Performance of UASB reactor treating synthetic textile wastewater: effect of physicochemical pretreatment

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ABSTRACT

The study explores the influence of physicochemical pretreatment on the performance of upflow anaerobic sludge blanket (UASB) reactors treating synthetic textile wastewater. Physicochemical pretreatment in this study utilized a new composite coagulant magnesium chloride added with aluminum chlorohydrate which produced nearly complete color removal and a partial chemical oxygen demand (COD) removal (~55%) efficiency. Various parameters such as volatile fatty acids (VFA), bicarbonate alkalinity (B-Alk.), gas production, total aromatic amines (TAAs) generation, COD, and color removal efficiency were monitored in the UASB reactors operated at different operating conditions. For the UASB reactor treating pretreated textile wastewater, a maximum of 99% COD removal was obtained at an organic loading rates (OLRs) of 1.2 kg COD m⁻³ d⁻¹ and hydraulic retention time (HRT) of 20 h. Whereas in case of without pretreatment, a maximum of both 92% COD and color removal efficiency were achieved at an OLR of 2.4 kg COD m⁻³ d⁻¹ and HRT of 20 h. However, in this case, highly toxic, carcinogenic, and mutagenic TAAs were observed to produce in the range of 6.9–8.1 mg L⁻¹. VFA/B-Alk. ratios were found in the range of 0.05–0.15, indicating the sufficient buffering capacity for stability of the reactor. The study demonstrates the significance of physicochemical pretreatment on the performance of UASB reactor for the treatment of textile wastewater. Nevertheless, it also shows the importance of introducing pretreatment in order to avoid the production of harmful aromatic amines in the treated UASB effluent.

Keywords: Aromatic amines; COD removal; Color removal; Pretreatment; Textile wastewater; UASB reactor

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