FABRICATION OF TiO_2 AND TiO_2/CNT MODIFIED PVDF MEMBRANES BY IN SITU POLYMERIZATION AND CHARACTERIZATION OF THEIR PHOTOCATALYTIC ACTIVITY AND FILTERING PROPERTIES

Ákos Ferenc Fazekas[1,2], Tímea Miklós[1], Zsuzsanna László[1], Gábor Veréb[1]

[1]Department of Biosystem Engineering, Faculty of Engineering, University of Szeged, Moszkvai Blvd. 9., H-6725 Szeged, Hungary
[2]Doctoral School of Environmental Sciences, University of Szeged, Rerrich Béla Sq. 1, H-6720 Szeged, Hungary
e-mail: fazekas@mk.u-szeged.hu

Abstract

Besides traditional water purification techniques of oily wastewater, such as oil traps, sand filters, flotation, and chemical destabilization, the development of advanced technologies is essential to increase the efficiency of treatments. Membrane filtration is a promising approach as it is a chemical-free and user-friendly treatment, that can be easily combined with other methods, and it effectively removes both micro- and nano-sized oil droplets. In addition to the many advantages of membrane filtration, fouling is the primary obstacle to its widespread use. In this study, we aimed to develop photocatalytically active, TiO_2 and TiO_2/CNT modified PVDF membrane surfaces via a grafting method that can be used to form chemical bonds between the nanoparticles and the membrane matrix. It was also aimed to characterize the photocatalytic efficiency of the modified membranes (TiO_2 and TiO_2/CNT) by the degradation of methyl orange ($c_{initial}=10^{-5}$ mol/dm^3) and to investigate its filtration parameters in the treatment of oil-containing wastewater (c=400 ppm). It was found that the steady-state fluxes of the TiO_2 and TiO_2/CNT modified membranes were six and four times higher, respectively, than those of the unmodified membrane. It was also observed that both reversible and irreversible resistances, and thus, the total resistances, were greatly reduced as a result of the modification. The purification efficiencies were 92% regarding the decrease of the chemical oxygen demand and at least 99% regarding the turbidity measurements for both the modified and unmodified membranes. Furthermore, both types of surface modification were successful in making the membranes photocatalytically active.

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