



Biodegradation of pentachlorophenol in a membrane bioreactor

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Abstract

Pentachlorophenol (PCP) is a toxic chemical, often used in the formulation of pesticide, herbicide, anti fungal agent, bactericide and wood preservative. This study is aimed at evaluating the potential of membrane bioreactor (MBR) to treat PCP contaminated wastewater. Synthetic wastewater with COD of 600 mg/L was fed into the MBR at varied PCP loading rate of 12–40 mg/m³/d. A PCP removal rate of 99% and a COD removal rate of 95% were achieved at a hydraulic retention time of 12 hs and a mixed liquor suspended solids (MLSS) concentration of 10,000 mg/L. When sodium pentachlorophenol (NaPCP), which has higher solubility in water, was used in the second phase of the study, at loading rates varying from 20 to 200 mg/m³/d, the removal rate of NaPCP was higher than 99% and the removal rate of COD was more than 96%. It was also found that at higher biomass concentrations, biosorption played an important role besides the biodegradation process. Batch experiments conducted in this study revealed that the sorption capacity to be 0.63 (mg PCP/g biomass) and occurred rapidly within 60 min. This phenomenon could enhance the PCP degradation through increased contact between microorganism and PCP. Further, the membrane resistance was low (trans-membrane pressure of 14 kPa) even after more than 100 ds of operation. In addition, the toxic level of PCP in the influent could have induced the microorganisms to secrete more extra-cellular polymeric substances (EPS) for their protection, which in turn must have increased the viscosity of the mixed liquor.

Keywords: Biodegradation; Biosorption; Membrane bioreactor; Pentachlorophenol; Sodium pentachlorophenol; Transmembrane pressure

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