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Photocatalytic membranes for water treatment

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Membrane operations have emerged as advanced separation processes in water treatment over the last decades but membrane fouling remains today as the main limitation of the process. In particular, the organic pollutants cause rapid and severe internal and surface fouling which results in a strong decrease of membrane permeate flux and separation performances. Direct coupling of separation and photo-catalytic degradation by using photo-catalytic membranes is an attractive way to mitigate the fouling. Membrane fouling by adsorbed organic macromolecules could be over came by photo-degradation because organic compounds such as humic and fulvic acids are decomposed at the surface of the membrane which is reactive. Moreover, it was observed that deposition of titania on the membrane increases its hydrophilicity which also contributes to fouling mitigation. Photo-catalytic Membrane Reactor (PMR) can be divided into two main groups: photo-catalyst in suspension or immobilized in/on the membrane. The main advantage of the second configuration is to minimize mass transfer resistance between the bulk of the fluid and the semi-conductor surface. Because of the forced transport of reactants by convection inside the pores, an increased reaction rate is observed. In a PMR with TiO_2 immobilized, the membrane acts as a support for the catalyst and might act as a barrier for molecule present in the solution (initial compounds and products or by-products of their decomposition). Ceramic membranes or polymeric membranes are the two possibilities to implement PMR. Ceramic membranes are resistant to heat and chemical corrosion, whereas polymeric membranes are more easily manipulated but less chemical resistant than the former ones. In this study, progress dealing with PMR developed in the European Institute of Membrane is illustrated by several examples. Ceramic and polymeric membranes were used.

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