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Optimization of Photocatalytic Degradation of Para-Nitrophenol in Visible Light by Nitrogen and Phosphorus Co-Doped Zinc Oxide Using Factorial Design of Experimental

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Abstract : In this study, Nitrogen and Phosphorous co-doped Zinc Oxide (NPZ) was prepared through a solvent-free reaction. The NPZ was characterized by Scanning Electron Microscopy (SEM) and Fourier Transform Infrared (FTIR) spectroscopy. The photocatalytic activity of the catalyst was investigated by monitoring the degradation of para-nitrophenol (PNP) under visible light irradiation and the process was optimized using factorial design of experiment. The factors investigated were initial concentration of para-nitrophenol, catalyst loading, pH and irradiation time. The characterization results revealed a successful doping of ZnO by nitrogen and phosphorus and an improvement in the surface morphology of the catalyst. The photo-catalyst exhibited improved photocatalytic activity under visible light by 73.8%. The statistical analysis of the optimization result showed that the model terms were significant at 95% confidence level. Interactions plots revealed that irradiation time was the most significant factor affecting the degradation process. The cube plots of the interactions of the variables showed that an optimum degradation efficiency of 66.9% was achieved at 10mg/L initial PNP concentration, 0.5g catalyst loading, pH 7 and 150 minutes irradiation time.

Keywords : nitrogen and phosphorous co-doped Zno, p-nitrophenol, photocatalytic degradation, optimization, factorial design of experimental
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