Optimum operating conditions in hybrid water treatment process of multi-channel ceramic MF and polyethersulfone beads loaded with photocatalyst

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ABSTRACT
The effects of water back-flushing period (FT) and polyethersulfone (PES) beads concentration loaded with titanium dioxide (TiO2) photocatalyst were investigated in a hybrid process of multi-channel ceramic MF and photocatalyst. The space between the outside of the membrane (0.4 μm pore size) and the module inside was filled with the PES beads. UV at a wavelength of 352 nm was radiated from outside of the acryl module. A quantity of humic acid and kaolin was dissolved in distilled water and utilized here as synthetic water. As a result of FT effect, resistance of membrane fouling (Rf) was decreased when FT decreased from NBF (no back-flushing) to 2 min at BT 10 s. Therefore, the FT 2 min at BT 10 s was the optimal condition to reduce membrane fouling and to maintain high permeate flux in our hybrid process. As a result of photocatalyst PES beads concentration, Rf was minimum at 40 mg/L when photocatalyst beads concentration was changed from 50 to 5 mg/L. The highest treatment efficiency of turbidity was 97.6% at 30 g/L. However, the treatment efficiency of UV254 absorbance, which was the organic matter concentration, decreased from 83.5 to 77.3% when PES beads concentration was changed from 50 to 5 mg/L.

Keywords: Microfiltration; Photocatalyst; Hybrid process; Ceramic membrane; Water treatment

1. Introduction
Photocatalytic oxidation, a new type of water pollution control technology, with the characteristics of high efficiency, low-energy consumption and a wide range of application, can oxidize most organic compounds, especially non-biodegradable organic contaminants, by mineralizing them to small inorganic molecules. For this reason, photocatalytic oxidation technology has broad prospects for application. Among various semiconductor photocatalysts, there is a general consensus among researchers that TiO2 is more superior because of its high activity, large stability to light illumination, and low price [1–4]. In photocatalytic degradation, two modes of TiO2 application are adopted: (1) TiO2 immobilized on support materials and (2) TiO2 suspended in aqueous medium [5,6].

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