Study on the Photocatalytic Behaviors of Volatile Organic Compounds in Air by UV/TiO2 Process

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ABSTRACT

ABSTRACT The objective of this research is to study the decomposition behaviors of gaseous phase by using UV/TiO2 photocatalytic system within a continuous-type photoreactors to investigate the reaction efficiency of the photooxidation of gas-phase volatile organic compounds (IPA and Formaldehyde). The experiments were carried out under various UV light intensities, flow rate, humidities, reaction time, initial concentrations of the reactant and photocatalytic area in an disk-type and an annulus-type photoreactor to investigate the removal efficiencies of pollutants and organic intermediates, CO2 in order to determine the completeness of decomposition The Fluent 6.2 software was used to simulate the flow field of air stream with the photoreactor to validate whether the flow is laminar flow. Based on the simulated results, it ’ s confirmed that no radial convection effect exist in the potoreactor, the reaction determining step to whole reaction would be the effect of wall shearing stress and the effect of detention time. In the 400W UV photocatalytic systems for degrading the IPA and formaldehyde, only the effect of axial detention time was to be as the main limitation to the removal of VOCs. That is why the reaction rate decreased with increasing flowrate and initial concentration of IPA. The decomposition of formaldehyde is limited to the superficial active site of catalyst, the degrading rates decreased with increasing flowrate and initial concentration of formaldehyde. In the 8W UV photocatalytic systems for degrading the IPA, the two effects of shearing stress and retention time were need to be combine for discussing the reaction behaviors. In the 8W UV/TiO2 system, the decomposition rates of IPA and formaldehyde increased with decreasing flowrates, but it exist an optimum flowrate. Almost of VOCs can be totally degraded. When flowrate is at 600ml/min, the best removal was about 50%. The initial concentration of 20ppmv to 200ppmv（IPA） and 3ppmv to 30ppmv (formaldehyde), the removal of the two VOCs were from 40% down to 20% (IPA) and from 100% down to 20% (formaldehyde). The mineralization conversion of VOCs by TiO2 process ranged from 20% to 90%. Compare to the decomposition results of the 8W and 400W systems, the better removal of IPA can be reached by the 400W system rather than 8W system. However, the difference of mineralization conversion of VOCs by the 8W and 400W systems was found to be trivial. The mineralization rates of VOCs increased with decreasing initial concentration of VOCs and flowrate. Key word: Oxidize advanced, photocatalyst, IPA, formaldehyde, conversion

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