Effects of alumina trihydrate (ATH) on formation of biofilms settled on inert carriers of polyethylene terephthalate (PET)

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Received 1 June 2012; Accepted 22 May 2013

ABSTRACT

Alumina trihydrate (ATH), one of typical complexes of aluminum (Al), was selected to study its effects on the formation of biofilms settled on inert carriers made of polyethylene terephthalate (PET) filaments. Four identical biological reactors were developed to cultivate biofilms under a series of ATH concentrations. Three-dimensional elastic inert PET carriers were used as the biofilm substrata. The biofilm characteristics including the amounts of total biofilm, extracellular polymeric substances (EPS) productions, active biomass, and microbial activity, were investigated. The impact of Al toxicity on the formation of biofilms was also discussed. The results showed that the colloidal ATH was easily adhered to the inert carriers, and the effects of ATH on the formation of biofilms colonized on the inert carriers were clearly observed. Compared to the biofilm characteristics when ATH was absent, the presence of ATH could increase the amounts of total biofilm production, EPS production, active biomass, and microbial activity: when the ATH concentrations reached 0.1, 0.2, and 0.5 mg/L (as Al3+), the total biofilm amount would increase to 1.44, 2.14, and 2.60 times, respectively, and the EPS production would enhance to 1.21, 1.60, and 1.85 times, respectively. Similar ratios for EPS production were also obtained for the corresponding active biomass and microbial activity. These results suggested that ATH is beneficial to the formation of biofilms settled on inert carriers, and the impact of Al toxicity seems to be insignificant in this study on the colonized microbes and the biofilm formation, probably due to the low ATH concentration (0.5 mg/L as Al3+ in maximum) in the reactors.

Keywords: Biofilm formation; Alumina trihydrate; Polyethylene terephthalate; Aluminum toxicity

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