ABSTRACT

This study developed an environmentally friendly catalyst through green synthesis of lead oxide (PbO) nanoparticles assisted by red shoot leaf extract (*Syzygium myrtifolium*) as a stabilizing and capping agent. PbO nanoparticles were applied as a catalyst in the decolorization process of methylene blue using a Fenton-like method to evaluate the effectiveness and determine the optimum reaction conditions. The methodology includes extraction of red shoot leaves, synthesis and characterization of PbO, and decolorization of methylene blue with variations in concentration and volume of H_2O_2 and catalyst mass. The decolorization process was analyzed using UV-Vis spectrophotometry, while the decolorization solution was studied through the parameters of Chemical Oxygen Demand (COD), Pb content using Atomic Absorption Spectrophotometry (AAS), and the presence of hydroxyl radicals ($^{\bullet}OH$) through fluorescence analysis. The results showed that PbO nanoparticles were successfully synthesized with β-PbO (massicot) phase, with an average crystallite size of 38.386 nm and a crystallinity of 85.2%. The PbO catalyst produced a maximum decolorization efficiency of 70.21% in 25 mL of 5 ppm methylene blue solution within a contact time of 1 hour. Further analysis showed an increase in COD values, Pb content, and hydroxyl radicals due to residual H_2O_2 and catalyst in the solution. This indicates the active role of PbO in producing $^{\bullet}OH$ radicals in a Fenton-like reaction, although further treatment of the decolorization waste is required.

Keywords: green synthesis, lead oxide, Fenton-like, decolorization, methylene blue