Preventing the Production of Fluid Fine Tailings

A COSIA/government supported research project is focusing on preventing the production of Fluid Fine Tailings (FFT), one of the most difficult tailings management issues facing the oil sands mining industry. FFT must be stored in tailings ponds for decades while the solids settle (consolidate) out of the fluid stream, which slows reclamation and poses an environmental liability.

At oil sands mines, total tailings that remain after bitumen extraction and primary processing are transported via pipeline to a containment pond. The tailings slurry contains water, coarse particles (sand), fine particles (clay and silt) and traces of residual bitumen. After being discharged from the pipeline into the disposal area, the coarse particles settle quickly and form a beach, leaving a fine particle content of 6 to 10 per cent in the fluid. After a few years of settling, the remaining mixture of FFT achieves a 30 to 35 per cent solid content in the pond. FFT has been stored in tailings ponds in northern Alberta for decades while the solids consolidate out of the fluid stream, which has slowed reclamation efforts and poses an environmental liability.

With funding from COSIA, Natural Resources Canada and Alberta Innovates – Environment and Energy Solutions (AI-EES), researchers at Inline Dewatering Ltd. will conduct laboratory trials of cross flow filtration (CFF) technology to remove greater volumes of water from the total tailings stream before it is deposited into tailings ponds. Increasing the solids content of total tailings to more than 70 per cent shows promise for preventing the future production of FFT.

CFF is a pressure and flow driven filtration process that also allows for rapid recycle of water and heat energy, which could reduce greenhouse gas emissions while allowing for more efficient bitumen processing. Previous CFF trials involved a simple, closed-circuit pumping loop using porous or slotted pipe as the filter medium for dewatering total tailings streams. The slurry flowed parallel to the filter pipe, forming a filter cake on the pipe surface. However, due to the shear of the flowing slurry, the buildup of filtration cake reached equilibrium, resulting in a relatively constant filtration rate. Dewatered tailings from the end of the pipe were discharged for deposition with a paddle mixer to homogenize the tailings and prevent them from segregating prior to circulation.

Inline Dewatering Ltd.’s work will look at the impact of the tailings properties such as particle size distribution, solids content and bitumen content on filtrate flux and cake porosity. Other filter media including sintered steel and porous plastic pipe will also be evaluated. Properties of the dewatered tailings once they are deposited will be measured to assess segregation behaviour and geotechnical stability. Finally, scale effects will be explored to determine how the lab experiments may be scaled up to field operating conditions.