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MODELING OF COAGULATION-MICROFILTRATION HYBRID PROCESS FOR TREATMENT OF OILY WASTEWATER USING CERAMIC MEMBRANES

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In this novel paper, fouling mechanisms of Mullite-alumina ceramic membranes in treatment of oily wastewaters in hybrid coagulation – microfiltration (MF) process have been presented. Hermia's models for cross flow filtration were used to investigate the fouling mechanisms of membranes at different time intervals with various coagulant concentrations. Four coagulant ((ferrous chloride ($FeCl_2 \cdot 4H_2O$), ferrous sulfate ($FeSO_4 \cdot 7H_2O$), aluminum chloride ($AlCl_3 \cdot 6H_2O$) and aluminum sulfate ($Al_2(SO_4)_3 \cdot 18H_2O$)) plus equal concentration of calcium hydroxide in form of calcium hydroxide ($Ca(OH)_2$) were evaluated in the coagulation – MF hybrid process at different concentrations (0, 50, 100 and 200 ppm). To determine whether the data agree with any of the considered models, the coefficient of determination (R_2) of each plot for one model was compared with the others. In addition, average prediction errors of models are calculated. The results showed that cake filtration model can be applied for prediction of the permeation flux decline for MF and coagulation – MF hybrid process with best and worst average error equal to 0.96% and 5.78% respectively. Results indicated that by increasing time in filtration pore blocking behavior changes and one model cannot predict pore blocking behavior in all filtration time with very good preciseness.

Keywords: microfiltration, coagulation, fouling, oily wastewater treatment.

1. Introduction

Oily wastewaters are one of the major pollutants of the aquatic environment and removing oil from these oil-in-water emulsions is an important aspect of pollution control. This is due to the emission of a variety of industrial oily wastewaters from sources such as refineries, petrochemical plants and transportation. Several methods have been used for treatment of theses wastes, such as chemical destabilization by using inorganic salts, coagulation and occulation, dissolved air flotation, and membrane processes [1 – 4]. It is well

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