PYROLYSIS ATMOSPHERE EFFECT ON BIOCHAR PROPERTIES AND PTEs BEHAVIOR

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Pyrolysis is considered as a prospective safe treatment for biomasses contaminated by potentially toxic elements (PTEs). The PTEs speciation and their chemical transformation during the thermal treatment result in significantly different volatility of the PTEs. Previous study revealed that, in presence of one or more PTEs among Pb, Cu, and Zn, it is possible to pyrolyze contaminated biomasses up to 600°C retaining PTEs in the biochar attaining a final product characterized by low metals mobility and high porosity (1). These two characteristics, high surface area and PTEs stability, suggest the opportunity to evaluate the valorization of biochar in different application fields (fertilizer, activated carbons precursor, filler in wood and polymer composites, contaminants adsorbent in wastewater and soil, floating cover) (2, 3).

Nevertheless, it is worth to underline that few studies exists dealing with the PTEs behavior as a function of pyrolysis temperature for different biomass types. Whereas, the influence of pyrolysis atmosphere on the biochar properties is often overlooked. To the best of our knowledge, there is still a comprehension gap concerning the PTEs fate, as well as mobility in the biochar produced under different pyrolysis atmospheres.

To this aim, in the present study the effect of the carrier gas composition on both physico-chemical properties of biochar and PTEs fate during pyrolysis has been experimentally investigated. Slow pyrolysis experiments of Pb contaminated Populus nigra (Pb= 21.65 mg kg-1) were conducted using N_2, CO_2, steam and a mixture of them as carrier gas at different temperatures (465°C, 550°C, 700°C). Products yield, gas composition and biochar chemical and physical characteristics were measured, and Pb recovery in the biochar was determined. The chemical forms of heavy metals were analyzed in accordance with the sequential extraction method proposed by the Community Bureau of Reference (BCR) . The preliminary results show that the nature of the carrier gas influences pyrolysis products yield and Pb recovery in the biochar as well as its mobility.

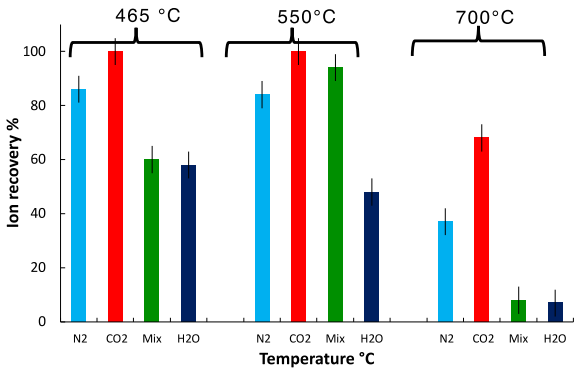

Figure 1 – Pb Recovery (wt.%) in the biochars produced at different carrier gas and temperature

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