



Prevention and control of struvite and calcium phosphate precipitation by chelating agents

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ABSTRACT

The problems stemming from struvite precipitation on pipe walls, valves, faucets, and propellers in the anaerobic sludge digestion processes of wastewater treatment plants have been extensively reported. In addition to the diverse sources of the struvite-forming ions (Mg^{2+} , NH_4^+ , and PO_4^{3-}) present in its wastewaters, Israel has hard water with characteristic high concentrations of Ca^{2+} that causes the formation of calcium phosphate on plant equipment. This study focuses on the use of chelating agents to control struvite and calcium phosphate precipitation. The reaction conditions required to prevent the precipitation of either salt by ethylenediaminetetraacetic acid or nitrilotriacetic acid and for the selective precipitation of struvite after calcium chelation are reported. Both chelating agents promoted the chelation in solution of Ca^{2+} over that of Mg^{2+} . In contrast, for precipitated calcium phosphate and struvite, higher chelating agent concentrations were required to dissolve the former than the latter. The amounts of both chelating agents, added in proper concentrations, were sufficient to bind mainly the Ca^{2+} ions, thus preventing the precipitation of $\text{Ca}_3(\text{PO}_4)_2$ and leaving more phosphate ions available to precipitate Mg^{2+} ions as struvite. Performed properly, this process will remove Ca^{2+} and Mg^{2+} ions from the supernatant. In addition, after separation, the struvite can be collected and used as fertilizer. The potential toxicity of both chelating agents to the biomass was also studied in this work.

Keywords: Struvite; Calcium phosphate; Chelating agents; Anaerobic sludge; Wastewater

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