



High performance degradation of phenol from aqueous media using ozonation process and zinc oxide nanoparticles as a semiconductor photo catalyst in the presence of ultraviolet radiation

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ABSTRACT

Phenol and its derivatives, which are considered to be the most important and most common pollutants in water resources, can cause severe poisonings in the form of systemic disorders, anorexia, weight loss, diarrhea, dizziness, and difficulty in swallowing, blurred urine, irritation of gastrointestinal tract, liver and blood in man. The aim of this study was to evaluate the efficiency of ozonation (O₃) and ultraviolet irradiation and ZnO nanoparticles (UV-ZnO) to remove phenol from aqueous solutions. The effect of different concentrations of phenol (10, 50 and 100 mg/L), the effect of pH (5 and 9), the effects of zinc oxide nanoparticles (0.1 and 0.2 g/l), the effect of contact time (5, 10, 20, and 30 min), and the effect of ozone initial concentration (10, 20 and 30 mg/L) were investigated on the efficiency of the phenol removal process. All experiments were performed on a laboratory scale in a cylindrical glass reactor with a volume of 2 L. The radiation source was an ultraviolet (125 W) lamp with a wavelength of 254 nm. Experiments were carried out to determine the effect of the ozonation process on phenol removal in an ozonation reactor with a production capacity of 5 g/h and an oxygenating device with production capacity of 3 L/min. The results of this study showed that the highest phenol removal efficiency in nano-photo catalytic and ozonation processes in 30 min was 94.24% (pH = 5) and 96.64% (pH = 9), respectively. Also, in nanophoto catalytic process, with the increase in the dose of zinc oxide nanoparticles from 0.1 to 0.2 g/L with contact time of 30 min, the phenol removal efficiency increased from 64.24% to 71.56%, respectively. Also, in the process of ozonation, with increasing ozone concentration, the phenol removal efficiency increased.

Keywords: Ozonation; Phenol; Zinc oxide nanoparticle; Ultraviolet radiation; Semiconductor; Photo catalyst

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