

Inhibition of calcium and magnesium-containing scale by a new antiscalant polymer in laboratory tests and a field trial

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Abstract

Membrane scaling is caused by the deposition of insoluble salts as feedwater converted to brine, affecting the operation of seawater RO plants. Membrane scaling at the Dalian RO desalination plant was analyzed using Dalian seawater. Based on the characteristics of Dalian seawater, a new environmentally friendly, biodegradable antiscalant PAP-1 was synthesized in the laboratory. The performance of PAP-1 to inhibit calcium and magnesium-containing scale was studied both in the laboratory and at the Dalian seawater RO desalination plant. It was found that PAP-1 is effective in inhibiting scale formation. The experimental results in the laboratory indicate that the proper dose is 3–5 ppm when the concentration of calcium is 1000 mg/L and of magnesium is 2800 mg/L. The pH of the feed water was in the range of 3–9. The efficiency of calcium scale inhibition of PAP-1 is higher than 97.24% and magnesium scale inhibition is higher than 98.63% with 9 ppm PAP-1. The test performed at the Dalian seawater RO plant confirmed the scale inhibition ability of PAP-1 compared with the Nalco PermaTreat 191 scale inhibitor. The results from both antiscalants were similar. The average scale formation rates of calcium and magnesium of 14 samples was 2.822 g/h and 5.562 g/h separately with the addition of PAP-1 in each membrane unit; PAP-1 was more effective than Nalco PermaTreat 191. At the same time, the algae growth inhibition test showed that the addition of PAP-1 does not affect the growth of algae, which is an indication that PAP-1 has no toxicity and is a suitable and environmentally friendly antiscalant.

Keywords: Membrane scaling; Antiscalant; RO; Desalination
