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# Effectiveness of a photocatalytic organic membrane for solar degradation of methylene blue pollutant

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AB STR A C T

The results of a feasibility study are presented on the use of a polystyrene (PS) organic membrane as a photocatalyst support in the degradation of organic pollutants in aqueous solution. Methylene blue (MB) was employed as a model dye and commercial titanium dioxide ($TiO_2$) was used as a photocatalyst. The MB dye which is resistant to direct photolysis especially at high concentrations was successfully eliminated by $TiO_2$ fixed on the PS membrane in aqueous dispersion under solar irradiation. Photodegradation results of MB showed that the film with 10 wt% $TiO_2$ exhibited a remarkable ultraviolet (sun light) photocatalytic activity over 5 h, with 68% of the pollutant being degraded. This is similar to a $TiO_2$ slurry system. The photocatalytic degradation obeyed pseudo-first-order kinetics at low initial MB concentration. The optimum pH for efficient removal of dye was found to be 11. An increase in initial dye concentration decreased the degradation rate. The applicability of Langmuir–Hinshelwood kinetic equation revealed that the degradation of MB occurred mainly on the surface of the photocatalyst. The concept and results provide a promising platform for fabricating highly efficient organic photocatalytic membranes for water treatment.

*Keywords:* Water treatment; Organic pollutant; Methylene blue; Solar photocatalysis; Immobilized $TiO_2$; Organic membrane

## 1. Introduction

Water pollution caused by organic chemicals produced from the textile, paper, plastic, leather, food, and mineral processing industries is a very serious problem [1,2]. This is mainly due to the presence of synthetic dyes that are resistant to bacterial degrada- tion and conventional chemical processes. With the increasing shortage of clean water sources worldwide, the development of low-cost and efficient advanced water treatment technologies is urgently needed [1,2].

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