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Photocatalytic Degradation of Gaseous Toluene: Effects of Operational Variables on Efficiency Rate of TiO2 Coated on Nickel Foam

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Abstract : Purpose: The photocatalytic degradation of pollutants is a novel technology with various advantages such as high efficiency and energy saving. In this research, the effects of operational variables on the photocatalytic efficiency of TiO_2 coated on nickel foam in the removal of toluene from the simulated indoor air have been investigated. Methods: TiO_2 film were prepared via the sol-gel method and coated on nickel foam. The characteristics and morphology were found using XRD, SEM, and BET technique. Then, the effects of relative humidity, UV-A intensity, the initial toluene concentration, TiO_2 loading, and the air circulation velocity on the photocatalytic degradation rate have been evaluated. Results: The optimal degradation of toluene has been achieved with loading 4.35 g TiO2 on the foam, 30% RH, 5.4 µW.cm−2 UV-A intensity, and 20 ppm initial concentration in the air circulation velocity of 0.15 fpm. Conclusion: The changes of toluene photocatalytic degradation rate have been studied at various times. Also, the kinetic behavior of toluene photocatalytic degradation has been investigated using Langmuir-Hinshelwood (L-H) model.

Keywords : photocatalytic degradation, operational variables, tio_2, nickel foam, gaseous toluene, nanotechnology
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