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Synthesis and characterization of N- doped ZnO nanoparticles as efficient photocatalyst and its photocatalytic activity

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Preparations of nitrogen-doped zinc oxide (N-ZnO) nanoparticles were carried out by a simple sol-gel method using Zinc acetate and urea precursors at different (1:0, 1; 0.5, 1:1 and 1:2) molar ratios at pH value ~7-8. Detailed morphology investigations were characterized using XRD, high-resolution transmission electron microscopy (HRTEM), scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR) and Raman spectroscopy. The methylene blue was chosen as a probe molecule to explore the photocatalytic performance of the prepared photocatalysts compared to that of the commercially ZnO. XRD results confirmed that the synthesized photocatalyst at 1:1 molar ratio was highly crystalline; having hexagonal wurtzite structure. Unlike the 1:2 ratio since it showed much less crystalline structure than the 1:1 mole ratio. The average particle size of best catalyst was estimated to be around 35 nm. The calculations of band gap energy of prepared photocatalysts at 1:1 and 1:2 molar ratios are 3.17 and 3.11 eV, respectively. The photocatalytic performance of the prepared photocatalysts were evaluated by photodegradation of methylene blue where it reaches 97.5%

photodegradation efficiency within 30 min for the 1:1 molar ratio and 70.42% for the 1:2 molar ratio for 30 min. Also, the calculated reaction rate constant for 1:1 mole ratio is 0.11718 s⁻¹ and for 1:2 is 0.0485 which almost the half of the previous one. The prepared photocatalysts provides an efficient charge carriers transfer with high photocatalytic activity. In addition, the highest photocatalytic efficiency can be explained by large surface area, narrow band gap energy, small particles size, and efficient charge carriers' separation.

Biography

Mariam Al Saidi is a Research Assitance of Nanotechnology and Advanced Materials Program at Kuwait Institute for Scientific Research, KISR since 2016. She has completed her BE in Chemical Engineering by Kuwait University. Her research interests include sol-gel chemistry, chemical engineering of photocatalytic processes, design development porous photocatalysts and photocatalytic applications in destruction of organic compounds, hydrogen production. She has participated in few industrial projects in nanotechnology and photocatalysis applications.

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