

Kinetics and Thermodynamics Adsorption of Phenolic Compounds on Organic-Inorganic Hybrid Mesoporous Material

Authors : Makhlof Mourad, Messabih Sidi Mohamed, Bouchher Omar, Houali Farida, Benrachedi Khaled

Abstract : Mesoporous materials are very commonly used as adsorbent materials for removing phenolic compounds. However, the adsorption mechanism of these compounds is still poorly controlled. However, understanding the interactions mesoporous materials/adsorbed molecules is very important in order to optimize the processes of liquid phase adsorption. The difficulty of synthesis is to keep an orderly and cubic pore structure and achieve a homogeneous surface modification. The grafting of $\text{Si}(\text{CH}_3)_3$ was chosen, to transform hydrophilic surfaces hydrophobic surfaces. The aim of this work is to study the kinetics and thermodynamics of two volatile organic compounds VOC phenol (PhOH) and P hydroxy benzoic acid (4AHB) on a mesoporous material of type MCM-48 grafted with an organosilane of the Trimethylchlorosilane (TMCS) type, the material thus grafted or functionalized (hereinafter referred to as MCM-48-G). In a first step, the kinetic and thermodynamic study of the adsorption isotherms of each of the VOCs in mono-solution was carried out. In a second step, a similar study was carried out on a mixture of these two compounds. Kinetic models (pseudo-first order, pseudo-second order) were used to determine kinetic adsorption parameters. The thermodynamic parameters of the adsorption isotherms were determined by the adsorption models (Langmuir, Freundlich). The comparative study of adsorption of PhOH and 4AHB proved that MCM-48-G had a high adsorption capacity for PhOH and 4AHB; this may be related to the hydrophobicity created by the organic function of TMCS in MCM-48-G. The adsorption results for the two compounds using the Freundlich and Langmuir models show that the adsorption of 4AHB was higher than PhOH. The values obtained by the adsorption thermodynamics show that the adsorption interactions for our sample with the phenol and 4AHB are of a physical nature. The adsorption of our VOCs on the MCM-48 (G) is a spontaneous and exothermic process.

Keywords : adsorption, kinetics, isotherm, mesoporous materials, Phenol, P-hydroxy benzoique acid

Conference Title : ICACCE 2018 : International Conference on Applied Chemistry and Chemical Engineering

Conference Location : Paris, France

Conference Dates : July 19-20, 2018