

Effect of Residual Bitumen on Polymer based Flocculation of Mature Fine Tailings

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Bitumen production via the water extraction process has resulted in the accumulation of huge volumes of waste tailings. These tailings contain substantial amounts of fine clays that settle very slowly, forming a viscous suspension referred to as mature fine tailings (MFT). Such large volumes and extremely slow consolidation of the MFT pose a significant environmental issue. Methods to treat MFT are being explored, one of which includes the use of novel flocculants to enhance flocculation and hence, improve consolidation of fines. However, small amounts of residual bitumen remaining in MFT can impact the effectiveness of the flocculation process.

In the current study, residual bitumen content in MFT was varied using Denver cell extraction or blending of MFT. The effect of bitumen content on polymer-induced flocculation and settling was studied. Focused Beam Reflectance Measurement (FBRM) and Quartz Crystal Microbalance (QCM) were used to study polymer performance, measuring floc growth in-situ and polymer adsorption onto bitumen and clay surfaces, respectively. Such interactions were also verified from zeta potential measurements.

Settling tests showed that the removal of bitumen from raw MFT caused an increase in settling rate through Hychem AF246 polymer addition (MW 14.5×10^6 Da; dosage 50 ppm). However, a critical bitumen content was measured beyond which, further removal of bitumen resulted in a decrease in settling performance. FBRM results confirmed that flocs also decreased in size beyond the critical bitumen content. The results indicate that a critical bitumen content is required to optimize MFT flocculation and settling.