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Photocatalytic degradation of congo red by using PANI and PANI/ZrO_2: under UV-A light irradiation and dark environment

Sibel Zor*, Bilge Budak

Department of Chemistry, Kocaeli University Science – Art Faculty, Kocaeli, Turkey, Tel. +90 262 303 2034; Fax: + 90 292 303 2003; email: merve@kocaeli.edu.tr (S. Zor), Tel. +90 262 303 2022; email: bilgebudak.bb@gmail.com (B. Budak)

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ABSTRACT

In this study, polyaniline (PANI) and polyaniline nanometal oxide (PANI/ZrO_2) composites synthesized by the chemical polymerization method were structurally characterized by X-ray diffraction, Fourier-transform infrared spectroscopy, scanning electron microscopy, and transmission electron microscopy methods. The thermal behavior of polymeric composites was analyzed using thermogravimetric analysis. Bandgap energy of PANI and PANI/ZrO_2 were calculated by using the Tauc plot. The photocatalytic effect of PANI nanocomposites with and without nano-ZrO_2 in different amounts (0.1, 0.5, and 1.0 wt.%) on the degradation of congo red dye was investigated under UV-visible light irradiation (UV-A, 365 nm) and a dark environment. The effect of light on 100% of the degradation of the congo red was investigated by using PANI and PANI/ZrO_2 photocatalysts. PANI and PANI/ZrO_2 catalysts under UV-A light irradiation were found to be more effective in 100% the degradation of the congo red dye molecules than that of in the dark environment. The photocatalytic activities of the catalysts were increased by the addition of nano-ZrO_2 to the PANI structure. The reaction kinetics were investigated by using the first-order reaction kinetic model. The photocatalytic reaction rate was higher by increasing the amount of nano-ZrO_2 used in the polymeric composite.

Keywords: PANI; PANI/ZrO_2; Congo red; Photocatalytic degradation; Wastewater

* Corresponding author.