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Performance on calcium scales inhibition in the presence of a novel double-hydrophilic block terpolymer

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ABSTRACT

An effective method for controlling scale formation in circulating cooling water system is the use of scale inhibitors. A novel multi-functional scale inhibitor AA–APES–H_3PO_3 terpolymer, was prepared by acrylic acid (AA), ammonium allylpolyethoxy sulfate (APES), and phosphorous acid (H_3PO_3) and the structural properties were identified by Fourier transform infrared and ^{1}H-NMR. The inhibitory power of the terpolymer was determined by using a static scale inhibition method. The polymer's effectiveness on calcium scales was assessed by using X-ray diffractometer, scanning electron microscopy (SEM) and transmission electron microscopy (TEM). It is shown that AA–APES–H_3PO_3 terpolymer exhibited an excellent ability to control the formation of $CaCO_3$ scale at a mole ratio of 2/1 (AA/APES) with an inhibition efficiency of 92.6% at a level of 8 mg L^{-1}, and at the same time, it maintained a superior efficiency even at increasing solution temperature, pH value, and Ca^{2+} concentration. Compared with commercial inhibitors, the order of preventing the precipitation of calcium carbonate was AA–APES–H_3PO_3 > EDTMP > HEDP > PESA > PAA. Also the terpolymer displayed a superior ability to prevent calcium phosphate with approximately 100% inhibition efficiency at the dosage of 6 mg L^{-1}.

Keywords: Double-hydrophilic block terpolymer; Scale inhibition; Calcium carbonate; Calcium phosphate

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