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Removal Capacity of Activated Carbon (AC) by Combining AC and Titanium Dioxide (TIO_2) in a Photocatalytically Regenerative Activated Carbon

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Abstract : The most used techniques to remove pollutants from wastewater are adsorption onto activated carbon (AC) and oxidation using a photocatalyst slurry. The aim of this work is to eliminate such drawbacks by combining AC and titanium dioxide (TiO_2) in a photocatalytically Regenerative Activated Carbon. Anatase titania was deposited on powder-activated carbon made from grape seeds by the impregnation method, and then the composite photocatalyst was employed for the removal of reactive black 5, which is an anionic azo dye, from water. The AGS/TiO_2 was characterized by BET, MEB, RDX and optical absorption spectroscopy. The BET surface area and the pore structure of composite photocatalysts (AGS/TiO_2) and activated grape seeds (AGS) were evaluated from nitrogen adsorption data at 77 K in relation to process conditions. Our results indicate that the photocatalytic activity of AGS/TiO_2 was much higher than single-phase titania. The adsorption equilibrium of reactive black 5 from aqueous solutions on the examined materials was investigated. Langmuir, Freundlich, and Redlich–Petersen models were fitted to experimental equilibrium data, and their goodness of fit is compared. The degradation kinetics fitted well to the Langmuir-Hinselwood pseudo first order rate low. The photocatalytic activity of AGS/TiO_2 was much higher than virgin TiO_2. Chemical oxygen demand (COD) removal was measured at regular intervals to quantify the mineralization of the dye. Above 96% mineralization was observed. These results suggest that UV-irradiated TiO_2 immobilized on activated carbon may be considered an adequate process for the treatment of diluted colored textile wastewater.

Keywords : activated carbon, pollutant, catalysis, TiO_2
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