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Optimization of horizontal photocatalytic reactor for decolorization of methylene blue in water

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ABSTRACT

The prototype photocatalytic reactor was designed and then constructed in a horizontal scheme for testing the decolorization of methylene blue (MB) as a toxic organic model by UVA irradiation. The optimization of the photocatalytic reactor with a recycling system using TiO_2 nanoparticles (P25) as photocatalysts was investigated in this work. The efficiencies on MB photocatalytic decolorization of three geometric photocollectors in the reactor: (i) parabolic through collector (PTC), (ii) compound parabolic collector (CPC), and (iii) flat-plate collector (FPC), including the presence and the absence of parabolic reflector cover the UVA tubular lamp as an artificial light source were compared. Excepting only the CPC, the experimental results indicate that the orientation of light rays using the reflector as a primary and the collector as a secondary, can improve on the photocatalytic efficiency of MB decolorization. In our case, the PTC with the presence of the reflector shows higher performance on the MB decolorization than the CPC with the absence of the reflector and the FPC with the presence of the reflector. The photocatalytic reaction over MB decolorization can be explained under pseudo-first-order kinetics model. For our study, the optimums of MB suspension flow rate and TiO_2 catalyst concentration were found toward 345 mL/min and 1.0 g/L, respectively.

Keywords: Decolorization; Methylene blue; Photocatalytic reactor; Titanium dioxide

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