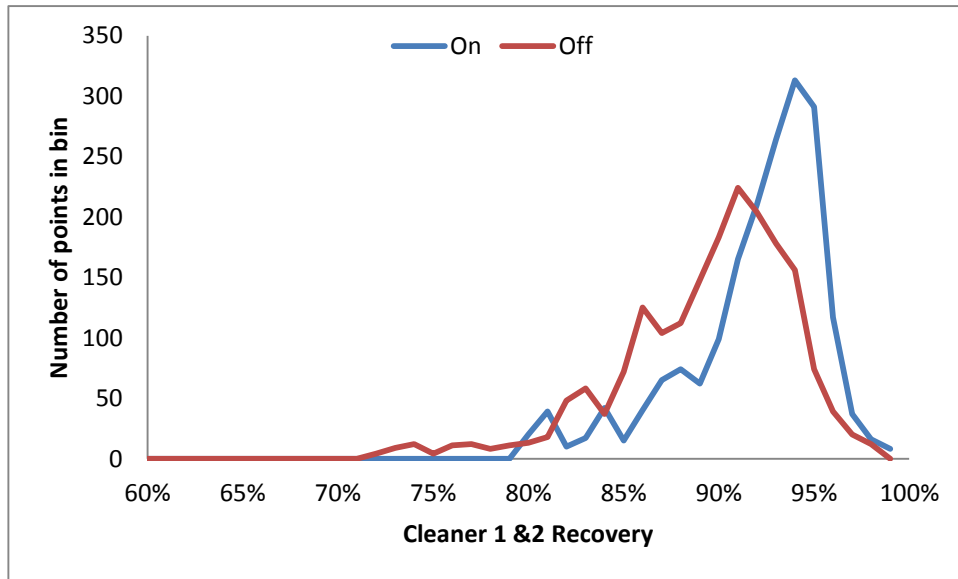


Figure 1: Histogram of iron recovery for the 45-day test

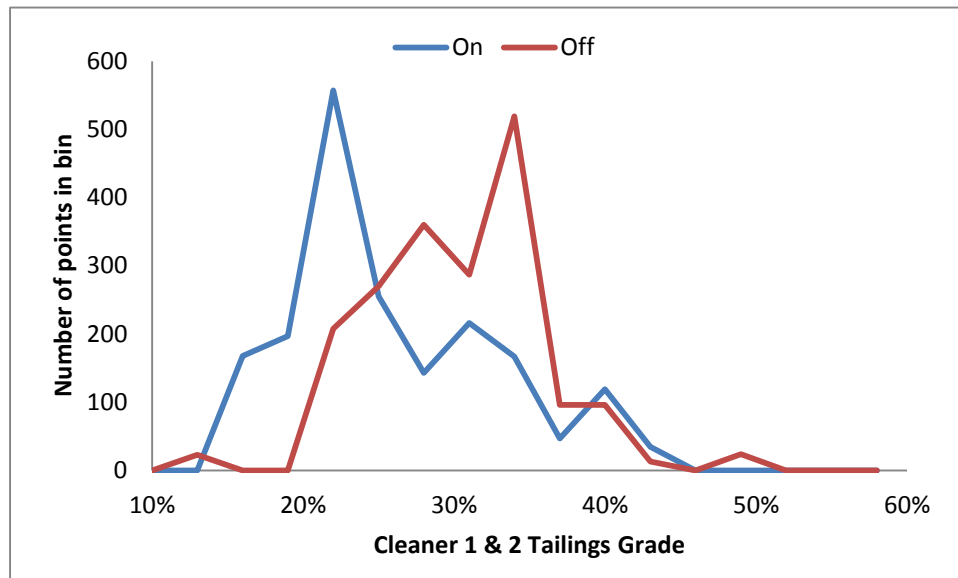


Figure 2: Histogram of iron tailings grade – 45 day test

Referring to Figure 2 the tailings grade was also clearly lower when the FloatStar system was “ON”. This supports the increase in recovery shown in Figure 1.

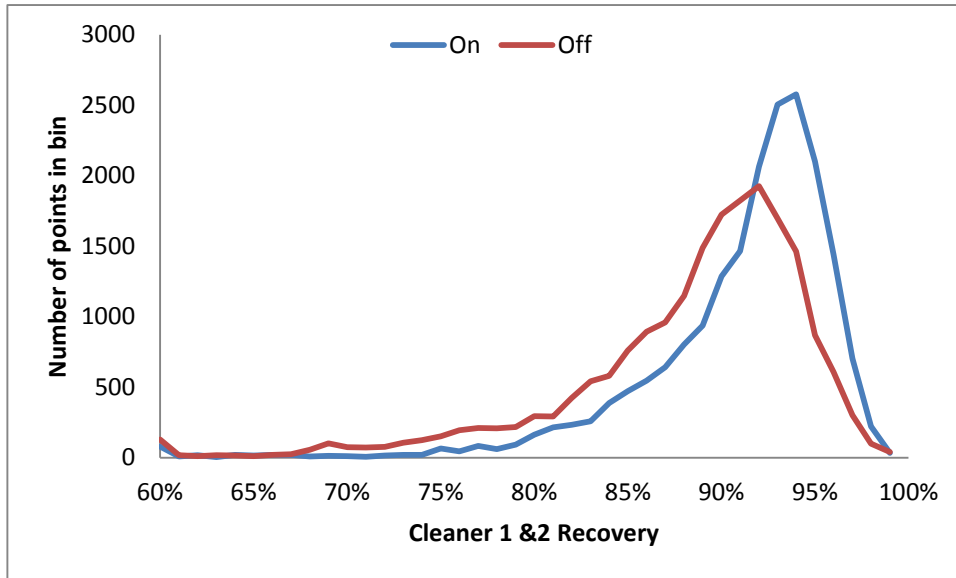


Figure 3: Histogram of iron recovery for the long-term test

Figure 3 shows the results for the long-term stabilisation test. Clearly the recovery of iron was higher when the system was “ON” than when it was “OFF”.

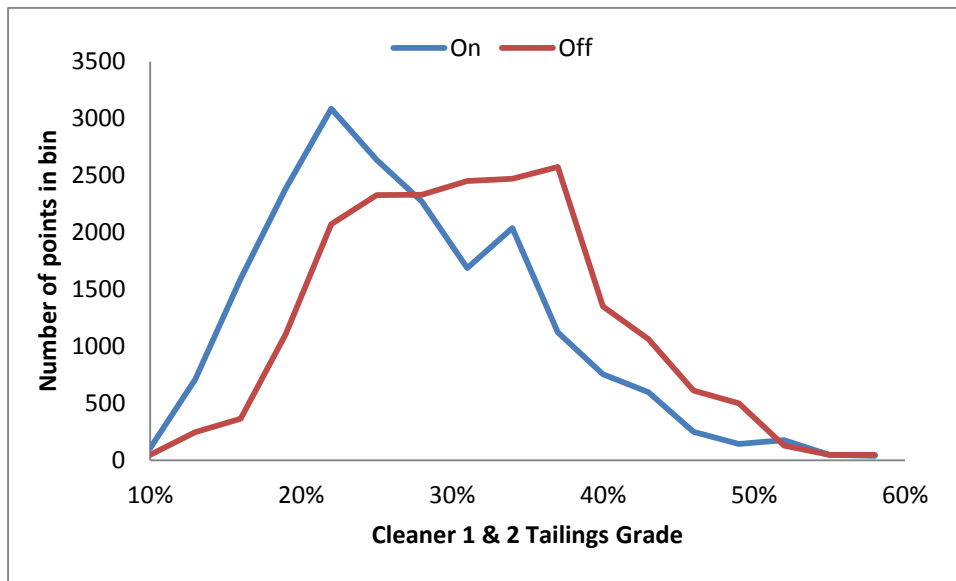


Figure 4: Histogram of iron tailings grade – long-term test

Figure 4 shows that the iron tailings grade was lower when the system was “ON” than when it was “OFF”. This confirms the recovery improvement shown in Figure 3.

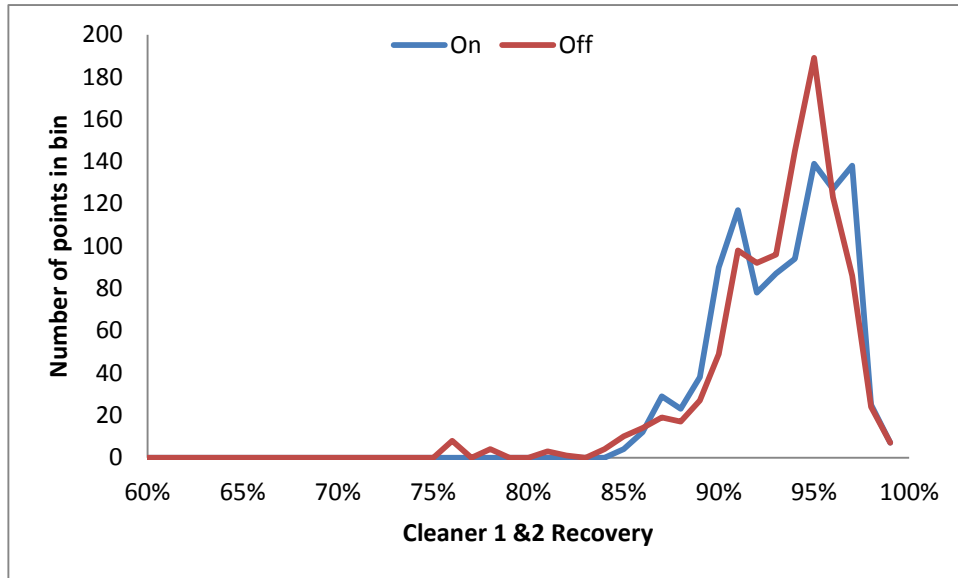


Figure 5: Histograms of iron recovery for the optimisation test campaign

Under optimisation mode it was difficult to determine from the histograms whether there was an improvement in recovery. The recovery performance under both “ON” and “OFF” was similar, although there was a slight overall improvement in recovery when the system was “ON”. The tailings grade results (not shown) were similarly inconclusive.

The actual improvement values are shown below in Table I.

Table I: Comparison of iron recovery for Cleaner 1 and 2 (all tests)

| | | Cleaner 1 & 2 | | |
|-------------------|-----|---------------|------|------|
| | | OFF | ON | Diff |
| 45-day test | [%] | 89.3 | 91.9 | 2.5 |
| Long-term | [%] | 88.3 | 91.0 | 2.7 |
| Optimisation test | [%] | 93.2 | 93.3 | 0.17 |

Conclusions

The analysis of the results shows clearly that the Mintek system provided considerable benefit. It was very interesting to note the magnitude of the benefit from advanced stabilisation alone. The long-term test in particular showed that improvements in performance were not simply temporary, or limited to a short period directly after the commissioning. The data from the optimisation test campaign, while only representing a small operating period, confirms the improved performance under the Mintek system. It can be concluded that even on circuits with a low number of flotation units, using reverse flotation, that advanced control can provide considerable benefit.

Conference

Full paper was presented at:

The Southern African Institute of Mining and Metallurgy (SAIMM) 2011 – Iron Ore and Manganese Ore Metallurgy Conference, Johannesburg, South Africa, July 2011.