



# Innovations with Lime:

Improving polymer performance to minimize production of fluid fine tailings

Polymer flocculation processes, such as thickeners and inline mixing, are commonly used for tailings treatment in the oil sands industry. Some operators experience poor process performance in two key areas. First, the microfine particle capture rates may be too low. In addition, the flocs formed by these processes may be sensitive to shearing; this could result in the need for end of pipe treatment due to breakdown of flocs prior to discharge to tailings ponds.

Lime dosing improves existing tailings treatment processes by more effectively capturing microfines during treatment and producing flocs which are less sensitive to shearing. This results in the production of durable deposit formations, without the need for end of pipe treatment.

## ▼ PRIMARY BENEFITS: REDUCED PRODUCTION OF FLUID FINE TAILINGS AND OPERATIONAL COST SAVINGS

- Lime dosing reduces production of fluid fine tailings and associated environmental liability through improved microfines capture in tailings treatment.
- Thickened tailings produced from lime treatment are less sensitive to shearing. Compared to polymer only treatment, treating tailings with lime increases the amount of captured microfines that remain in the tailings during pumping.
- Lime dosing reduces the fractionation of different sized tailings while settling, also known as segregation.
- Lime dosing produces high clarity, softened water with potential other uses.
- Carbon dioxide is permanently sequestered by the formation of calcium carbonate with lime addition.

## ▼ WHAT'S NEW?

Graymont's innovative lime treatment approach uses a dilute lime slurry as a coagulant, prior to the use of a polymer flocculant, to achieve increased microfines capture, leading to durable, non-segregating treated tailings.

## ▼ COMMON MISCONCEPTIONS ABOUT LIME TREATMENT



### The chemical cost of lime is too high.

Lime dosage is minimized by optimizing the lime slurry concentration. Thanks to more effective polymer use and reduction in fluid fine tailings production, Graymont expects operators to achieve a net reduction in operating costs when treating with lime.



### There's no way to supply enough lime to meet demand.

Graymont is uniquely positioned to meet demand in Western Canada, with an established and growing distribution network. Whether 100 or 100,000 tonnes per year are required, we work directly with each client to adapt to their independent supply and shipment needs.

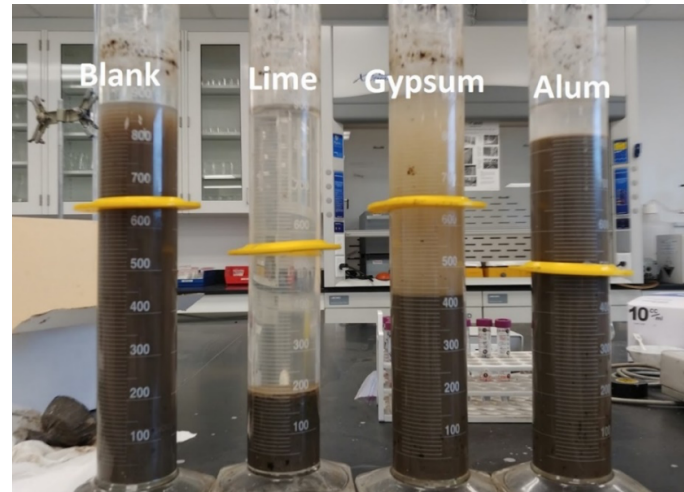


### Calcium builds up in recycled water.

At elevated pH, calcium reacts with carbonates and will precipitate out of the water as insoluble calcium carbonate, without the formation of soluble calcium bicarbonates that could build up in process water over time. Therefore, lime dosing at the targeted pH level results in lower soluble calcium than alum or gypsum dosing. Soluble calcium levels below 60 ppm are achievable at the targeted pH level.

# How it works

- Lime is used as a coagulant by rapidly mixing fluid fine tailings with a 5 wt.% calcium hydroxide slurry to achieve a target pH level. Slurry dosages vary depending on the tailings, but can be as low as 400 ppm on a wet tailings weight basis.
- A polymer flocculant is added via slow mixing, causing large flocs to build and settle. The flocs capture suspended microfines, organics, etc.
- Settling occurs at a much faster rate compared with competing coagulants, such as gypsum.
- The resultant flocs are less sensitive to shearing (e.g. during pumping), preserving microfines capture upon deposition.
- This produces a high clarity, softened overflow or release water with soluble calcium levels less than 60 ppm.



## ▼ HIGHLIGHTS

Experiments carried out by Graymont compared lime, gypsum and alum treatments. Lime treatment of fluid fine tailings yielded faster settling rates, better water clarity and improved shear performance

## References/Further reading

Rahal, K., Fox, J., Leikam, J., Tate, M., & Romaniuk, N., 2018. "Impact of Calcium Hydroxide on the Equipment and Process of Oil Sands Tailings Treatment." Proceedings of the 22nd International Conference on Tailings and Mine Waste; Keystone. Vancouver (BC): UBS Studios: 387-397.

Tate, M.J., Leikam, J., Fox, J., and Romaniuk, N., 2017. "Use of Calcium Hydroxide as a Coagulant to Improve Oil Sands Tailings Treatment." Proceedings of the 22nd International Conference on Tailings and Mine Waste; Keystone. Edmonton (AB): University of Alberta Geotechnical Centre: 720-732.

Graymont is a global leader in lime and limestone solutions. Our products are essential in addressing today's most pressing environmental issues while supporting vital industrial processes and agricultural needs

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