Journal of the Iranian Chemical Society
https://doi.org/10.1007/s13738-022-02632-6

ORIGINAL PAPER

Performance of TiO_2/Ag/CA for efficient adsorption of methylene blue

Devagi Kanakaraju[1] · Feniellia Diwvya Anak Kutiang[1] · Sheikh Mohammad Fareth Abdul Hadi[1] · Ying Chin Lim[2]

Received: 29 March 2022 / Accepted: 30 July 2022

Abstract

The incorporation of additives and inclusion of metal dopants on titanium dioxide (TiO_2) could improve its inherent limitations and result in enhanced photocatalytic efficiency. In this work, the performance of TiO_2/Ag with the use of cellulose acetate (CA) was investigated for the degradation of a model dye pollutant under different operational settings. The surface morphology, elemental composition, crystallinity, and band gap of TiO_2/Ag/CA composite were verified by scanning electron microscopy, energy-dispersive X-ray, X-ray diffraction, and UV–Vis diffuse reflectance spectroscopy, respectively. An increase in CA concentration from 1 to 2 wt% led to the high removal of methylene blue (MB). The highest removal of MB (90.90%) was obtained by TiO_2/Ag/CA under the conditions of 4 g/L catalyst loading, 5 ppm MB concentration, and at unadjusted pH (7.8). The recyclability study showed that the removal efficiency of the retrieved photocatalyst remains as much as ~78% after 3 cycles, demonstrating its sustainability in water treatment. The remarkable adsorption effect shown by CA as an additive greatly enhanced the removal of MB by the TiO_2/Ag photocatalyst under UV irradiation and dark condition. The TiO_2/Ag/CA composite, which has dual roles in adsorption and photocatalysis, could be employed as a pollution removal agent in water.

Keywords Silver · Photocatalysis · Titanium dioxide · Adsorption · Wastewater · Dye