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Inhibition of calcium carbonate and sulfate scales by a polyether-based polycarboxylate antiscalant for cooling water systems

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ABSTRACT

To inhibit calcium carbonate and sulfate scales in cooling water systems, a new antiscalant (acrylic acid–oxalic acid–methallyl methoxy polyethylene glycol, [AA-HPEZ]) was synthesized via radical copolymerization, and the structure of inhibitors was characterized by Fourier Transform infrared spectroscopy, hydrogen Nuclear magnetic resonance, and carbon thirteen Nuclear magnetic resonance. The ability of the polymer to mitigate the calcium carbonate and calcium sulfate scales formation was tested by static scale inhibition methods. The inhibition efficiencies of AA-HPEZ toward $CaCO_3$ and $CaSO_4$ scales were 90.6% and 100%, with 8 and 4 mg/L, respectively. The performance of copolymer on inhibition to $CaCO_3$ and $CaSO_4$ precipitation was better than poly(acrylic acid), poly(epoxysuccinic acid), and hydrolytic poly(maleic anhydride). AA-HPEZ shows great antiscaling properties for $CaCO_3$ scale even for the solution with higher temperature and higher hardness.

Keywords: Crystallization; Scale inhibition; Copolymer; Calcium carbonate; Calcium sulfate

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