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Treatment of Isopropyl Alcohol in Aqueous Solutions by VUV-Based AOPs within a Laminar-Falling-Film-Slurry Type Photoreactor

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Abstract : This study aimed to develop the design equation of a laminar-falling-film-slurry (LFFS) type photoreactor for the treatment of organic wastewaters containing isopropyl alcohol (IPA) by VUV-based advanced oxidation processes (AOPs). The photoreactor design equations were established by combining with the chemical kinetics of the photocatalytic system, light absorption model within the photoreactor, and was used to predict the decomposition of IPA in aqueous solutions in the photoreactors of different geometries at various operating conditions (volumetric flow rate, oxidants, catalysts, solution pH values, UV light intensities, and initial concentration of pollutants) to verify its rationality and feasibility. By the treatment of the LFFS-VUV only process, it was found that the decomposition rates of IPA in aqueous solutions increased with the increase of volumetric flow rate, VUV light intensity, dosages of TiO2 and H2O2. The removal efficiencies of IPA by photooxidation processes were in the order: VUV/H2O2>VUV/TiO2/H2O2>VUV/TiO2>VUV only. In VUV, VUV/H2O2, VUV/TiO2/H2O2 processes, integrating with the reaction kinetic equations of IPA, the mass conservation equation and the linear light source model, the photoreactor design equation can reasonably to predict reaction behaviors of IPA at various operating conditions and to describe the concentration distribution profiles of IPA within photoreactors.The results of this research can be useful basis for the future application of the homogeneous and heterogeneous VUV-based advanced oxidation processes.

Keywords : isopropyl alcohol, photoreactor design, VUV, AOPs
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