

Eco-friendly process for the removal of Pb (II), Ni (II) and Zn (II) using different adsorbents: sepiolite and modified cedar

A. Lago[#], V. Rocha[#], T. Tavares

CEB - Centre of Biological Engineering, Universidade do Minho, 4710-057 Braga, Portugal
Group: BRIDGE | Line: Environmental Biotechnology and Bioengineering

[#]These authors equally contributed to this work

Heavy metal contamination in groundwater and sediments is one of the most relevant threats to environmental quality and human health. Their presence in the aquatic environment has attracted global attention due to their toxicity, persistence in nature, non-biodegradability and ability to bio-accumulate in food chains. The traditional treatment methods for their removal have been used but chemical methods are often restricted due to the technical or economic restraints. Various biomaterials have been used to entrap those ions from water and wastewater such as clays, zeolites, industrial and/or agriculture wastes, becoming a good alternative to industrial wastewater treatment [1, 2].

The capacity of natural sepiolite (clay) and modified cedar (wood) sawdust for heavy metals adsorption, lead (Pb), nickel (Ni) and zinc (Zn), has been assessed using a batch method. Natural sepiolite was supplied by TOLSA and cedar was obtained from Morocco. Scanning Electron Microscopy-Energy Dispersive Spectroscopy (SEM-EDS) was used to characterize the morphology and chemical composition of both adsorbents. Cedar was subjected to an alkaline chemical pre-activation with of 0.2 M solution of potassium hydroxide, as suggested by literature.

The adsorption capacity of these two adsorbents was investigated at 0.1 g adsorbent dose (maximum uptake dose achieved in previous assays in this laboratory). Sorption assays were carried out in batch system at room temperature ($25^{\circ}\text{C} \pm 1^{\circ}\text{C}$) and 160 rpm, for 24 h, with 200 mL of Pb (II), Ni (II), and Zn (II) solution with an initial concentration of 60 mg/L for each metal. Samples were analyzed for heavy metals concentration by Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES).

The experiments demonstrated that Pb (II) was adsorbed more efficiently than Ni (II) and Zn (II) by both tested adsorbents. The maximum uptake was reached for modified cedar with 24.45 mg/L for Pb (II). For Ni (II) and Zn (II) the best adsorbent was sepiolite, with an uptake value of 7.04 mg/L and 8.03 mg/L, respectively.

The conclusion of this study is that both adsorbent can efficiently adsorb cationic species, which may have an interesting application such as the removal of those species from polluted waters, using a low cost and environmental friendly process.

References

- [1] Zhou K, Yang Z, Liu Y, Kong X (2015) Kinetics and equilibrium studies on biosorption of Pb(II) from aqueous solution by a novel biosorbent: *Cyclosorus interruptus*. *J Environ Chem Eng* 3:2219–2228.
- [2] Hafshejani LD, Nasab SB, Gholami RM, Moradzadeh M, Izadpanah Z, Hafshejani SB and Bhatnagar A (2015) Removal of zinc and lead from aqueous solution by nanostructured cedar leaf ash as biosorbent. *J Mol Liq* 211:448–456.