PRODUCTION AND CHARACTERIZATION OF BIOCHAR PRODUCED FROM CO-PYROLYSIS OF LIGNOCELLULOSIC BIOMASS AND PLASTIC MULCHING SHEETS

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Agricultural biomass waste contaminated with agricultural plastics is a prominent waste stream in intense agricultural areas and complete separation of the plastic residues from the biomass is not always straightforward. There is a high possibility to use agricultural biomass and agricultural plastic wastes together in a single stream to produce valuable products via pyrolysis. However, effect of small scale plastic material presence on pyrolysis product yield is still unknown. Hence, the effect of low levels of agricultural plastics in the biomass on the mass balance and product composition of pyrolysis products were examined during this study. Co-pyrolysis of mixed soft wood and low-density polyethylene (black color agricultural plastic used for mulching) was carried out at 500 °C in a mini pyrolysis reactor set up. The produced char was characterized using proximate, elemental analysis, thermogravimetric analysis and analytical pyrolysis at 750 °C using PyGC/MS. Five types of char were produced during this study. Namely soft wood only (0%AgPlC) and mixtures of 1%, 5%, 10%, and 25% agricultural plastic material and soft wood (mass basis), referred to as 1%AgPlC, 5%AgPlC, 10%AgPlC and 25%AgPlC respectively. According to the mass balances experimentally obtained, the char yield was not significantly altered after incorporation of the plastic material into the feedstock. However increased plastic mass fraction increased the yield in tar/oil and decreased the gas yield. Moreover, the fixed C content and total C content were reduced and volatile matter content, total H content and H/C molar ratio were increased in the char material with increased levels of plastic in the feedstock. This indicates the lower stability of char produced with higher plastic levels. According to the analytical pyrolysis results of the char, molecular compounds composition was varying after plastic material incorporation. Phenol, toluene and xylene peak area percentage were higher in plastic incorporated char materials. These results can be used to understand the biomass and plastic interaction during pyrolysis. Further studies are recommended to identify the contaminants in the products of copyrolysis of agricultural biomass feedstocks contaminated with plastics.