

MOLECULAR CHARACTERIZATION OF NEW RENEWABLE FEEDSTOCKS BY MULTI-SCALE ANALYSIS USING GAS CHROMATOGRAPHY, MASS SPECTROMETRY AND AN OXYGEN SELECTIVE DETECTOR

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Alternatives to fossil fuels have been at the forefront of scientific research for many years. Detailed molecular characterization of new feedstocks such as pyrolysis oil from used wind blades is therefore of paramount importance to better understand the macroscopic behavior of these new materials. These feedstocks are made of complex chemical mixtures that require multi-scale analysis to be properly characterized. Several analytical techniques are currently employed for this purpose. The volatile fraction of the samples can be analyzed by gas chromatography hyphenated to mass spectrometry to identify the unknown compounds.

However, the diversity of the chemical classes present in such samples is very large and comprehensive two-dimensional gas chromatography coupled to mass spectrometry is required.

Next to MS, heteroatom-specific detectors can also be coupled to the chromatographic separation to provide additional valuable information. Since some compounds, like oxygenated molecules, can affect the macromolecular properties of the alternative fuel, the need for clear understanding of oxygen-bearing compounds is a major goal. However, the quantification and identification of oxygenated molecules is severely limited by the lack of oxygen-specific detectors.

To address this, a new type of oxygen-specific detector capable to identify and quantify molecules without the use of any standards was used. In addition to the characterization of oxygen-containing molecules, this new detector can also detect and quantify carbon, nitrogen, and sulfur.

This multi-scale analytical approach using GCxGC and various type of detectors appears to enhance our ability to adapt the related industrial processes in order to produce high-value products.