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4-Chlorophenol Degradation in Water Using TIO_2-X%ZnS Synthesized by One-Step Sol-Gel Method

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Abstract : Photocatalytic degradation, as an advanced oxidation technology, is a promising method in organic pollutant degradation. In this sense, chlorophenols should be removed from the water because they are highly toxic. The TiO_2 - X% ZnS photocatalysts, where X represents the molar percentage of ZnS (3%, 5%, 10%, and 15%), were synthesized using the one-step sol-gel method to use them as photocatalysts to degrade 4-chlorophenol. The photocatalysts were synthesized by a one-step sol-gel method. They were refluxed for 36 hours, dried at 80°C, and calcined at 400°C. They were labeled TiO_2 - X%ZnS, where X represents the molar percentage of ZnS (3%, 5%, 10%, and 15%). The band gap was calculated using a Cary 100 UV-Visible Spectrometer with an integrating sphere accessory. Ban gap value of each photocatalyst was: 2.7 eV of TiO_2, 2.8 eV of TiO_2 - 3%ZnS and TiO_2 - 5%ZnS, 2.9 eV of TiO_2 - 10%ZnS and 2.6 eV of TiO2 - 15%ZnS. In a batch type reactor, under the irradiation of a mercury lamp (λ = 254 nm, Pen-Ray), degradations of 55 ppm 4-chlorophenol were obtained at 360 minutes with the synthesized photocatalysts: 60% (3% ZnS), 66% (5% ZnS), 74% (10% ZnS) and 58% (15% ZnS). In this sense, the best material as a photocatalyst was TiO_2 -10%ZnS with a degradation percentage of 74%.

Keywords : 4-chlorophenol, photocatalysis, water pollutant, sol-gel
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