

ABSTRACT

Water pollution caused by textile dyes remains a significant issue. One such dye pollutant is *Remazol Black B* (RBB). RBB is an anionic azo textile dye with a complex aromatic structure, characterized by its strong blue color and toxicity. An effective and environmentally friendly method to address this issue is the use of adsorption-photocatalysis. This study aims to synthesize and characterize TiO₂-N and maleic acid-crosslinked chitosan membranes immobilized with TiO₂-N photocatalysts, as well as determine their effectiveness in adsorbing and degrading RBB dye. This study involves the synthesis of TiO₂-N using the hydrothermal method and characterization using FTIR, XRD, and UV-DRS. The synthesis of chitosan membranes and modified chitosan membranes includes chitosan/maleic acid (CS/MA), chitosan/TiO₂-N (CS/TiO₂-N), and chitosan/maleic acid/TiO₂-N membranes with varying TiO₂-N weights of 0.25 g (CS/MA/TiO₂-N 1); 0.4 g (CS/MA/TiO₂-N 2); and 0.55 g (CS/MA/TiO₂-N 3). Characterization of the chitosan and modified chitosan membranes was performed using FTIR, SEM-EDX, and physical tests. The pure chitosan membrane and modified chitosan membranes were then applied in the adsorption-photocatalysis process for the photodegradation of RBB solutions. The results obtained in this study were white TiO₂-N powder with a yield of 86.53% and modified chitosan membranes with a whitish color. The synthesized TiO₂-N had a bandgap value of 2.84 eV, anatase structure, and characteristic Ti-N (1637 cm⁻¹) and Ti-O (787 cm⁻¹) absorptions. The FTIR spectra of the modified membrane showed an increase in intensity at 1388 cm⁻¹ due to the characteristic N-O absorption and the appearance of Ti-N absorption at 1287 cm⁻¹ as an indication of the presence of TiO₂-N. SEM-EDX results showed that the modified chitosan membrane contained Ti, O, and N elements, whereas pure chitosan did not. The adsorption-photocatalysis process on a 50 ppm RBB solution with a volume of 20 mL, carried out for 1 hour without irradiation and continued for 5 hours under visible light, showed that the CS/MA/TiO₂-N 1 membrane variation provided the best results with an RBB degradation percentage of 97.2%. Reusing the modified chitosan membrane for three consecutive cycles shows a decrease in the degradation percentage of RBB dye.

Keywords: remazol black b, membrane, TiO₂-N, adsorption-photocatalysis