Accepted Manuscript

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PII: S1385-8947(17)32215-5
DOI: https://doi.org/10.1016/j.cej.2017.12.093
Reference: CEJ 18254

To appear in: *Chemical Engineering Journal*

Received Date: 27 August 2017
Revised Date: 17 December 2017
Accepted Date: 18 December 2017

Please cite this article as: S. Yu, Y. Wang, F. Sun, R. Wang, Y. Zhou, Novel mpg-C_3N_4/TiO_2 nanocomposite photocatalytic membrane reactor for sulfamethoxazole photodegradation, *Chemical Engineering Journal* (2017), doi: https://doi.org/10.1016/j.cej.2017.12.093

Novel mpg-C_3N_4/TiO_2 nanocomposite photocatalytic membrane reactor for sulfamethoxazole photodegradation

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Abstract

A novel mesoporous graphitic carbon nitride/titanium dioxide (mpg-C_3N_4/TiO_2) nanocomposite was successfully synthesized and incorporated into polysulfone (PSf) matrix to fabricate photocatalytic membranes. This study aimed to explore the photocatalytic ability of the novel nanomaterial membrane in degrading the antibiotic sulfamethoxazole (SMX) under solar light. The structural and morphological properties of the mpg-C_3N_4/TiO_2 nanocomposite and membrane were characterized using various techniques. The SMX photocatalytic degradation performance, pathway and mechanism by mpg-C_3N_4/TiO_2 photocatalytic membrane reactor (PMR) were systematically investigated using HPLC and LC-MS/MS. As a pharmaceutically active compound, SMX was transformed into 7 kinds of non-toxic and pharmaceutically inactive byproducts by the innovative PMR technology. SMX removal efficiency of the membrane PSf-3 (with 1% mpg-C_3N_4/TiO_2 loading) was the highest over the 30 h consecutive irradiation. Meantime, the membrane didn't affect the SMX photodegradation, and the structure was able to provide stable support with high integrity and flexibility after solar irradiation. The developed membrane has a great potential to be applied