EGU2020-2662
https://doi.org/10.5194/egusphere-egu2020-2662
EGU General Assembly 2020

Application of biochar from crop residues for the removal of lead and copper

José M. De la Rosa[1], Águeda Sánchez-Martín[1], María L. Sánchez-Martín[1], Nikolas Hagemann[2,3], Heike Knicker[1], and Paloma Campos[1]

[1]IRNAS-CSIC, Reina Mercedes Av. 10, Seville, Spain
[2]Ithaka Institute for Carbon Strategies, Ancienne Eglise 9, Arbaz, 1974, Switzerland
[3]Agroscope, Reckenholzstrasse 191, 8046 Zurich, Switzerland

Due to the chemical composition and surface properties of biochar, a C-rich porous material produced by pyrolysis of biomass, it can act as an effective tool for the remediation of soils polluted with trace elements [1, 2]. However, its capacity to sorb these contaminants in a solution varies considerably depend on pyrolysis conditions, but also on the feedstock. Thus, the major aim of this study is to evaluate the capacity of biochars from two crop residues to sorb Pb^{2+} and Cu^{2+}.

For this purpose, rice husk and olive pit biochars (RHB and OPB, respectively) were produced in a continuously feed reactor (Pyreka reactor, max. temperature 500 ºC, residence time 12 min; N_2 atmosphere).

The efficiency of lead and copper ions (Pb^{2}□, Cu^{2+}) removal by the biochars was investigated through batch adsorption experiments. 20 mL of single-metal solutions with 0.05, 0.1, 0.5, 1, 2 and 5 mM of initial concentration of Pb^{2+} and Cu^{2+} were mixed with 20 mg of milled biochar during 48 h. After filtering at 0.45 µm, their concentrations were measured by ICP-OES (Varian ICP 720-ES, Varian Inc., CA, USA).

Removal efficiency of both heavy metals was over 80 % for RHB and OPB when the initial cation concentration was ≤ 0.5 mM. RHB removal capacity was 26 % for Cu^{2+} and 35 % for Pb^{2+} when the initial concentration of metal was 5 mM, whereas OPB removal capacity for both cations was lower than 20 %. The adsorption data fitted well to a Langmuir model for both cations for RHB as other authors found [3]. Although, the Langmuir maximum sorption capacity obtained in this work for Cu^{2+} was similar to that obtain by Samsuri et al. (2014) [3], it was lower for Pb^{2+}. However, sorption data for OPB better fitted to a Temkin isotherm model for Cu^{2+} and Freundlich model for Pb^{2+}.

The selection of the adequate biomass to produce biochars for the immobilization of trace elements, as Pb and Cu, in soils is very important, due to the huge differences in their adsorption efficiency. RHB showed a greater removal efficiency for Cu^{2+} and Pb^{2} than OPB.

References:

[1] Uchimiya, M., Klasson, K.T., Wartelle, L.H., Lima, I.M., 2011. Chemosphere 82, 1438-1447.

[2] Zhao, J., Shen, X.-J., Domene, X., Alcañiz, J.-M., Liao, X., Palet, C., 2019. Sci. Rep. 9, 9869.

[3] Samsuri, A.W., Sadegh-Zadeh, F., She-Bardan, B.J., 2014. Int. J. Environ. Sci. Technol. 11, 967.

Acknowledgements:

The former Spanish Ministry of Economy, Industry and Competitiveness (MINEICO) and AEI/FEDER are thanked for funding the project CGL2016-76498-R (BIOREMEC). P. Campos thanks the "*Fundación Tatiana Pérez de Guzmán el Bueno*" for funding her PhD.