

Characterization of Used Wind Turbine Blade Pyrolysis Oil by Multi-Scale Analysis

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The search for greener alternatives to fossil fuels and energy with less environmental impact is a high priority in scientific research. One of the interesting alternatives comes from used wind turbine blades (WTBs). In fact, most parts of the wind turbines are made of concrete and steel, which are easily recyclable. However, the blades are a complex assembly of different materials (wood, resins, coatings, etc.). It is therefore necessary to develop a recycling process to divert the blades from landfill and recover valuable materials such as glass fiber, but also to produce fuel from this waste in the long term.

However, 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. In comparison to classical fossil fuels, the diversity of the chemical classes present in such samples is very large and comprehensive two-dimensional chromatography (GC×GC) coupled to mass spectrometry (MS) is required and has already been used in earlier studies [1,2].

In this study, GC×GC was coupled with MS to identify unknown compounds and with a flame ionization detector (FID) to quantify the identified compounds. Analyses were performed in both normal (non-polar x mid-polar) and reversed (mid-polar x non-polar) phase to determine the optimal configuration for the analysis. Because some compounds, like oxygenated molecules, can significantly impact on the macromolecular properties of the alternative fuel, with a direct impact on its properties and usability, a focus has been made to have a clear understanding of oxygen-bearing compounds present in pyrolysis oil [3].

However, the quantification and identification of oxygenated molecules is a major limitation due to the lack of oxygen-specific detectors suitable for this purpose. To address this, a new type of oxygen-specific detector capable of identifying and quantifying molecules without the use of standards was recently developed [4] and used in this study.

References:

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