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WATER ENVIRONMENT AND RECENT ADVANCES IN POLLUTION CONTROL TECHNOLOGIES

Photocatalytic membranes: a new perspective for persistent organic pollutants removal

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Abstract
The presence of conventional and emerging pollutants infiltrating into our water bodies is a course of concern as they have seriously threatened water security. Established techniques such as photocatalysis and membrane technology have proven to be promising in removing various persistent organic pollutants (POP) from wastewaters. The emergence of hybrid photocatalytic membrane which incorporates both photocatalysis and membrane technology has shown greater potential in treating POP laden wastewater based on their synergistic effects. This article provides an in-depth review on the roles of both photocatalysis and membrane technology in hybrid photocatalytic membranes for the treatment of POP containing wastewaters. A concise introduction on POP's in terms of examples, their origins and their effect on a multitude of organisms are critically reviewed. The fundamentals of photocatalytic mechanism, current directions in photocatalyst design and their employment to treat POP's are also discussed. Finally, the challenges and future direction in this field are presented.

Keywords Photocatalytic membrane · Photocatalysis · Persistent organic pollutant · Wastewater · Mixed matrix membrane · Submerged membrane photoreactors

Introduction

As many countries across the world are experiencing rapid development, industrialization and growth in populations, water consumption and demands are also increasing exponentially. Countries such as Malaysia (Ali Hassan 2013), Greece (Shan et al. 2015), Poland (Shan et al. 2015), South Africa, Malta (Annalise Grech 2012) and Iran (Ashouri 2014) have shown increment in water consumption in the past 10 years due to various reasons including growth in population and industrialization. Clean water sources become very limited as many of the existing water bodies are severely polluted by industrial discharges from textile, pharmaceutical, petrochemical and agricultural industries. Such wastewater intrusion affects the quality of water bodies thus increasing the cost of water treatment for domestic consumption. The emergence of various types of micropollutants that can harm human health as well as the increasingly stringent environmental laws have pushed researchers to look for efficient and sustainable water treatment techniques. Water treatments are necessary to ensure wastewater effluent pollution level is reduced to an acceptable level before they are discharged into natural water bodies. Currently applied wastewater techniques such as coagulation and flocculation (Verma et al. 2012) require additional chemicals to work effectively, while separation techniques such as gravitational settling and filtration (Yu et al. 2017) only contain the pollutants and transfer them into different phase/media. Secondary treatment is normally required to complete the treatment process.

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