ENERGY AND MATTER RECOVERY THROUGH SOLAR ASSISTED PYROLYSIS OF BIOMASS

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Work-In-Progress Abstract

Pyrolysis represents an environmentally sustainable strategy for the exploitation of biomasses grown on contaminated or physically degraded lands. It combines the recovery of a valuable material, the char, to the production of a combustible vapor phase. However, one of the main concerns about biomass pyrolysis is the need to provide an energy input in order to sustain the endothermicity of the pyrolysis reactions. Solar assisted pyrolysis could represent a possible solution to this bottleneck. Since solar pyrolysis reactors operate in more severe thermal conditions than the ones typically allowed in traditional pyrolysis reactorsthe dependence of char properties and gas composition on the thermal conditions of the solar assisted pyrolysis process has to be assessed in order to optimize the operating conditions for the valorization of char and the exploitation of the energy content of the vapor phase.

Solar assisted pyrolysis tests on *Populus nigra* L. have been conducted using a solar reactor (volume 6 L) heated by a concentrated tunable solar incident radiation at different final temperatures (800-1400°C) and heating rate (5-150°C/s). Preliminary results obtained for poplar char (see Figure 1) show that heating rate has a mild effect on char yield: a slight decrease of char yield is observed between 10 and 50 °C/s at the expense of gas yield, whereas the variations observed for the liquid yield are inside the experimental error. Higher heating rates do not produce remarkable variations on the product yields. The same trend is observed for gas composition. An increase of heating rate from 10 to 50 °C/s determines higher concentrations of H_2 and CO in the gaseous products at the expense of CO_2, thus producing an increase of the calorific value of the gaseous product.

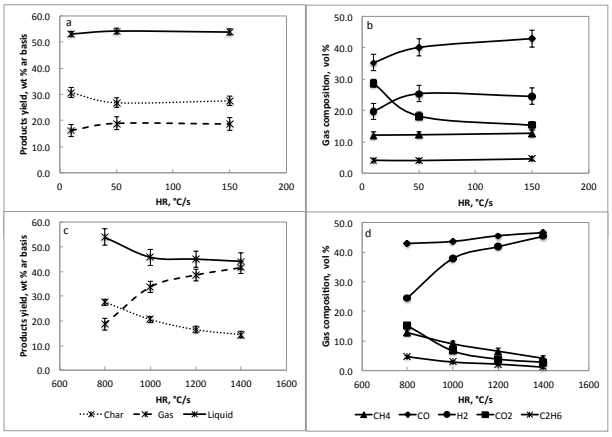

Figure 1. Effect of heating rate (panels a and b) and temperature (panels c and d) on products yield and gas composition

Temperature has a stronger effect on the pyrolysis process. Indeed, when pyrolysis is conducted at increasing temperature from 800 to 1400 °C the yield of char decrease as well as the liquid yield. On the contrary, gas yield increases enriching in CO and H_2.

The effect of thermal conditions on char chemico-physical properties has been studied by performing elemental analysis, porosimetry tests and inorganics analysis on the collected char samples. Both temperature and heating rate has a strong effect on the structural characteristics of the solid residue in terms of BET surface and pore volume.

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