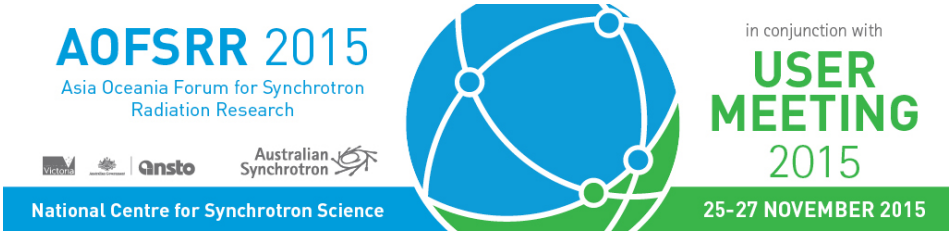

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Iron and phosphorus speciation in Fe-conditioned membrane bioreactor activated sludge

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Iron dosing of membrane bioreactors (MBRs) is widely used as a means of meeting effluent phosphorus targets but there is limited understanding of the nature of iron and phosphorus-containing solids that are formed within the bioreactor (an important issue in view of the increasing interest in recovering phosphorus from wastewaters). Of particular challenge is the complexity of the MBR system and the variety of reactions that can occur on addition of iron salts to a membrane bioreactor. In this study, the performances of pilot scale MBRs with dosing of ferrous salts were monitored for a period of seven months. The distributions of Fe and P-species in the Fe-conditioned sludges were determined using X-ray absorption spectroscopy at the Fe K-edge and the P K-edge. Regardless of whether iron was dosed to the anoxic or membrane chambers, iron present in the sludges was consistently in the +III oxidation state. Fitting of the Fe K-edge EXAFS spectra showed that an Fe(III)-phosphate species was the main Fe species present in both cases with the remaining fraction dominated by lepidocrocite (γ-FeOOH) and ferrihydrite (am-FeOOH). P speciation revealed by the P K-edge XANES spectra suggested that both co-precipitation (present as strengite or an amorphous ferric hydroxyl phosphate analogue of strengite) and adsorption of phosphorus by iron oxyhydroxide mineral phase contribute to removal of phosphorus from the MBR supernatant. Organic P was also an important component of the residual P pool in the sludges

Keywords

X-ray absorption spectroscopy, Membrane bioreactor, Iron, Phosphorus

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