

ABSTRACT

Water pollution from toxic and difficult to decompose synthetic dye waste is one of the environmental problems. One solution to overcome this problem is a membrane-based adsorption-photocatalysis method. The purpose of this study was to synthesize ZnO-Ag nanocomposites, chitosan/vanillin/ZnO-Ag membranes, and determine the effectiveness of degradation of methylene blue solution by chitosan/vanillin membranes with ZnO-Ag alloys. The study consisted of three stages, namely: 1) preparation of chitosan (CS), chitosan/vanillin (CS/Vn), and CS/Vn/ZnO-Ag membranes. 2) characterization of ZnO-Ag nanocomposites with FTIR, UV-DRS, and XRD, while the membranes were characterized using FTIR, SEM-EDX, and physicochemical tests. 3) testing the adsorption-photocatalysis performance of membranes against methylene blue. The results show that ZnO Ag is blackish-gray, with FTIR results showing Zn-O (486 cm^{-1}) and Ag-O (880 cm^{-1}) groups, UV-DRS results obtained an energy band gap of 2.85 eV , XRD results showed diffraction peaks at 2θ angles of 38.15° , 44.36° , and 64.46° which confirmed Ag into the ZnO lattice with a crystallite size of 26.57 nm . The results of the CS/Vn membrane were transparent, but turned brown after the addition of ZnO Ag, with the FTIR results of the membrane showing a shift in the O-H group from 3357 cm^{-1} to 3354 cm^{-1} , C-H (2878 cm^{-1}), and C=N (1652 cm^{-1}), the SEM EDX results showed a smooth membrane surface with a composition of C, O, Zn, and Ag, and the results of the physicochemical test showed that the addition of vanillin increased porosity (36.37%), water absorption (97.14%), the degree of swelling (150.96%), and decreased the contact angle (78.5°). The adsorption-photocatalysis test using the CS/Vn/ZnO Ag 15:1.5 membrane resulted in the highest methylene blue degradation of 92.64% .

Keywords: Membrane, Chitosan/Vanillin, ZnO-Ag, Adsorption-Photocatalysis