Nitrite effect on the phosphorus uptake activity of phosphate accumulating organisms (PAOs) in pilot-scale SBR and MBR reactors

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Abstract

Batch tests were performed to investigate the nitrite effect on the P-uptake of biomass grown in pilot-scale SBR and MBR systems. The results showed that the nitrite has an inhibitory effect on the aerobic P-uptake of the SBR and the MBR biomasses. The degree of inhibition was observed to be 65 % and 37 % at 10 mg NO_2-N/ℓ for the SBR and the MBR respectively. Both biomasses were found capable of using nitrite as electron acceptor as effectively as nitrate. Moreover, for the SBR biomass the anoxic P-uptake rate using nitrite was found even higher (60%) than the P-uptake rate with nitrate. From a modelling point of view, the current models require appropriate extensions to describe these various effects of nitrite. Hence, an extension of the ASM2d model has been provided. Prevention of nitrite build-up in full-scale EBPRs will eliminate the nitrite inhibition problem. Alternatively one can adopt a proactive approach in which the aerobic P-uptake phase is replaced with an anoxic P-uptake phase using **only** nitrite as electron acceptor. Such an approach offers considerable cost savings and enhanced nitrogen and phosphorus removal. This, however, requires further research for experimental validation and testing.

Keywords: ASM2d, MBR, modelling, nitrogen and phosphorus removal, nitrite inhibition, polyphosphate accumulating organisms, phosphate uptake, SBR