Thammasak Rojviroon 2006: Removal of Volatile Organic Compounds by Photooxidation. Master of Engineering (Environmental Engineering), Major Field: Environmental Engineering, Department of Environmental Engineering. Thesis Advisor: Mr. Sanya Siriwithayapakorn, Ph.D. 115 pages.
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Vapor of volatile organic compounds (VOC) is a major cause of indoor air pollution. Adverse health effects could result from long-term exposure to VOC vapor. This work presents kinetics of vapor removal of toluene and acetone, the commonly found VOC, by photooxidation on TiO_2 catalysts.

Photooxidation on TiO_2 catalysts is a two-step reaction sequence of adsorption and oxidation. To study the reaction kinetics of both adsorption and photooxidation, the experiments were carried out in a 0.61-liter air-tight batch reactor. The TiO_2 powder was fixed on to a 25-square centimeter (5x5) glass plate in 3 different ways, i.e. dip-coat in a 3.3% TiO_2 solution onto either single or both side and powder-coat with TiO_2 powder onto both side. Conditions in each experiment were selected combinations of three different intensities of light, i.e. 165.7, 193.3 and 1230.0 $\mu W\text{-}cm^2$, and two different temperatures, i.e 46 and 56 °C. All experiments were controlled at initial relative humidity of 45%. The results indicated that the optimum condition for toluene vapor removal was the combination of 193.3 $\mu W\text{-}cm^2$ light intensity at 46 °C along with

The kinetics of both adsorption and photooxidation was described by Langmuir-Hinshelwood type of reaction. The results indicated that the adsorption and photooxidation rates of toluene were lower that those of acetone. The highest adsorption rates ($r_{m,D}$) of toluene and acetone were 8.897×10^{-5} and 2.521×10^{-3} $mol\text{-}m^{-3}\text{-}min^{-1}$ respectively. Likewise, the highest photooxidation rates ($r_{m,L}$) of toluene and acetone were 1.166×10^{-4} and 3.328×10^{-3} $mol\text{-}m^{-3}\text{-}min^{-1}$ respectively.

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