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# Photocatalytic degradation of 1,2-dichloroethane using immobilized PAni-$TiO_2$ nanocomposite in a pilot-scale packed bed reactor

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**ABSTRACT**

1,2-Dichloroethane is one of the most important chlorinated volatile organic pollutants in wastewaters and has been listed as a priority pollutant by several regulatory organizations worldwide including United States Environmental Protection Agency (EPA). It is widely used as a precursor of the petrochemical industry to produce vinyl chloride monomer for the production of poly vinyl chloride (PVC). In this study, PAni-$TiO_2$ nanocomposite was synthesized by in-situ deposition oxidative polymerization method and its performance for photocatalytic degradation of synthetic 1,2-dichloroethane wastewater was investigated. A new pilot-scale packed-bed continuous photocatalytic reactor was designed and constructed. Glass beads were selected as the packing material. Immobilization was carried out using a modified dip coating and heat attachment method. The characteristics of synthesized PAni-$TiO_2$ nanoparticles were confirmed using FTIR, XRD, PSA, SEM and EDS techniques. Response surface methodology (RSM) based on central composite design (CCD) was used for Design of experiments. Design Expert software optimized 70.59% degradation of 1,2-dichloroethane with catalyst composition [TiO2: PAni] at [2.33:1] and catalyst loading at 0.39 mg/$cm^2$, respectively. In this study (1) PAni-$TiO_2$ nanocomposite was successfully immobilized on glass beads, (2) 1,2-dichloroethane was successfully degraded using synthesized PAni-$TiO_2$ nanocomposite under visible light irradiation and (3) the designed and constructed photocatalytic reactor performed well for conducting photocatalytic degradation of 1,2-dichloroethane experiments and (4) for experimental conditions of this work, PAni-$TiO_2$ nanocomposite was more effective than pristine $TiO_2$ under visible light irradiation.

*Keywords:* Photocatalytic degradation; Photoreactor; 1,2-dichloroethane; PAni-$TiO_2$; Immobilized glass beads; Response surface methodology

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