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SCALE INHIBITION BY A CARBOXYLATE-TERMINATED DOUBLE-HYDROPHILIC BLOCK COPOLYMER IN INDUSTRIAL RECYCLING WATER

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Acrylic acid (AA)-allylpolyethoxy carboxylate (APEL) copolymer was synthesized. The performance of AA-APEL on inhibition of $Ca_3(PO_4)_2$, $CaCO_3$ and $CaSO_4$ precipitation was compared with that of current commercial inhibitors. It was shown that AA-APEL exhibited excellent ability to control inorganic minerals, with approximately 95.6 % $CaSO_4$ inhibition and 99.8 % $Ca_3(PO_4)_2$ inhibition at levels of 3 and 6 mg/L, respectively. AA-APEL also displayed ability to prevent the formation of $CaCO_3$ scales. Surface morphology characterization of $Ca_3(PO_4)_2$, $CaCO_3$ and $CaSO_4$ was investigated with scanning electronic microscopy. The inhibition mechanism was proposed that the formation of the excellent solubility of AA-APEL-Ca complexes due to high hydrophilic PEG segments in the AA-APEL matrix.

Keywords: double-hydrophilic block copolymer, nonphosphorus inhibitor, surface morphology, industrial recycling water.

Introduction

For environmental and economic reasons, a greater number of cycles for industrial water should be used. However, it cannot be realized without development of scale control methods (Zhang et al., 2016; Liu et al., 2016). The potential of mineral precipitation continues to be by far the most costly design and an operating problem in recycling-water systems (Chaussemier et al., 2015; Liu et al., 2015; Al Nasser et al., 2011). Alkaline scales such as calcium carbonate can be easily controlled by acidifying and maintaining pH below 7.5. Due to its low cost, sulfuric acid is usually used for pH control thereby increasing the potential of calcium-sulfate scale formation. In addition, using sulfuric acid to

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