Thesis Title	Biosorption of Heavy Metal Ions in Wastewater by Immobilized Biological Waste
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Abstract

The objectives of this work were to study the adsorption of heavy metal ions from wastewater by biological wastes, to immobilize biological waste by polymers, to investigate the heavy metal ions adsorption capacity of immobilized biological waste and to study the efficiency of the immobilized biological waste after regeneration by acidic solution

In this study, we selected biological wastes from food and drug industrial such as brewery yeast, *Aspergillus niger* and activated sludge from wastewater treatment plants for examining their capacities in heavy metal ions adsorption. The experimental results demonstrated that adsorption reached equilibrium in 30 min. Langmuir adsorption isotherms were employed to analysis the maximum adsorption capacities. It was found that activated sludge from Plant N (AS-N) could adsorb several heavy metal ions such as Cd, Cu, Ni, Pb and Zn as high as 37, 40, 16, 44, 21 (mg-metal/g-biomass) respectively. The activated sludge from Plant A adsorbed Pb as high as 106 (mg-metal/g-biomass). While *Aspergillus niger* and brewery yeast had lower adsorption capacities compared with activated sludges.

Activated sludge from Plant N (AS-N) was immobilized in two different sizes, ie. 3.35-4.00 and 1.18-2.00 mm. with cellulose acetate (CA), polyvinylalcohol (PVA) + polyethyleneamine (PEI) and sodium alginate (SA). The experimental results showed the adsorption of heavy metal ions at pH 6 by immobilized activated sludge beads, of which particle size was 3.35-4.00 mm., decreased more than 56 percent compared to the pure nonimmobilized AS-N. However when the activated sludge beads immobilized with CA, PVA+PEI and SA, of which particle sizes were 1.18-2.00 mm., were employed in the adsorption of lead ions, the lead adsorption capacities were increased as high as 17.90, 16.72, 23.47 (mg-metal/g-immobilized biomass) respectively. In addition, we also studied the characteristics of the heavy metal adsorption of adsorbent beads after the regeneration with 0.1 M HCl through 3 cycles of adsorption/desorption. It revealed that lead was removed more than 90% by rinsing but the adsorption capacity of adsorbent beads decreased 49%.

Keywords : Adsorption / Heavy Metal Ions / Biological Waste / Immobilization / Langmuir Isotherm