



P-ISSN 2249-8028
 E-ISSN 2221-4902
 UJCS 2015, 3(3): 99-114
 © 2014, IJCS
 Received: 15-04-2014
 Accepted: 19-04-2014

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Removal of lead (II) from aqueous solution using low cost abundantly available adsorbents: A review

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Abstract

Lead is known to be venomous for human body systems i.e. nervous, digestive and skeleton system even if it is present in low levels. Today's demand for safe, eco-friendly, easily available and low cost adsorbents for the removal of Lead from contaminated waters has necessitated research interest towards the production of low cost alternatives that is why it is an urgent that all possible sources. This review gives some outlines of basic principles of adsorption and adsorption process.

Keywords: Lead; Aqueous solution; Low cost adsorbents; Adsorption.

1. Introduction

Lead is one of the heavy metals that are often found in industrial wastewater and its discharge into the environment poses a serious threat due to its toxicity to aquatic and terrestrial lives.^[1] It is a group IV element on the periodic table which is remarkably highly resistant to corrosion in most acid and naturally occur as element buried in the earth crust in insoluble and biologically inoffensive forms.^[2] Enhanced industrialization such as manufacturing of storage batteries, television tube, printing paints, pigments, photographic materials, gasoline additives, matches and explosives brought about lead bearing wastewater.^[3] Exposure to Lead is widely recognized as a major risk factor for several human diseases once it goes beyond the World Health Organisation (WHO) maximum permissible limit ($3-10 \mu\text{g}\cdot\text{L}^{-1}$) in drinking water.^[4] It forms complexes with Oxo-groups in enzymes to affect virtually all steps in the process of haemoglobin synthesis and porphyrin metabolism.^[5] Other problems associated with toxic levels of lead exposure are encephalopathy, seizures and mental retardation, anemia and nephropathy.^[6-8] Hence, lead must be removed as much as possible from industrial effluents to prevent environmental hazard from its discharge. Adsorption technology has been widely preferred to other traditional methods such as coagulation, flocculation, filtration, ozonation or sedimentation in the removal of pollutants from wastewater.^[9] In this technology, activated carbons are commonly used adsorbent due to their high adsorption capacity, a result of their high surface area and surface reactivity but their regeneration is, however, difficult and expensive.^[10] Quest for effective and economical technologies have brought about biosorption. It is based on metal binding capacities of various biological materials, mainly composed of cellulose, hemicelluloses and lignin that make them effective adsorbents for a wide range of pollutants due to the presence of functional groups such as hydroxyl, carboxyl, methoxyl and phenols.^[11] Recent studies have shown that heavy metals can be removed using plant materials such as empty palm oil fruit bunch^[12], sour soup seeds^[13], modified casava fibre^[14], coconut shell^[15], duck weed^[16], sago waste^[17], African spinach stalk^[18], palm fruit fibre^[19], hop^[20], orange peels^[21] and spent tea leaves^[19,22]. Banana Stalks (BS) are generated in large amount as waste product after the consumption of banana and these constitute an environmental menace due to the fact that they are left to decompose being of non-economic importance.^[23] However, BS is a rich ligno-cellulosic agricultural waste, whose previous application has been limited to the production of activated carbon for malachite green dye removal^[24] and not yet applied to Pb(II) removal.^[25] The present study investigated the adsorptive capacity of BS as a low-cost adsorbent for the biosorption of Lead(II) from aqueous solution. The effects of physical parameters such as initial concentration, pH, and temperature and bio-adsorbent dosage on the biosorption process have been investigated. In addition, the biosorption equilibrium isotherms, kinetics and thermodynamic parameters have been determined.

Removal Of Lead Ii From Aqueous Solution Using Low Cost

SA Adler



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