

MOLECULAR CHARACTERIZATION OF USED WIND TURBINE BLADES BY MULTI-SCALE ANALYSIS USING GC, MS AND AN OXYGEN SELECTIVE DETECTOR

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Alternatives to fossil fuels have been a major focus of scientific research for many years. In this context, the detailed molecular characterization of emerging feedstocks such as pyrolysis oil from used wind blades is essential to better understand the macroscopic behavior of these new materials and to maximize their valorization processes. These feedstocks consist of highly complex chemical mixtures that require multi-scale analytical approaches for proper characterization. Several complementary analytical techniques are therefore used for this purpose. The volatile fraction of the samples can be analyzed by gas chromatography coupled with mass spectrometry, enabling the identification of unknown compounds. However, due to the wide diversity of chemical classes present in such, the separation power of two-dimensional gas chromatography is required. 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 final product, the need for clear understanding of oxygen-bearing compounds is a major objective. Yet the lack of oxygen-specific detectors has long limited the quantification and identification of these molecules. To overcome this limitation, a new type of oxygen-specific detector capable of identifying and quantifying molecules without the need for specific standards has been employed. In addition to the characterization of oxygen-containing molecules, this new detector can also measure carbon-, nitrogen-, and sulfur-containing species. Overall, this multi-scale analytical strategy, combining the separation power of GC and a variety of detection techniques, significantly improves our capacity to adapt industrial processes and ultimately produce high-value products.