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Preparation of reusable nano N-TiO_2/graphene/titanium grid sheet for electrosorption-assisted visible light photoelectrocatalytic degradation of a pesticide: Effect of parameters and neural network modeling

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Abstract

Nitrogen doped-TiO_2 (N-TiO_2) nanoparticles were successfully prepared via manual grinding method. Electrophoretic deposition method has been developed to deposit N-TiO_2 nanoparticles and graphene (G) nanoplatelets onto titanium grid sheet. The obtained film (N-TiO_2/G) was characterized using FESEM, XRD, BET surface area, XPS, FT-IR, and UV-Vis DRS. In the present work, the removal of diazinon as a common pesticide from aqueous solution was investigated by electrosorption-assisted photoelectrocatalytic process using N-TiO_2/G nanocomposite under the visible light irradiation. The removal efficiency of diazinon obtained 80 % for the electrosorption-assisted photoelectrocatalytic process; while, it was 28.3% for photocatalytic and 23.7% for electrosorption processes, solely. Moreover, even after five successive cycles, the catalyst exhibited constant activity. An artificial neural network (ANN) model was developed to predict the removal of diazinon solution. The findings indicated that the ANN provided reasonable predictive performance (R^2 =0.9995). The relative importance of each studied variable on the electrosorption-assisted photoelectrocatalytic process was evaluated. Diazinon and electrolyte concentrations were found to be the most significant factors, followed by pH, applied bias potential and contact time. The main intermediates of diazinon degradation were identified using GC-Mass spectrometry.