CDS olutions

APPLICATIONS INFORMATION USING ADVANCED SAMPLE HANDLING TECHNOLOGY

Pyrolysis-GC/MS of Plant Material

The structural material of plants, including trees and grasses and products made from them, like lumber, and kraft paper, is comprised largely of two biopolymers - cellulose and lignin. Cellulose is a polymer of glucose, and is also the major constituent of cotton, rayon and white paper. Lignin is a complex aromatic biopolymer that is removed from wood pulp in the process of making white paper.

When pyrolyzed, cellulose generates many highly oxygenated compounds, including furans, especially furancarboxaldehyde and hydroxymethyl furancarboxaldehyde, and levoglucosan, as shown in Figure 1. Considerable acetic acid is also produced.

The pyrolysis products of lignin are essentially phenolic, frequently methoxyphenols and dimethoxyphenols, as seen in Figure 2.

When a plant material, like wood, or a product such as fiberboard is pyrolyzed, the pyrolysis products from both cellulose and lignin are evident. Because cellulose also produces considerable CO_2, H_2O and char, the peaks from the lignin are frequently more prominent even though the sample may contain more cellulose than lignin.

Figure 3 shows the pyrogram of a piece of wood, in which the methoxyphenols from lignin are readily apparent, but the furans and levoglucosan are also evident.

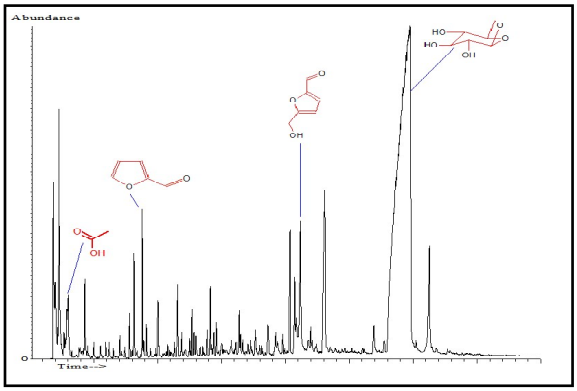

Figure 1. Cellulose at 750°C.

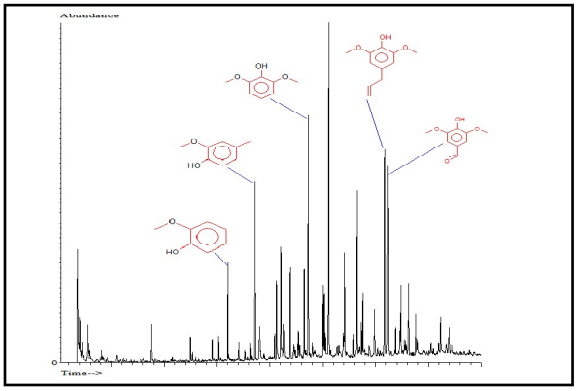

Figure 2. Lignin at 750°C.

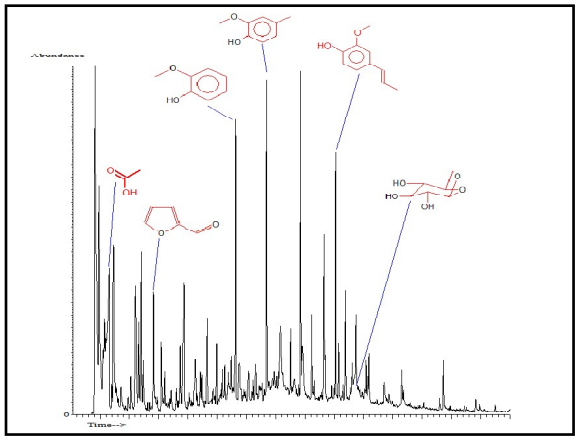

Figure 3. Wood at 750°C.

Equipment

These samples were analyzed using a CDS Model 5250 Pyroprobe Autosampler, interfaced to an Agilent6890/5975B gas chromatograph/mass spectrometer.

Model 5250 Conditions

Valve Oven:	300°C
Transfer Line:	325°C
Temperature:	750°
Time:	15 seconds
Sample Purge:	0.1 min
Equilibration:	0.1 min
Post Pyro Delay	0.1 min

GC Conditions

Carrier:	Helium
Injector:	350°C
Split:	50:1
Column:	HP-5MS (30m X 0.25mm)
Detector:	5975B MS
Range:	35 - 550

GC Program:

Initial:	40°C for 2 minutes
Ramp:	10°C/min.
Final:	300°C

FOR MORE INFORMATION CONCERNING THIS APPLICATION, WE RECOMMEND THE FOLLOWING READING:

T. Ohra-aho et al., Direct analysis of lignin and lignin-like components from softwood kraft pulp by Py-GC/MS techniques, J. Anal. Appl. Pyrolysis, 74 (2005) 123-128

Additional literature on this and related applications may be obtained by contacting your local CDS Analytical representative, or directly from CDS at the address below.

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