ABSTRACT

Green synthesis is a material synthesis approach that utilizes natural materials as environmentally friendly reducing and stabilizing agents. This study aims to synthesize, characterize, and analyze the effectiveness of Fe_3O_4/rGO nanocomposites based on ketapang leaf extract (Terminalia catappa L.) in degrading astaxanthin waste. The phytochemical compounds contained in ketapang leaf extract have been proven to reduce and stabilize Fe_3O_4 particles, which were subsequently composited with rGO to produce Fe_3O_4/rGO nanocomposites in order to enhance photocatalytic degradation efficiency through the prevention of electron-hole recombination. The Fe_3O_4/rGO nanocomposites were then characterized to determine their structural, morphological, and optical properties. XRD characterization showed that the Fe_3O_4/rGO nanocomposites possessed a cubic spinel structure with a crystallite size of 12.76 ± 0.71 nm and a lattice parameter of 8.37 ± 0.23 Å. SEM-EDX characterization revealed the morphology of Fe_3O_4 particles distributed on the surface of rGO sheets with elemental compositions of 71.32% Fe, 15.89% C, and 9.62% O, confirming the successful formation of Fe_3O_4/rGO nanocomposites. UV-Vis characterization using the Tauc Plot method demonstrated favorable optical properties with a bandgap energy of 2.75 eV for the Fe_3O_4/rGO nanocomposites, which lies between the values of Fe_3O_4 and rGO, indicating the formation of effective electronic interfacial interactions between both materials. The degradation efficiency of astaxanthin wastewater using the photocatalyst reached an optimum level of 69.11% for the Fe_3O_4/rGO nanocomposites at 150 minutes, with a degradation rate constant of 0.0044 min^{-1}. These results indicate that Fe_3O_4/rGO nanocomposites have strong potential as environmentally friendly photocatalytic materials for astaxanthin wastewater degradation applications.

Keywords *: green synthesis, ketapang leaf, Fe_3O_4/rGO nanocomposite, photocatalysis, astaxanthin*