Application of response surface methodology for optimization of operational variables in photodegradation of phenazopyridine drug using TiO$_2$/CeO$_2$ hybrid nanoparticles

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ABSTRACT

In the present work, a powder mixture of the TiO$_2$ and CeO$_2$ solid oxides was used for preparation of TiO$_2$/CeO$_2$ hybrid nanoparticles. Crystallite size and structure of prepared TiO$_2$/CeO$_2$ hybrid nanoparticles were determined by X-ray diffraction and transmission electron microscopy techniques. The effect of operational variables such as catalyst dosage, initial drug concentration, irradiation time, and distance of the solution from UV lamp was predicted and optimized in the photocatalytic removal of phenazopyridine (PhP) using response surface methodology. The results showed that the predicted values of removal efficiency were found to be in good agreement with the experimental results with a correlation coefficient ($R^2$) of 0.9542. The optimum operational conditions were found to be: catalyst dosage of 0.41 g L$^{-1}$, initial drug concentration of 6.61 mg L$^{-1}$, irradiation time of 30 min, and distance of the solution from UV lamp of 2 cm. Under the optimized conditions, the maximum removal rate (97.74%) of PhP was achieved.

Keywords: Titanium dioxide; Photocatalytic removal; Phenazopyridine drug; Optimization; Operational variables; Response surface methodology

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