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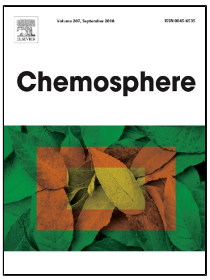

Polymer Reaction Engineering Tools to Design Multifunctional Polymer Flocculants

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Polymer Reaction Engineering Tools to Design Multifunctional Polymer Flocculants

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Abstract

A series of multifunctional terpolymers, poly(*N*-isopropyl acrylamide/2-(methacryloyloxy) ethyl trimethyl ammonium chloride/*N*-*tert*-butylacrylamide) [P(NIPAM-MATMAC-BAAM)] were designed to flocculate and dewater oil sands mature fine tailings (MFT). The hydrophobic BAAM comonomer helped expel water out of the sediments, while the cationic MATMAC comonomer promoted charge neutralization of the negatively-charged particles suspended in MFT. The chemical composition distributions of these terpolymers were designed based on the knowledge of the reactivity ratios of all comonomers, instead of by trial and error, as usually done for most polymer flocculants. The binary reactivity ratios of the comonomers were estimated by synthesizing the binary copolymers with varying mole fraction of each comonomer in the feed, and experimentally measuring the corresponding fraction of comonomer in the copolymers. Polymer reaction engineering tools were used to minimize compositional drift and guarantee the synthesis of terpolymers with narrow chemical composition distributions suited for MFT dewatering. Focused beam reflectance measurement (FBRM) experiments showed that the terpolymer promoted the formation of MFT large flocs (120 μm). The initial settling rate (ISR) decreased with increasing flocculant hydrophobicity, likely because the hydrophobic terpolymer segments did not take part in the bridging of the MFT particles. Contrarily, the sediments