Non-Isothermal Pyrolysis of Citrus Unshiu Peel

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Abstract:

In this study, the non-isothermal pyrolysis of citrus unshui (C. unshiu) peel was studied by thermogravimetric analysis (TGA) and evolved gas analysis/pyrolyzer-gas chromatography/mass spectrometry (EGA/Py-GC/MS). Two types of analytical pyrolysis-GC/MS experiments, EGA-MS and multi-shot GC/MS, were conducted to determine the thermal profiles of the pyrolysis products, as well as the detailed pyrolysis product distribution of each thermal zone. The pyrolysis of pectin, hemicellulose, cellulose, and lignin was also carried out to interpret the pyrolysis behavior of C. unshiu peel. TGA and EGA-MS of C. unshiu peel revealed five main weight loss stages, such as water and limonene vaporization, pyrolysis of pectin, hemicellulose, cellulose, lignin, and char stabilization. Multi-shot GC/MS revealed the specific pyrolysis products of each component of C. unshiu peel. Limonene was vaporized with water below 140ºC. Large amounts of methanol, acetic acid, 5-hydroxymethylfurfural, 3,5-dihydroxy-6-methyl-2,3-dihydro-4H-pyran-one, and p-vinylguaiacol were produced between 140 and 280ºC, at which temperature range pectin and hemicellulose decomposed. The specific pyrolyzates of cellulose formed between 211 and 360ºC, and a small amount of lignin pyrolyzates were also detected over a wide temperature range (141–360ºC). At temperatures higher than 360ºC, small amounts of aromatics were produced as the by-products of char stabilization.

* Excerpted from online journal website (Click the title)

Frontier Labs products used:

Multi-Shot Pyrolyzer