

FATE OF LEAD DURING PYROLYSIS OF LIGNOCELLULOSIC BIOMASS

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Abstract

In recent years, lignocellulosic biomass role as an alternative energy source to fossil fuels gain interest among the scientific community. Both its direct use and, even more, the use of biofuels produced after upgrading chemical and thermo-chemical processes, among which the pyrolysis, have been analyzed in the scientific literature and demonstrated in selected cases. To address the rising demand for lignocellulosic biomass, required to this aim, while mitigating iLUC (indirect land use change) related concerns, a viable solution could be the use of biomasses produced on marginal lands and contaminated soils. However, the biomasses produced on contaminated soils may be as a consequence contaminated by pollutants contained in the soils, like heavy metals (HMs). The presence of heavy metals in the biomass structure could hinder both its processing through pyrolysis and the subsequent use of the potentially contaminated pyrolysis products.

In the above-mentioned framework, the aim of this work is to evaluate the fate of lead (Pb) during contaminated lignocellulosic biomass pyrolysis in terms of lead distribution between pyrolysis products; moreover, it has to be considered that the presence of HMs can also modify the yields and properties of pyrolysis products. The experimental campaign tested a variety of combinations of pyrolysis final temperatures (from 450 up to 800 °C) and biomass pretreatments (i.e. untreated or doped with HMs salts). The employed biomass is a poplar (*Populus nigra*); the poplar biomass was doped via wet impregnation with two different lead salts, lead acetate and lead nitrate, to achieve a concentration of lead of 1000 ppm. Moreover, by using two different salts, information can be gained on the effect of the starting chemical form of lead on its fate during pyrolysis. All the pyrolysis products, as well as the untreated and doped biomass, were characterized in their yields and composition. In particular, the ICP-MS (Induced Coupled Plasma Mass spectroscopy) represents a key tool for the purpose of this work, since it detects HMs in the biomass and pyrolysis products at ppm levels, granting the possibility to track lead displacement during pyrolysis.

In summary, the present work aims to shed light on the basics of heavy metals behaviors during the pyrolysis of HMs contaminated lignocellulosic biomass. Moreover, the possible effects of HMs on pyrolysis products yield and properties are also analyzed.