Harnessing Zinc Oxide (ZnO) Nanoparticles for Enhanced Photocatalytic Applications

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Environmental pollution is a major challenge to clean environment from pollutants, therefore, there is also a great need to purify water from various pollutants to provide friendly environment. In this context, zinc oxide (ZnO) was addressed as a nano-photocatalyst for water purification from various dyes. The sol-gel method was employed to synthesize ZnO-based nanoparticles, and then was further characterized to examine its crystal structure, surface morphology, and light absorbance behavior to study the optical properties of as-synthesized ZnO nanoparticles. In this regard, XRD analysis was carried out to confirm the formation of ZnO nanoparticles as well as its pure wurtzite crystal structure. SEM analysis reveals the agglomerated nanoparticle's morphology with irregular shape and size of ZnO nanoparticles. Furthermore, UV-vis investigation shows that ZnO nanoparticles are photocatalytic nature as the maximum light absorbance was achieved at 379 nm wavelength, revealing that optimum photocatalysis process may occur in the UV range of light. Therefore, photocatalytic activities were performed for methylene blue (MB) dye in water in relation to irradiation times (0, 15, 30, 60, 90, 120, 150, and 180 min), and in return optimum degrading efficiency of MB dye was observed as 95 % in 180 min irradiation time. All findings show that ZnO nanoparticles are suggested as talented candidate for future nano-optoelectronic devices due to their outstanding UV emission properties. Keywords: ZnO, Nanoparticles, Sol-gel, photocatalyst, Methylene blue (MB), photocatalysis

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