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Synthesis of ZnO Nanoparticles with Varying Calcination Temperature for Photocatalytic Degradation of Ethylbenzene

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Abstract : The increasing utilization of Zinc Oxide (ZnO) as a better alternative to TiO_2 has been attributed to its wide bandgap (3.37eV), lower production cost, ability to absorb over a larger range of the UV-spectrum and higher efficiency in some cases. ZnO nanoparticles were synthesized via sol-gel process and calcined at 400°C, 500°C, and 650°C. The as-synthesized nanoparticles were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS), and Brunauer–Emmett–Teller (BET) surface area measurement. Scanning electron micrograph revealed pseudo-spherical and rod-like morphologies and a high rate of agglomeration for the sample calcined at 650°C, Brunnauer Emmett Teller (BET) surface area measurement was highest in the sample calcined at 500°C, energy dispersive X-ray spectroscopy (EDS) results confirmed the purity of the samples as only Zn and O_2 were detected and X-ray diffraction (XRD) results revealed crystalline hexagonal wurtzite structure of the ZnO nanoparticles. All three samples were utilized in the degradation of ethylbenzene, and a UV-Vis spectrophotometer was utilized in monitoring degradation of ethylbenzene. The sample calcined at 500°C had the highest surface area for reaction, lowest agglomeration and the highest photocatalytic activity in the degradation of ethylbenzene. This revealed temperature as a very important factor in improved and higher photocatalytic activity.

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