Efficient Removal of Organic Pollutants in Wastewater Using Pulsed Laser Synthesized TiO2/WO3/g-C3N4 Nanocomposite

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Rapid developments in industry and economy have resulted in global water issues, both in the environment, like contamination, and in alarming increases in demand. It is essential to develop an efficient method to remove the organic pollutants that can cause a variety of adverse health effects. Researchers proved that photocatalysis is the ideal method for the removal of organic pollutants by using a photocatalyst which works under mild experimental conditions due to non-toxicity, low material cost, and availability of solar radiation. In this study, a semiconductor photocatalyst was developed for the safe removal of organic pollutants from wastewater. However, catalysts (WO3, TiO2, ZnO) have some limitations due to the wide band gap, which corresponds to 4-5% of the sunlight. The photocatalytic performance of Titanium Dioxide (TiO2) was improved by the preparation of TiO2/WO3/g-C3N4 nanocomposite. A Pulsed Laser Ablation in Liquids (PLAL) technique was applied to synthesize the TiO2/WO3/g-C3N4 nanocomposite for the first time. The prepared nanocomposite was characterized using advanced analytical techniques such as X-ray diffraction (XRD), X- ray photoelectron spectroscopy (XPS), UV-vis spectroscopy, and photoluminescence (PL). Five samples with different concentrations of g-C3N4 were made. Results showed that TiO2/WO3/15%g-C3N4 is the most efficient material for the removal of organic pollutants with the efficiency of 91.5% and a recyclability rate of more than 3 times. This nanocomposite may help degrade a wide range of organic pollutants in real field applications, such as cleaning industrial wastewater.

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