MULTI-TECHNIQUE CHARACTERIZATION OF BIOCHAR FORMATION

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It is known that biomass forms an intermediate liquid before forming the solid “char” (figure 1) but the role of this intermediate liquid on the structure of char and on the mechanisms of pyrolysis is still poorly understood.

In this talk we will present how in-situ rheology and 1H NMR analysis [2] are interesting techniques to understand the mechanism of biochar formation through an intermediate “visco-elastic” material. These techniques allow assessing the physical-chemistry of biomass conversion to char at real-time and high temperature conditions.

Then the slow pyrolysis of the same biomass was conducted in a fixed bed analytical reactor, with a good control of mass transfers, temperature history and quench of the sample at different temperatures. High resolution 2D solid 1H-13C NMR [3] and quantitative 1D 13C NMR [4] of the biomass chars as produced at different temperatures have been conducted. The conversion of main moieties present in biomass to the formation of the aromatic clusters present in biochars is quantified by a specific 13C CP/MAS NMR method (figure 2).

We will conclude on the importance of the development of complementary analytical techniques [5,6] to figure out the mechanisms of biomass char formation.