PRODUCTION AND CHARACTERIZATION OF SPRUCE WOOD AND BARK BIOCHAR

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Biochar produced from pyrolysis of biomass has great potentials to be used the agricultural sector. With unique properties, use of biochar in agronomy can improve soil fertility, increase crop yields and sequestrate carbon as well. Production conditions have considerably effects on yield and property of biochar and gas and liquid by-products. This work aimed to investigate the impact of highest treatment temperature (HTT), atmosphere (CO_2 and N_2) and feedstock on yield of solid, liquid and gas products from pyrolysis of spruce wood and bark as well as characteristics of the produced biochar. Spruce wood and bark chips were pyrolyzed in a fixed bed reactor under slow heating conditions with presence of nitrogen and carbon dioxide, which continuous monitoring gases products. The produced biochars were characterized by a combination of proximate analysis, elemental analysis, N_2 and CO_2 adsorption for BET surface area and porosity analysis, ^{13}C NMR spectroscopy and scanning electron microscopy. It was found that products distribution from pyrolysis of spruce wood and bark are considerably different, mainly owing to the differences in physical and chemical properties of them. In both nitrogen (N_2) and carbon dioxide (CO_2) atmosphere, yields of biochar and liquid products decreased at a higher HTT, together with production of more gas products. The experimental and analysis results indicate that pyrolysis behaviors of the spruce wood and bark in N_2 and CO_2 is different. Pyrolysis in CO_2 led to different extents of pyrolysis reactions and produced biochar with changed physico-chemical properties compared to those produced in N_2 atmosphere. The CO_2 seems to enhance cracking of volatile organic carbons, leading to reduction of amount of formed liquid products. The experimental findings in this study indicate that the carbon neutral biomass and CO_2 could be co-utilized as feedstock and influencing carrier gas with multi benefits for biochar production, energy generation and waste management.

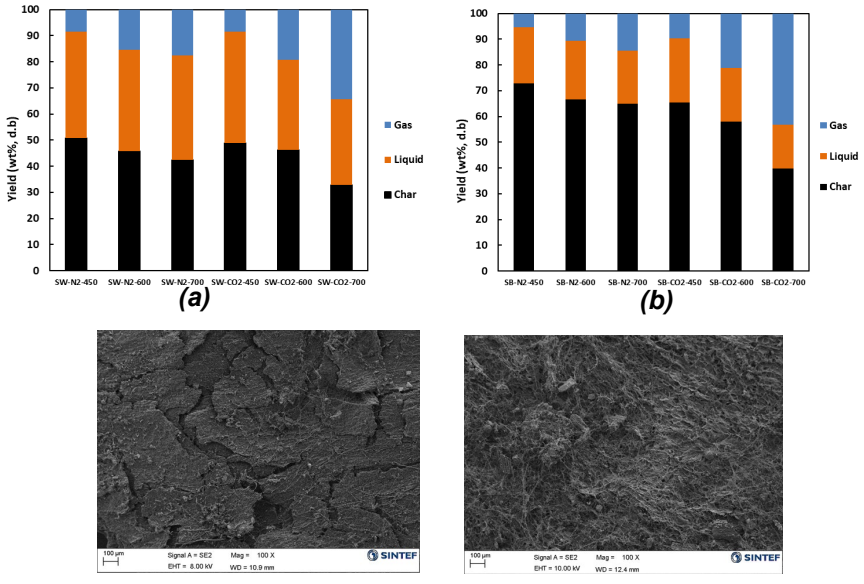

Figure 1 – Product yields from pyrolysis of spruce wood (a) and bark (b) and bark char produced in atmosphere of N2 (c) and CO2 (d)