

## Biosorption of Metal Ions Co (II) and Zn (II) from Aqueous Media Using Biochar Obtained from Algae Biomass

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Heavy metals are chemical species that cannot be destroyed or degraded. The substantial concentration of heavy metals in industrial effluents is a global environmental problem. Currently, mining operations, metal cladding facilities, industrial development and other human activities are the main contributions to the discharge of high levels of heavy metals into water and soil. Thus, their presence in the environment is a threat to both it and the health of living organisms. A suitable solution for removing heavy metals from aqueous effluents is biosorption, but finding an effective biosorbent remains an open problem. It is known that the affinity of heavy metals for algae biomass is limited due to the limited number of functional groups available for interactions with metal ions. Therefore, the use of physico-chemical treatments of the raw algae biomass and its transformation into biochar is one the main strategies for obtaining efficient biosorbents for the removal of heavy metals. In this study, biochar's obtained by pyrolysis of marine algae biomass (*Ulva lactuca* sp.) at two different temperatures (320 and 550 °C) under oxygen-limited conditions, were used as biosorbents for the removal of Co (II) and Zn (II) ions from aqueous solution. Characterizations using FTIR spectrometry, SEM microscopy and showed that all biochar biosorbents (BC-320 and BC-550) have rough surface, porous structure and numerous oxygen-containing functional superficial groups. The biosorption of Co (II) and Zn (II) ions on biochar biosorbents reached equilibrium in maximum 60 min for an initial concentration of 25 mg Co (II)/L and 25 mg Zn (II)/L. All biosorption kinetic data are best describes by the pseudo-second order model, while the intra-particle diffusion model indicates the limited involvement of elementary diffusion processes in the Co (II) and Zn (II) ions retention mechanism. On the other hand, the Langmuir model fit the equilibrium data of Co (II) and Zn (II) ions biosorption on BC-320 and BC-550, compared with the Freundlich model. All the results included in this study show the efficiency of biochar in the removal processes of Co (II) and Zn (II) ions from aqueous media and highlight the possible application on an industrial scale.

**Keywords:** biosorption, biochars, ions removal, aqueous media, algae biomass

### References:

- Bogusz, A., Oleszczuk P., Dobrowolski R., *Biores. Technol.* 196, 540 (2015).  
Gupta, V.K., Nayak, A., Agarwal, S., *Environ. Eng. Res.* 20(1), 1, (2015).  
Mudhoo, A., Garg, V.K., Wang, S., *Environ Chem Lett.* 10, 109 (2012).  
Wael, M.I., Asad, F.H., Yahia, A.A., *Egyptian J. Basic Appl. Sci.* 3, 241 (2016).