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Photodegradation and durability of LPNTP-promoted N-doped TiO_2 in a continuous-flow photocatalysis/membrane separation system

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ABSTRACT

Yellow N-doped TiO_2 (TiO_xN_y) powder, synthesized using the liquid-phase nonthermal plasma technique, was produced from a mixed aqueous solution containing commercial titanium dioxide (Degussa P-25) and an N-precursor (ammonium chloride, NH_4Cl), and used for photodegrading C. I. Acid Orange 7 (AO7) in a continuous-flow photocatalysis–membrane separation system. The effects of the initial AO7 concentration, TiO_xN_y dose, oxygen concentration, and solution pH on AO7 photodegradation were investigated to obtain the optimum operational conditions. The experimental results indicate that the optimal dose of TiO_xN_y was 0.5 g L^{-1}, and the AO7 degradation efficiency was effectively improved by increasing the oxygen concentration from 0% to 40% or reducing the initial AO7 concentration from 15 to 5 mg L^{-1}. Moreover, the degradation efficiency for AO7 increased as pH decreased, with the catalyst exhibiting maximum efficiency at pH 2. The durability of the photocatalyst was evaluated by reusing the photocatalyst 11 times, and the recycled catalyst could repeat five runs without a significant decrease in treatment efficiency. In addition, the durability of the TiO_xN_y catalysts with aeration, which reduces catalyst deactivation, was longer than that without aeration.

Keywords: Photodegradation; Durability; N-doped TiO_2; LPNTP technique

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