

Myo-inositol hexakisphosphate (phytate) inhibits calcium carbonate crystallisation in hard water

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Abstract

A batch system and a flow system with synthetic water were used to study calcium carbonate precipitation and phytate crystallisation inhibitory effects. Afterwards, phytate inhibitory effects on calcium carbonate crystallisation were tested in a real system, working with a cistern filled with hard water. Finally, the effects of phytate on calcium carbonate crystallisation were compared with another phosphate derivative and with a chelating agent.

The results obtained with the batch system demonstrated that 1.52 μM of phytate completely avoided calcium carbonate crystallisation when the calcium concentration was less than 7.9 mM and the carbonate concentration was 5.83 mM. The results corresponding to the flow system showed that 3.03 μM of phytate led to a 95% reduction of calcium carbonate scale formation on a copper pipe after 48 h, operating at 30°C. In addition, in a full-scale system, the dissolved calcium and bicarbonate concentration was increased for a given time when adding phytate to the cistern. Finally, using a batch system, it was demonstrated that phytate effects on calcium carbonate crystallisation reduction were superior to those shown by triphosphate and EDTA.

The results presented demonstrate that phytate at very low concentrations can be used to prevent calcium carbonate scale formation without changing the mineral composition of water due to its capacity as a crystallisation inhibitor.

Keywords: phytate, inhibition, calcium carbonate, scale formation, water hardness