PB FATE DURING PYROLYSIS OF HEAVY METALS CONTAMINATED BIOMASS

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Abstract
In the context of renewable energy and alternative fuels, "unconventional" lignocellulosic biomass is attracting great interest. An example of this biomass is represented by heavy metals contaminated biomass that come from polluted sites (i.e. marginal lands). Pyrolysis is a promising thermochemical valorization treatment for contaminated biomass; however, the presence of heavy metals raises environmental concerns tied both to their release during the process and to the utilization of the contaminated pyrolysis products. Therefore, it is fundamental to consider the heavy metals displacement among pyrolysis products and their chemical speciation when processing heavy metals contaminated biomass.
This work investigates the behavior of lead (Pb) in terms of Pb recovery in the char and its chemical speciation at different pyrolysis temperatures, focusing on the effects of different initial Pb chemical speciation and contamination type (e.g. detrital or authigenic), which correspond to the type of bond between the heavy metal and the biomass tissues.
To this aim, two sets of experiments are conducted. To consider the effect of the initial Pb chemical speciation a chosen biomass, poplar, is doped with two different lead salts, namely lead nitrate ($Pb(NO_3)_2$) and lead acetate ($Pb(CH_3COO)_2$). To simulate different contamination types, the same biomass is demineralized and then doped with lead acetate ($Pb(CH_3COO)_2$) following three different procedures (i.e. dry mixing, wet impregnation and ion exchange). All the doped and the reference feedstocks are then pyrolyzed at three pyrolysis temperatures, 465, 600 and 800 °C, and the produced chars are analyzed to determine Pb content and chemical speciation.
From the obtained results it emerges that while initial Pb speciation has a marginal influence on Pb recovery in char, it clearly affects the chemical form of the retained Pb. On the other hand, different contamination types affect both Pb recovery in char and its chemical speciation, hinting at the relevance of this parameter.