



Heavy metal fixation in biochar after microwave pyrolysis of sewage sludge

Jakub Racek^{a,*}, Jan Sevcik^a, Renata Komendova^b, Jiri Kucerik^b, Petr Hlavinec^a

^aAdMaS Research Centre, Faculty of Civil Engineering, Brno University of Technology, Purkynova 651/139, 61200 Brno, Czech Republic, Tel. +420604981530; emails: racek.j@fce.vutbr.cz (J. Racek), jansvock@gmail.com (J. Sevcik), hlavinec.p@fce.vutbr.cz (P. Hlavinec)

^bInstitute of Chemistry and Technology of Environmental Protection, Faculty of Chemistry, Brno University of Technology, Purkynova 464/118, 61200 Brno, Czech Republic, emails: komendova@fch.vut.cz (R. Komendova), kucerik@fch.vut.cz (J. Kucerik)

Received 27 November 2018; Accepted 15 April 2019

ABSTRACT

The sequestration of heavy metals (HMs) in sewage sludge (SS) caused by slow microwave pyrolysis (MP) treatment was studied. The MP was carried out using a full-scale unit working at 300°C and pressure 800 hPa with 3 kW magnetron at 2.45 GHz. To determine the efficiency of sequestration, a new methodology was used. The SS from three waste water treatment plants (WWTPs) differing in capacities, inflow and drying procedure were used to study the effect of pelletization and additives addition. The total HMs content in sludges and produced biochars was determined by extraction using *Aqua Regia*, while soluble fraction (bioavailable, potentially harmful fraction) was determined by extraction using deionized water. The analyses revealed significantly low concentration of biologically available HMs after MP process in biochars prepared by pelletization and with additives. Therefore, the slow MP showed its potential to immobilize most of HMs in biochar structure thereby preventing their fixation, solubilization, and bioavailability for plants and microorganisms and may enable its use in agriculture. We conclude that slow MP represents an eco-friendly way of SS disposal, which belongs among the important strategies of circular economy.

Keywords: Sewage sludge treatment; Microwave pyrolysis; Biochar; Heavy metal fixation

* Corresponding author.