ABSTRACT

Water pollution by tartrazine is persistent and difficult to degrade. ZnO photocatalysis has the potential to address this problem, but it is limited to light response and electron-hole recombination. Mn doping is done to lower the band gap and increase activity in visible light. In the form of a membrane, glycerol is added as a plasticizer to improve its mechanical properties. This study aims to evaluate the photocatalytic performance of Mn-doped ZnO-based chitosan membranes in tartrazine degradation. This study aims to synthesize and evaluate the photocatalytic performance of Mn-doped ZnO-based chitosan membranes in tartrazine degradation under visible light. The membrane is synthesized by impregnating Mn-doped ZnO and ZnO into the chitosan matrix with and without the addition of glycerol. Characterization was performed using XRD, FTIR, SEM-EDX, and UV-Vis DRS. Photocatalytic activity was analyzed through tartrazine degradation assays using a first-order pseudo-kinetic model and statistically tested using ANOVA. The results showed that Mn-doped ZnO and ZnO had a wurtzite structure, with a decrease in crystal size from ±16 nm to ±11.4 nm and a decrease in band gap from ~3.2 eV to ~2.7 eV. The addition of glycerol increases the flexibility and hydrophilicity of the membrane, but decreases the distribution of active species on the surface. Tartrazin degradation followed first-order pseudo-kinetics ($R^2 > 0.90$), with the highest rate constant on the 30% ZnO–Mn membrane without glycerol ($k = 0.4432\ min^{-1}$). ANOVA analysis ($p = 0.004$) showed significant differences between membrane variations. Chitosan–ZnO membranes doped with 30% Mn without glycerol exhibit the most optimal photocatalytic performance.

Keywords *: Membrane, Mn-doped ZnO, Tartrazin, Photocatalytic Degradation.*