

ABSTRACT

The increasing contamination of wastewater due to industrial activities has become a serious threat to the environment and human health. One promising solution is the use of photocatalytic methods based on TiO₂ nanoparticles, which are effective in degrading organic pollutants. However, the limitations of TiO₂, such as a wide band gap and rapid electron-hole recombination, reduce its efficiency. To address this, modification of TiO₂ nanoparticles by incorporating Mo atoms has been applied to narrow the band gap and reduce electron-hole recombination. Synthesis was carried out using an Nd:YAG laser with an energy of 85 mJ and a wavelength of 1064 nm, following the principle of pulsed laser ablation in an aqueous medium to produce TiO₂ and TiO₂/Mo nanoparticles. The resulting nanoparticles were then characterized using UV-Vis and FESEM to analyze optical property changes due to Mo modification. Characterization results showed that TiO₂ nanoparticles had an average size of 11,7 nm, while TiO₂/Mo nanoparticles had an average size of 11,2 nm, with both types exhibiting a spherical shape. Photodegradation results of methylene blue with an initial concentration of 10 ppm for 210 minutes showed a concentration reduction to 3.49 ppm for TiO₂ and 2.49 ppm for TiO₂/Mo, with degradation efficiencies of 65.1% and 75.07%, respectively. These findings prove that modification by adding Mo atoms enhances photodegradation effectiveness by overcoming the limitations of TiO₂.

Keywords: Photocatalysis, TiO₂ Nanoparticles, TiO₂/Mo Nanoparticles, Pulsed Laser Ablation, Methylene Blue Degradation.