Thesis Title	A Development and Design the Ceramics Adsorbent made by Coffee Residue
Thesis Credits	12
Candidate	Mr. Chaiyan Chaiya
Supervisor	Assoc. Prof. Dr. Virote Boonamnuayvitaya
Degree of Study	Master of Engineering
Department	Chemical Engineering
Academic Year	1999

Abstract

The objectives of this work were to study factors affecting the forming of made the adsorbent comprised of coffee residue and clay, to investigate the capacity of heavy metal ions adsorption, to elucidate adsorption mechanism of adsorbent by varying pH and temperature, to confirm the adsorption efficiency of the adsorbent after regenerated with water and to compare the adsorption performance between the adsorbent and activated carbon.

Firstly, we studied the factors of temperature, the weight ratios between coffee residue and clay and the diameter affecting the formation of the adsorbent. The experimental results demonstrated that the weight ratio of coffee residue to clay of 80:20, the diameter of 4 mm. and the pyrolysis temperature 500 ^{o}C for 2 hours were the suitable forming condition of the adsorbent. The adsorption reached equilibrium in 30 min. and followed the Langmuir adsorption isotherm. The maximum adsorption capacity (V_m) of the adsorbent for several heavy metal ions of Cd, Cu, Pb, Zn and Ni as high as 39.52, 31.15, 19.53, 13.39 and 11.0 mg-metal/g-adsorbent respectively. In the study of mechanism, the maximum adsorption capacity (V_m) decreased with the decreasing pH and increased with the increasing the solution temperature. The heat of adsorption (ΔH) was calculated to be 1.11 kcal./mol demonstrated that the adsorption should be the physical adsorption. In the regeneration experiments, the adsorbed ions were almost (90%) removed by rinsing with water and the adsorption capacity decreased slightly (10%) after three times regeneration. In addition, with the analytical results of FT-IR and Zeta potential meter,

we found that there were functional groups of O-H, C=O and C-N groups on the adsorbent surfaces which have the electrical charge of -37.1 mV. It may be concluded that the adsorption was controlled by electrostatic force between O-H, C=O and C-N functional groups charged with negative electric charges and the positive charged heavy metal ions. In the adsorption performance comparison between the adsorbent and activated carbons, through the maximum adsorption capacity per weight of activated carbon was larger than which of the adsorbent, however the maximum adsorption capacity per specific area was smaller, since the adsorption characteristic of the adsorbent was controlled by electrostatic force.

Keywords : Adsorption / Heavy Metal Ions / Coffee Residue / Activated Carbon / Langmuir Adsorption Isotherm / FT-IR / Zeta Potential