Mining Solutions

DRIMAX® Iron Ore Dewatering Case Study

BASF
We create chemistry

BASF's Mining solutions at a glance

BASF's Mining Solutions business offers a diverse range of mineral processing chemicals and technologies to improve process efficiencies and aid the economic extraction of valuable resources.

We offer our products and technology solutions to the global mineral processing industry along with expert advice and technical support. Our global team is driven by a common goal to provide the best sustainable solution to meet our customers' processing needs. With technical representation in over 100 countries, BASF's technical support is provided on a global, regional and local basis.

Our chemical and process expertise includes reagents, equipment, process technologies and know-how. All of which are focused on hydrometallurgy, solid liquid separation, tailings management, materials handling, flotation and digital mining solutions.

DRIMAX®

BASF's DRIMAX® Dewatering aids are highly effective surface-active agents specifically designed to reduce the moisture content of filter cakes and centrifuge solids. BASF's Dewatering and Filtration Solutions includes expert consultation, engineering equipment, supply, and commissioning services along with on-site technical and commercial support.

Benefits include

- Decreased thermal drying costs
- Reduced freight charges associated with drier mineral concentrates
- Improved solids handleability
- Ease of filter cake discharge
- Prolonged filter cloth life
- Reduced filtration cycle times

Principle uses & applications

DRIMAX® products may be added either directly to the filter feed or to wash water applied to the filter cake via spray bars. They can be used alone, or in conjunction with MAGNAFLOC® flocculants and coagulants. Their application is common in a wide variety of mineral slurries from industries including alumina, copper, nickel, gold, iron ore, sand & coal.

Case study – iron ore

The two scenarios considered explain how cake moisture improvements were achieved by applying optimum BASF chemistry to iron ore horizontal belt filter applications. In the first example DRIMAX® 1234 alone was used to achieve a 2.3% moisture improvement, and in the second example a combination of MAGNAFLOC® flocculant and DRIMAX® 1239 NF was used to achieve a 3.4% moisture improvement.

Process issue

Iron ore sites in the Pilbara region of Western Australia needed to reduce their filter cake moisture content to help reduce transportation costs and ensure bulk sea cargo safety. The value of reducing water shipped to overseas smelters lies in the reduced likelihood of liquefaction during transportation enabling the customer to operate within the required limits. Reducing the final moisture of the product being transported also improves the value chain allowing more iron ore to be shipped per unit volume. Dewatering of fines is a common requirement for iron ore producers, with filter cake moisture content becoming a key process target in mineral processing applications. Increasing focus on transportable moisture limits (TML) and lower quality ore bodies requiring beneficiation with fines-rich subaqueous deposits, can all be associated with the increase in overall fines content and consequent high moisture processing issues of iron ore filter feed.

Solution

In the first example considered, it was found that a high proportion of fines content in the beneficiated filter feed had led to tighter particle-packing and reduced drainage pathways for the filtrate to escape, which resulted in a high moisture cake. BASF's DRIMAX® was applied to reduce the aqueous surface tension between particles so that the water trapped between the fines could release.

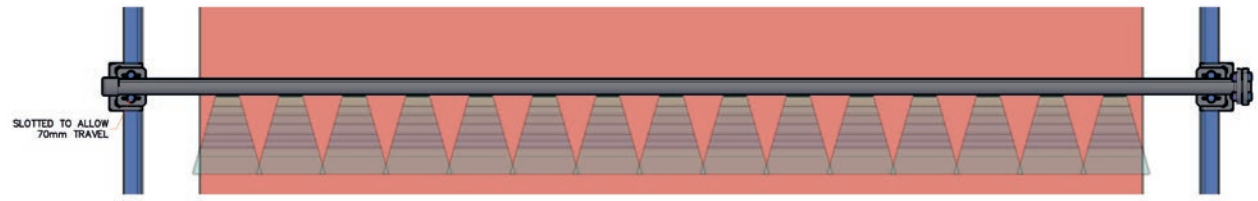
In the second example a flocculant selected from BASF's MAGNAFLOC® range was used to pre-agglomerate particles and reduce the surface area of the particulates in the slurry. This was added prior to the addition of DRIMAX®. This two-product approach gave fast dewatering, clear filtrate water and delivered the lowest possible final moisture. By applying both chemical and engineering technical expertise, BASF were able to develop a solution for both situations through optimised chemical selection and customised dosing configuration of the spray bar addition point.

Engineering

BASF evaluated the current wash water set up and responded by designing and supplying a customised spray bar to be used for the application of DRIMAX® surfactant as added to the wash water. This site specific dosing configuration was a critical step in delivering consistent results of the overall DRIMAX® performance. The positioning of the spray bar, DRIMAX® dilution, spray nozzle selection and water pressure all perform a crucial role in the successful cake moisture reductions achieved from these projects.

Spray bar configured to maximize cake moisture management

Fig. 1: **Filter belt design**



This is an example of spray bar design showing the water curtain required to deliver DRIMAX® across the entire filter cake.

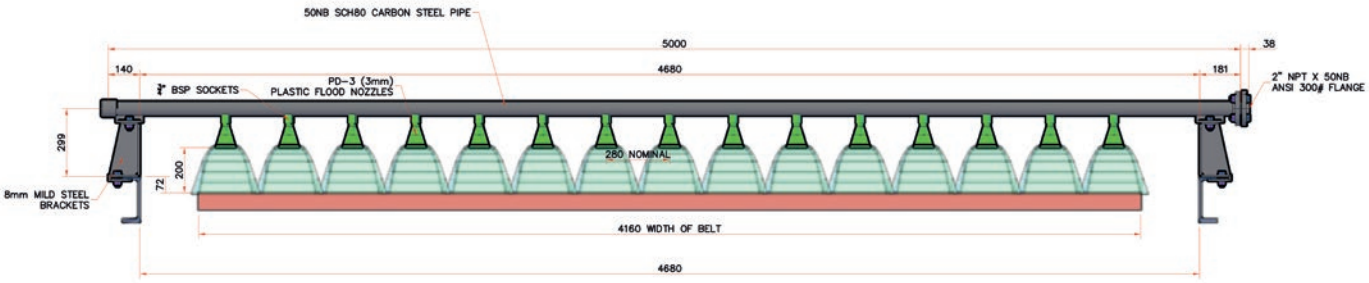
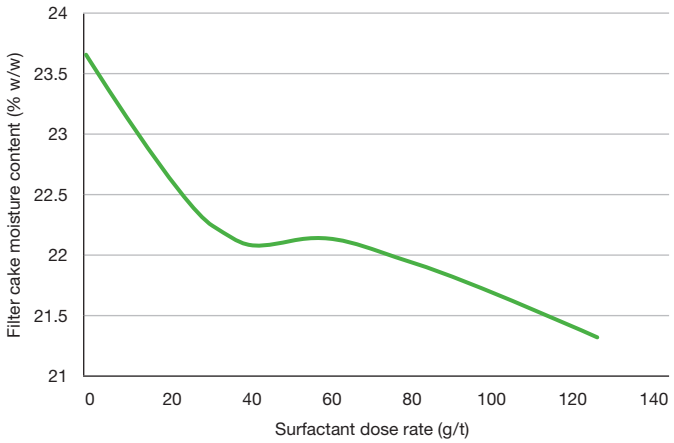


Image credit Effect Engineering

Example 1

Filter cake/ DRIMAX® dose	Results
Cake feed	60% wt/wt
Oiginal final cake moisture	23.6% wt/wt
Optimised final cake moisture	21.3%
Treatment	DRIMAX® 1234 at 125 g/t

Fig. 2: **Dose response**



Results

The use of DRIMAX® 1234 on this sample resulted in a 2.3% absolute decrease in filter cake moisture at a dose rate of 130 g/t, taking the moisture from 23.6% wt/wt to 21.3% wt/wt. A relationship can be seen between surfactant dose rate and filter cake moisture content, and a 1.3% moisture improvement was noted with a dose of just 30 g/t. DRIMAX® was able to lower the surface tension of the moisture trapped within the filter cake, leading to faster and more efficient water release during the suction time on the belt. As a result of the chemical treatment the final cake moisture reductions were sufficient to meet the customer targets.

Example 2

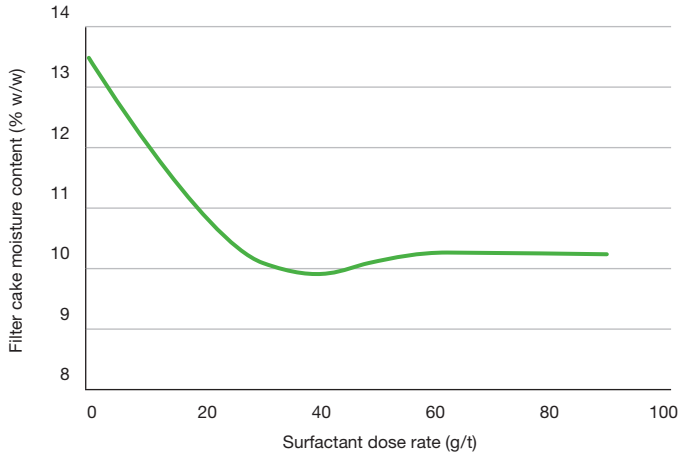
Filter cake/ DRIMAX® dose	Results
Cake feed	64% wt/wt
Oiginal final cake moisture	13.5% wt/wt
Optimised final cake moisture	10.3%
Treatment	MAGNAFLOC® 5250 0.7 g/t + DRIMAX® 1239 NF at 50 g/t

Laboratory testwork on this sample showed that the optimum treatment to give the lowest moistures required both surfactant and flocculant addition. Flocculant works to bind the fine particulates together to form larger aggregates and reduce the overall surface area whist expanding the space available between flocs. This produces a more permeable filter cake which in turn promotes rapid dewatering and reduces filter cloth blinding. Dose response tests confirmed that a very small dosage of MAGNAFLOC® 5250 gave the desired effect, and higher doses were prone to cause overdosing and water retention. The optimum dose was found to be 0.7 g/t and this took the moisture from 13.5% to 11.5%.

Product	Flocculant dose rate (g/t)	Cake moisture (%)
Blank	0	13.5
MAGNAFLOC® 5250	0.7	11.5
	2	11.8
	3.5	12.2

Lower moistures still were required in order to meet process targets, and DRIMAX® 1239 NF was selected from BASF's surfactant range due to its fast hydration properties and non-flammable formulation making it easy to handle on site from both a usage and a health and safety perspective. Laboratory tests showed a good response to dosage when DRIMAX® treatment was added to the floc-conditioned sample, and the cake moistures were found to reduce further. An optimum dose of 30 g/t delivered 10.1% moistures and full-scale plant implementation was instigated.

Fig. 3: **Surfactant dose response with 0.7 g/t of flocculant (MAGNAFLOC® 5250) addition prior**



For the trial, the modified spray bars were installed, and the flocculant dosage control was auto linked to the belt feed mass DCS signal, whilst the DRIMAX® dosage was linked to the spray bar water flow. Trial results were found to correspond well with the Laboratory results and gave a consistent final cake moisture of 10.6% which met the desired process requirements.

Day	Time (hrs)	Moisture (% w/w)	Pump flow rate (l/h)	DRIMAX® dosage (g/t)	Average moisture (% w/w)
1	11.30	11.5	5.7	50	10.66
	12.00	10.5	5.7	50	10.66
	13.00	10.9	5.7	50	10.66
	13.30	10.8	5.7	50	10.66
	14.00	10.3	5.7	50	10.66
	14.30	10.5	5.7	50	10.66
	15.00	10.1	5.7	50	10.66
	15.30	12.6	0	0	12.50
	16.00	12.2	0	0	12.50
	16.30	12.9	0	0	12.50
	17.00	12.3	0	0	12.50
2	07.00	10.2	5.7	50	10.64
	07.30	10.6	5.7	50	10.64
	08.00	10.8	5.7	50	10.64
	08.30	10.7	5.7	50	10.64
	09.00	10.3	5.7	50	10.64
	09.30	13.0	5.7	50	10.64
	10.00	10.2	5.7	50	10.64
	10.40	10.2	5.7	50	10.64
	11.00	10.5	5.7	50	10.64
	11.45	10.2	5.7	50	10.64
	12.00	10.3	5.7	50	10.64
	13.30	15.4	0	0	12.52
	14.00	13.0	0	0	12.52
	15.00	10.6	0	0	12.52
	15.00	12.1	0	0	12.52
	16.00	11.5	0	0	12.52

Conclusions

The use of DRIMAX® surfactant was able to successfully treat two iron ore fine samples from the Pilbara region. Both vacuum filtration applications produced a lower filter cake moisture content when the surfactant was applied. The second sample required an addition of flocculant which improved the solids throughput rate on the vacuum belt by forming a more permeable filter cake. Correct dosing of both chemicals is an important factor to identify and control for all filtration applications. Overdosing of either flocculant or surfactant results in a negative impact on filter cake moisture content. Solids throughput capacity was improved with increasing flocculant addition, but this had to be traded against a corresponding increase in filter cake moisture content. It was estimated that for every 1% w/w moisture reduction, a cost saving of approximately $1 million was realised through a combination of reduced cake moistures, improved throughputs, and extended belt life (less blinding).

Highlights of DRIMAX® performance

- Absolute decrease in final filter cake moisture by up to 3.5%
- Increased water quality and recovery back into the process plant
- Reduction in risk of supply value chain when final product is exported
- Reduction of the final moisture allows more iron ore to be shipped creating more value

Technical service

Full technical service and advice in all aspects of product selection, equipment design, reagent application, laboratory tests and plant trials will be provided.

Benefits

Economical

- Proven cost-performance benefit across many users
- More consistent plant performance

Operational

- Improved performance by reducing the filter cake moisture which equates to operational cost improvements
- Decrease in filter belt cake separation time
- Extended filter cloth life
- Reduced filtration cycle times

Environmental

- Reducing energy consumption in filtration circuit
- BASF's sustainability commitments cover every part of the product supply chain
- Higher water recovery back into the process
- Reduced carbon footprint using BASF products

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