Sustainable use of biomass for cleaning-up aqueous effluents contaminated with heavy metals

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Abstract.
The utilization of no economical value biomass as low-cost biosorbent for the removal of heavy metals from aqueous effluents is a relatively new concept, which began to be increasingly used in the wastewater treatment processes, mainly because it is in agreement with the principles of sustainable development. In this study, mustard biomass obtained from mustard husk and low quality seeds, was investigated as suitable biosorbent for the removal of heavy metals (Pb(II) and Cd(II)) from aqueous effluents, through batch biosorption experiments. The biosorbent was characterized by EDX spectrometry, IR spectrometry and SEM microscopy. The effect of initial solution pH, biosorbent dose, initial heavy metals concentration, contact time and temperature on the biosorption of Pb(II) and Cd(II) ions were analyzed. The mustard biomass has a good biosorption potential fro Pb(II) and Cd(II) at pH 5.5, 5 g/L biomass dose and a contact time higher than 60 min. The experimental kinetic data were better fitted with pseudo-second order kinetic model than pseudo-first order model. The Langmuir isotherm model was found to be more adequate for the mathematical description of equilibrium data. The maximum biosorption capacity calculated under mentioned conditions was 0.39 mmol/g for Pb(II) and 0.53 mmol/g for Cd(II), respectively.

Key words: mustard biomass, biosorption, heavy metals, aqueous effluents.

1. Introduction

Heavy metals are considered persistent pollutants in environment, because they have a considerable toxic effect even at lower concentration, have an accumulating tendency and cannot be destroyed or degraded (Hlihor R.M. and Gavrilescu M., 2009). Among all heavy metals, Pb(II) and Cd(II) are the most hazardous, because they cannot be biologically metabolized and are toxic for most life forms (Londrigan P.J. et al., 1990). From this reason, the permissible limits of Pb(II) and Cd(II) in drinking water are very low (0.5 mg/L for Pb(II) and 0.3 mg/L for Cd(II), respectively) (NTPA 001/2005). Beyond the permissible limits, both Pb(II) and Cd(II) causes acute and chronic diseases in human body, such as anemia, hypertension, learning disabilities, kidney damage and mental retardation (Gogate P.R. and Pandit A.B., 2004; Yuan G. et al. 2014).

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