CHEMICAL MODIFICATION OF LIGNOCELLULOSIC MATERIALS FOR Pb(II) REMOVAL FROM AQUEOUS SOLUTION

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The discharge of heavy metals into aquatic ecosystems has become a matter of concern over the last few decades because their persistence and toxicity, which can seriously affect plants, animals and human life (Abdolali et al., 2014). Therefore, it becomes essential to remove them from wastewaters. Among the conventional methods for removal of heavy metals from aqueous solutions, biosorption onto lignocellulosic materials (LMs) (either natural substances or agro-industrial wastes and by-products) has been considered as an inexpensive, simple, effective and eco-friendly alternative. However, to improve the LMs properties and increase their capacity for metal ion uptake, it is highly recommended pretreat the LMs before being used in biosorption processes. The treatment has been carried out using various reagents such as mineral/organic acids, bases, organic compounds or oxidation agents. This study reports the use of walnut shells (WS), coconut shells (CS) and grape seeds (GS) modified with different molarity solutions of citric acid (CA) as biosorbents to remove Pb(II) ions from aqueous solutions (Salazar-Rabago and Leyva-Ramos 2016). Due to the introduction of carboxylic groups on the surface of LMs during the treatment, the adsorption capacity of WS, CS, and GS towards Pb(II) was considerably increased. Among all WS3, CS3, and GS1 (the last number corresponds to the molarity of the acid solution) exhibited the highest adsorption capacities. The values of the point of zero charge (pH\text{PZC}) for the LMs and treated LMs all ranged from 2.4 to 4.5 revealing that all materials had acidic surface. The metal uptake augmented 32, 34 and 38 times the adsorption capacity of WS3, CS3, and GS1 respectively with the increasing pH in the range of 2 to 5. At pH > pH\text{PZC} the electrostatic attraction between the negatively charged surfaces and the Pb(II) ions in the solution favored the adsorption of Pb(II) onto WS3, CS3, and GS1. On the contrary, at pH < pH\text{PZC} the adsorption decreased by the electrostatic repulsion existing between the positively charged surfaces and the Pb(II) ions. These results indicate that the optimum pH for the removal of Pb(II) ion is 5. Therefore, at pH=5 and T=25 °C, the adsorption capacities of WS3, CS3, and GS1 materials were 162, 171 and 302 mg/g respectively; in other words 3.2, 7.8 and 2.8 times greater than WS, CS, and GS correspondingly. Additionally, the adsorption of Pb(II) on either modified LMs was not reversible neither pH=2 nor pH=5.

**Keywords:** Biosorption of Pb(II), Modified lignocellulosic materials, Electrostatic attraction

**References:**


Salazar-Rabago, J. J., Leyva-Ramos, R. (2016). Novel biosorbent with high adsorption capacity prepared by chemical

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