Pyrolysis-GC/MS of Switchgrass

Application Note
Energy

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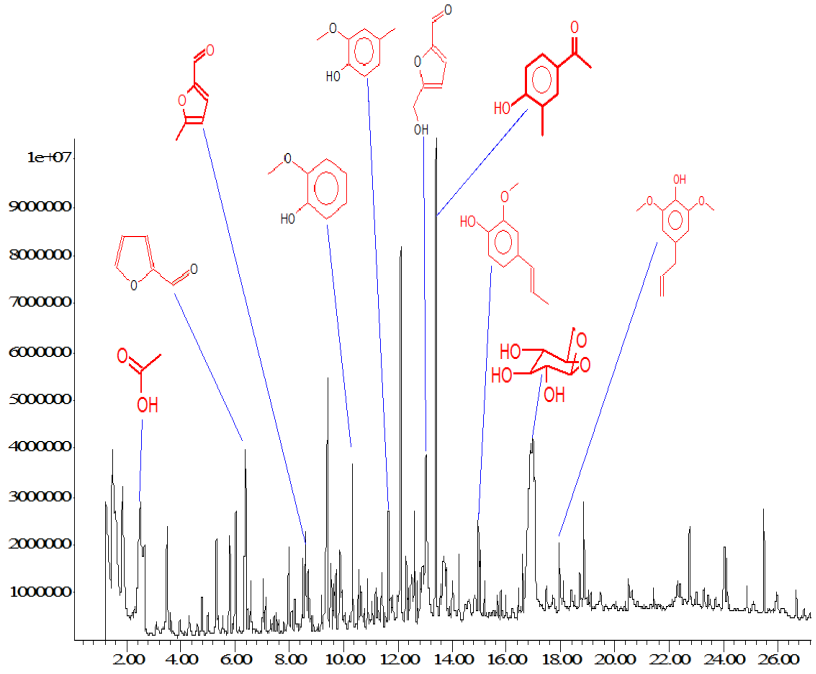
Switchgrass, like many other plant materials, is comprised largely of cellulose and lignin. Cellulose is a glucose polymer, and when pyrolyzed produces considerable char, water, carbon dioxide and many polar organic compounds. Significant among these are levoglucosan and furans such as furanone, furancarboxaldehyde and hydroxymethyl furancarboxaldehyde. Acetic acid is also produced.

Lignin is a complex, crosslinked aromatic biopolymer which can make up to 30% of plant material. It is essentially insoluble, and is responsible for much of the heat produced when plant materials are burned. When pyrolyzed, it produces mostly subsituted phenolics, including a series of methoxyphenols and dimethoxyphenols. These compounds are seen in the pyrograms of many wood and paper products including fiberboard, kraft paper and cardboard.

The figure below shows a pyrogram of switchgrass at 650°C. Since both cellulose and lignin are present, pyrolysis products from both biopolymers are seen in the pyrogram. From the cellulose, acetic acid and levoglucosan (eluting at about 17 minutes) are prominent, along with the characteristic furans. Lignin contributes the aromatics, including the methoxyphenols and dimethoxyphenols.



Instrument Conditions
Pyroprobe Autosampler

Pyrolysis:	650°C 15 seconds	Sample Purge:	0.1 min
Valve Oven:	300°C	Equilibration:	0.1 min
Transfer Line:	325°C	Post Pyro Delay	0.1 min

GC/MS

Column:	5% phenyl (30m x 0.25mm)
Carrier:	Helium, 50:1 split
Injector:	350°C
Oven:	40°C for 2 minutes
	10°C/min to 300°C
Mass Range:	35-550

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

A. A. Boateng et al., Pyrolysis of switchgrass (Panicum virgatum) harvested at several stages of maturity, J. Anal. Appl. Pyrolysis 75 (2006) 55-64.