

Solar Ag/P3HT@TiO₂ Photocatalysis of Phenol Wastewater by a Pilot-Scale Fresnel Lens Assisted IPCC Reactor

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One of advanced oxidation processes (AOPs) - solar photocatalysis with novel Ag/P3HT@TiO₂ as catalyst was used to treat phenol wastewater (10 mg/L) in this study. Moreover, a pilot-scale Fresnel lens mounted inclined plate curvature channel (IPCC) reactor was well design, established and evaluated for the treatment of phenol wastewater. 5 Fresnel lens which were made of PMMA with a thickness of 2 mm, a pitch of 0.5 mm, a facet depth of 0.2 mm, and Fresnel circles of 395 were used and mounted on IPCC. Results showed that the degradation efficiency of phenol wastewater could reach 98.35% with a dosage of 0.5 g/L Ag/P3HT@TiO₂ and a reaction time of 3 h under solar light irradiation (average UV_{a+b} : 42.90 W/m²). In addition, the intensity of solar light was found to be focused with an increase of 1.86 to 3.91 times and the temperature of wastewater could be raised for 3 to 5°C with the assistance of Fresnel lens, leading to that the degradation rate of phenol molecule in Ag/P3HT@TiO₂ photocatalytic process increases 1.66 times as compared to without Fresnel lens system. The molecules of phenol were more efficiently decomposed into low-molecular-weight organic acids which were further mineralized into CO₂ and H₂O. Accordingly, the Fresnel lens enhanced IPCC reactor showed a synergistic effect on the solar photocatalytic process not only in effectively dealing with a large amount of industrial organic wastewater, but also in the sector of energy conservation in terms of effective utilization of solar energy.

Keywords: Solar Photocatalysis, Ag/P3HT@TiO₂, IPCC, Phenol, Fresnel lens