Quantitative evaluation of biochars performances obtained from algae biomass in metal ions biosorption processes

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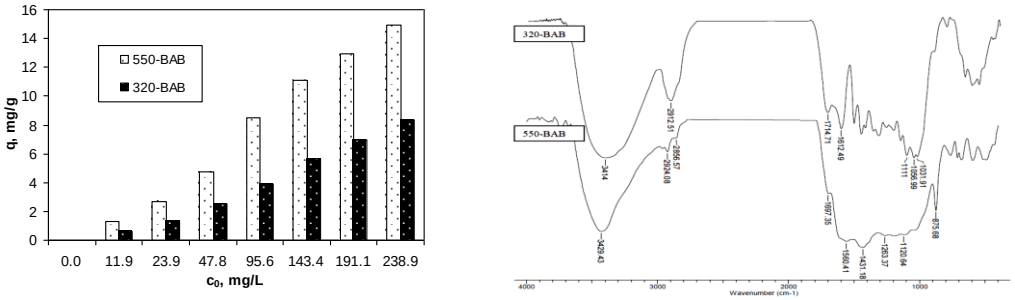
Nowadays, heavy metal pollution has become an acute problem. Due to toxic toxicity, persistence and accumulation tendency, high concentrations of heavy metals are found in the environment, becoming an important factor in the degradation of the ecosystem (Mudhoo et al., 2012). More and more cases of accidental pollution of inland or international waters, air or soil with substances or products containing heavy metals are frequently reported in the media and are also the subject of concern in the scientific world. Algae biomass is widely found and has a wide range of uses, representing a valuable biomass resource due to its properties in solving various environmental problems, such as decontamination of soil and wastewater, etc. (Gupta et al., 2015). Due to the fact that in summer these algae are undesirable, due to the uncontrolled growth and the unpleasant smell they generate, finding new uses in environmental protection has a double benefit. Based on these considerations, in this study, algae biomass (*Ulva lactuca sp*.) was transformed into biochar by a slow pyrolysis process (Bogusz and Oleszczuk, 2015; Wael et al., 2016). Pyrolysis of algae biomass was performed at two temperatures (320 and 550 °C), for 8 hours, and under oxygen-limited conditions. The obtained biochars (320-BAB and 550-BAB) were then used as biosorbents for the removal of Zn(II) ions from aqueous solution, in optimal experimental conditions (initial solution pH of 5.0; biochar dose of 4.0 g/L, contact time of 60 min.). The obtained experimental results (Fig. 1a) have indicate that the 550-BAB is more efficient in the removal of Zn(II) ions from aqueous media than 320-BAB, even if the recorded FTIR spectra shows that 550-BAB is poorer in functional groups than 320-BAB (Fig. 1b).



(a) (b)

Figure 1. Biosorption efficiency of biochars obtained from algae biomass in Zn(II) removal processes.

To explain these differences, the elemental analysis of these two types of biochars was performed, as well as their morphological characterization. Thus it was observed that even though 550-BAB has a smaller number of functional groups than 320-BAB, its specific surface area is much larger and its basic character is much more pronounced, making this biosorbent much more efficient in biosorption processes of Zn(II) ions. The quantitative evaluation of the biosorptive performances of these two biochars in the Zn (II) ion removal processes was performed using the Langmuir, Freundlich and Temkin isotherm models, and the obtained parameters were analyzed in detail.

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).