Title: Separation of bio-oil into homogeneous families of phenolic compounds according to their molecular size and polarity.

Authors: Arianna Sabina, Jorge Pequerul, Noemí Gil-Lalaguna, Isabel Fonts, Alfonso Cornejo, José Luis Sánchez

Abstract:

The production of Sustainable Aviation Fuels (SAF) is one of the ways of facing climate change. One of the main challenges in their production based on renewable sources is to reach the adequate level of aromatic compounds that, by regulation, must be present in these fuels to avoid operating problems in today's turbine engines (minimum of 8 wt. %). Due to the phenolic structure of lignin itself, thermal decomposition of lignocellulosic biomass can be a feasible alternative for obtaining aromatic compounds of renewable origin. Specifically, in the pyrolysis process, the biomass decomposes giving rise to a liquid product (bio-oil) containing a highly complex mixture of sorted organic compounds, such as aldehydes, ketones, acids, furans, phenols, methoxyphenols, anhydrosugars, pyrolytic lignin and other oligomers, with different functional groups and molecular size. In this work we have studied the fractionation of bio-oil from fast pyrolysis of lignocellulosic biomass with the aim of separating more homogeneous families of phenolic compounds in terms of polarity and molecular size. The fractionation has been based on the flash liquid chromatography method, applied to molecular size separation (gel permeation resin) and polarity separation (silica column). The fractions obtained were analyzed using characterization techniques such as gas chromatography-mass spectrometry (GC/MS) to identify the volatile compounds, size exclusion chromatography (SEC) to measure the distribution of molecular weight, and nuclear magnetic resonance spectroscopy (NMR) to determine the functional groups, molecular structure and chemical composition. Some results showed that it was possible to separate and concentrate phenolic monomers according to families (with similar functional groups: 2 hydroxyl groups on the one hand and 1 hydroxyl group and 1 methoxyl group on the other hand) present in two monomeric fractions of lignocellulosic bio-oil (previously submitted to molecular size fractionation).