ISSN: 1391-8796
Proceedings of 9th Ruhuna International Science & Technology Conference
University of Ruhuna, Matara, Sri Lanka
January 19, 2022

Mg-Doped ZnO nano particles for photodegradation of methylene blue and chlorophenol

Silva S.S.H. and Edussuriya M.*
Department of Chemistry, University of Ruhuna, Wellamadama, Matara, Sri Lanka.

Commercial dyes, methylene blue (MB), 4-chlorophenol (4CP) and 2-chlorophenol (2CP) can form mutations in the human body by consumption of contaminated water from industrial waste. As a solution for this environmental issue, the degradation process of MB, 4CP and 2CP in synthetic waste water was studied using the photocatalyst, Mg doped ZnO nanoparticles (NPs), under natural sunlight irradiation. NPs were synthesized by co-precipitation method with and without polyethylene glycol as the stabilizer. Mixture of $ZnCl_2$ and $MgCl_2$ solutions and NaOH were used to synthesize series of $Zn_{1-x}Mg_xO$ NPs with the values of x = 0.000, 0.025, 0.050, 0.100 and 0.150. Broad characteristic absorption bands in UV-vis spectra at 365 and 378 nm were detected for ZnO and Mg doped ZnO NPs respectively. The photocatalytic activity of NPs was evaluated using UV Spectroscopy and the best degradation Efficiency (DE) of 3.7 ppm MB was found as 96.7% in 16 min irradiation at 664 nm with x = 0.025, $Zn_{1-x}Mg_xO$ catalyst with the stabilizer. However, undoped ZnO resulted in 27.1% DE. Enhancement of DE may be attributed to the incorporation of Mg into ZnO structure, which leads to the modification of band gap and hence, increase of the fermi level. Exceeding the critical concentration of the dopant lowered the DE by increasing the band gap known as Burstein Moss effect. With the same experimental conditions and the catalyst, 4CP and 2CP exhibited 97.7 and 79.8% DE respectively, for 100 min. The effect of pH of the medium on DE of CPs was found with the optimum pH of 8.0. The results show a feasibility to utilize the Mg doped ZnO NPs, $Zn_{1-x}Mg_xO$ with x= 0.025 as a resource of photodegradation for organic substances such as MB, 4CP and 2CP in wastewater treatment.

Keywords: Photodegradation, Methylene Blue, Cholorophenol, Mg doped ZnO

*Corresponding author: madurani@chem.ruh.ac.lk