



Application of nanotechnology and nanomaterials in water and wastewater treatment: membranes, photocatalysis and disinfection

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ABSTRACT

In recent decades, the introduction of novel and promising nano-materials for development of next generation of membranes of advanced antifouling and anti-scaling properties as well as for disinfection and photo-catalysis has been observed. Membranes made of these materials enable to obtain significantly higher water/permeate fluxes than thin film composite membranes currently used in membrane separation processes. Nano-materials such as silica, zeolites, metals (Ag, Zr and Ti) and metal oxides (TiO₂, ZrO₂, ZnO, Al₂O₃), metal-organic compound, and carbon-based materials, that is, carbon nanotubes (CNTs) and graphene-based materials are the most often applied for membrane modifications. In the paper, the state of the art in progress and challenges related to preparation of membranes made of nano-materials is presented. Novel composite membranes can be divided into two categories: (i) membranes made of only from graphene-based materials also known as freestanding membranes and (ii) polymeric/ceramic membranes modified with nano-materials. Modification of polymeric membranes can be made either by introduction of nano-material on a membrane surface or its addition to a membrane casting solution followed by membrane formation from a mixture of a polymer and a nano-material. The future prospect of membranes based on nano-materials in regard to the final separation efficiency and commercial scaling up has been discussed.

Keywords: Nano-materials; Membranes; Disinfection; Photo-catalysis; Review; Water and wastewater treatment

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