ABSTRACT

Water pollution caused by industrial waste containing organic dyes such as methylene blue poses a serious threat to the environment and public health. Photocatalysis based on zinc oxide (ZnO) nanoparticles is a promising method for the efficient decomposition of such pollutants. However, the performance of ZnO remains limited due to its wide band gap energy and the high recombination rate of electron–hole pairs. This study investigates the enhancement of ZnO photocatalytic activity through doping with molybdenum (Mo). ZnO and Mo-doped ZnO (ZnO:Mo) nanoparticles were synthesized using the pulsed laser ablation method with a Nd:YAG laser (λ = 1064 nm, 85 mJ) in aquadest. Characterizations using UV-Vis spectrophotometry, XRD, and FESEM revealed that Mo doping reduced the band gap from 3.20 eV to 2.9 eV and decreased the particle size from 17.2 nm to 15.6 nm, with a spherical morphology. Mo incorporation significantly enhanced the photocatalytic degradation of methylene blue, increasing the degradation efficiency from 56.84% to 93.96%. These results confirm that Mo doping effectively improves the photocatalytic performance of ZnO by modifying its optical properties and inhibiting charge recombination. Therefore, ZnO:Mo demonstrates strong potential as an efficient photocatalytic material for water purification applications.

***Key Words**: Photocatalyst, Nanoparticles, ZnO:Mo, ZnO, Pulsed Laser Ablation, Methylene Blue Degradation*