GTSNN2014-0163

Kinetic and Degradation of Chlorpyrifos using N-doped TiO_2 under Visible Light in Photocatalysis Process

Kritsana Srisith[1], Jirapat Ananpattarachai[1,2,*] and Puangrat Kajitvichyanukul[1,2]

[1]Department of Civil Engineering, Faculty of Engineering, Naresuan University, Phitsanulok, Thailand

[2]Centre of Excellence on Environmental Research and Innovation,

Faculty of Engineering, Naresuan University, Phitsanulok, Thailand

E-mail: jirapata@nu.ac.th

Abstract

Chlorpyrifos is a crystalline organophosphorus compound. It is widely used as insecticides in Thailand and contaminated in many environment media such as water, sediment, soil and plants. This research studied the adsorption and degradation of chlorpyrifos by titanium dioxide (TiO_2). X-ray diffraction (XRD) and Scanning Electron Microscopy (SEM) were used to investigate characteristics of titania. From adsorption experiment, chlorpyrifos adsorbed on surface of N-doped TiO_2 in the dark and the reaction reached equiliburium within 30 min. The adsorption pattern could be explained by Langmuir Equation with kinetic constant in adsorption as of 63.6585. In comparison, Un-doped TiO_2 was experimented as a control material and it was found that the N-doped TiO_2 provided higher degradation efficiency than the undoped-TiO_2. With 10, 25, 100, and 200 ppm initial chlorpyrifos in aqueous solution, the reaction followed pseudo-first-order kinetics and the degradation efficiencies, using 1g/L of N-doped TiO_2 under neutral pH, were 73, 72, 64 and 44 %, respectively. From Langmuir-Hinshelwood equation, the reaction constant of adsorption (K) and constant degradation by photocatalysis reactions (k) is equal to 0.3933 and 0.1237, respectively. From this work, this application of n-doped TiO2 can be applied in the degradation of chlorpyrifos in water efficiently.

Keywords : degradation, chlorpyrifos, N-doped TiO_2, visible light, photocatalysis process