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Polymer Reaction Engineering Tools to Design Multifunctional Polymer Flocculants

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1 **Polymer Reaction Engineering Tools to Design Multifunctional Polymer Flocculants**

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7 **Abstract**

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

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