Pyrolysis of Different Tea Bag Papers Using the Pyroprobe

Application Note
Food & Flavor

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Abstract

Pyrolysis of Tea bag Paper using a CDS Model 6150 Pyroprobe.

Useful for competitive analysis, product development, regulation, and even forensic analysis, pyrolysis provides a simple way of studying any type of finished polymers by GC-MS. This includes food packaging, like tea bag paper. Tea bag paper is generally made from abaca cellulose fibers. These cellulose fibers are also mixed with synthetic materials to help retain tea particles. In the following examples, about 100 micrograms of papers from different tea bags were pyrolyzed to a setpoint of 600°C with Pyroprobe 6150.

Both papers from tea bags L and W shown in Figure 1 have characteristic peaks for cellulose, most notably, cellulose's monomer, levoglucosan. Along with peaks for cellulose, there are peaks for polystyrene's monomer (styrene) and polystyrene's trimer. These indicate polystyrene. Additionally, methyl methacrylate and butyl methacrylate are also present, indicating acrylic fibers. Due to the similarity of these pyrograms, it is likely that both these tea bags use paper from the same manufacturer.

It is interesting to note that caffeine is present tea bag W, but absent in L. In this study, tea bag W was steeped prior to its analysis, and some caffeine was left behind in the paper.

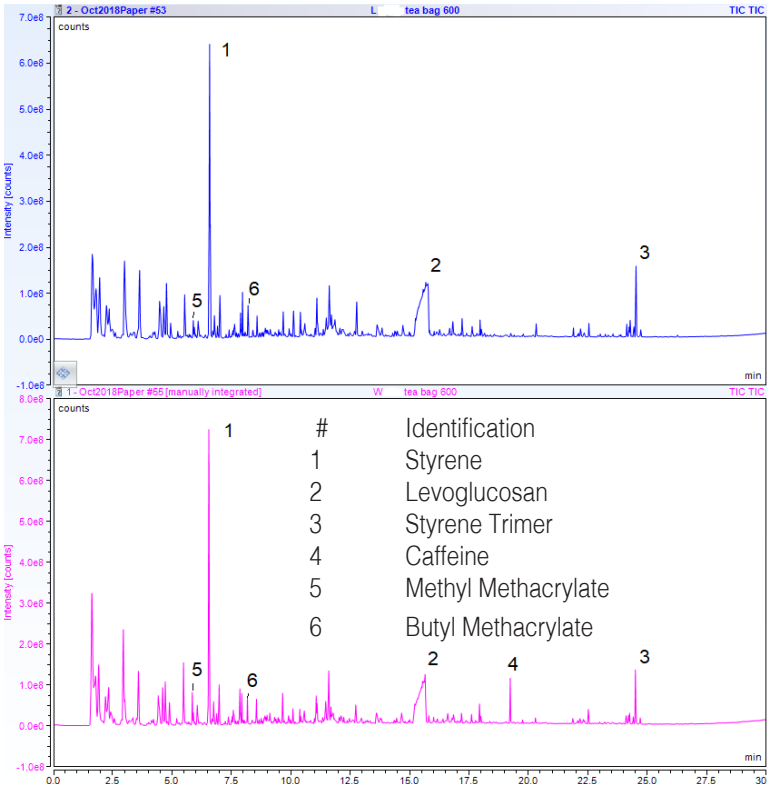


Figure 1. Paper L (top), Paper W (bottom), 600°C for 30 seconds.

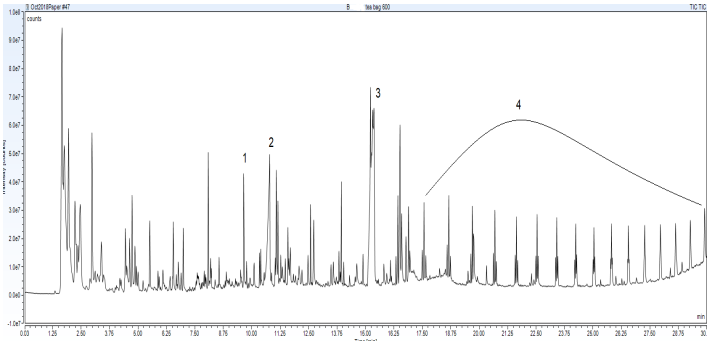
Experimental Parameters

Pyroprobe 6150
Pyrolysis: 600°C 30s
Interface: 300°C
Transfer Line: 325°C

GC/MS
Column: 5% phenyl (30m x 0.25mm)
Carrier: Helium, 75:1 split
Injector: 320°C
Oven: 40°C for 2 min
10°C/min to 300°C hold 15 min
Mass Range: 35-600amu

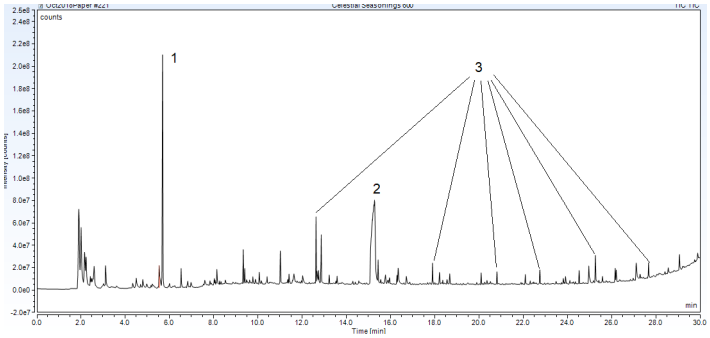
Tea bag papers B and C, shown in Figures 2 and 3 respectively, are very different from papers L and W. Instead pyrolysates of acrylic and polystyrene, paper B's pyrogram has vinyl benzoate and benzoic acid, pyrolysates of polyethylene terephthalate. Also, a triplicate peak pattern of aliphatics (diene, alkane, and alkene) most evident after 17 minutes, indicates polyethylene. So, along with cellulose, paper B contains polyester and polyethylene. Paper C's pyrogram has trimer and higher oligomers of polypropylene.

Tea bag papers shown here clearly differ in polymeric formulation. By easily revealing polymeric makeup of finished consumer goods, analytical pyrolysis with a Pyroprobe provides valuable knowledge that can be used for activities such as competitive analysis and product development.



#	Identification
1	Vinyl Benzoate
2	Benzoic Acid
3	Levoglucosan
4	Polyethylene Oligomers

Figure 2. Paper B, 600°C for 30 seconds.



#	Identification
1	Polypropylene Trimer (2,4-Dimethyl-1-heptene)
2	Levoglucosan
3	Polypropylene Oligomers

Figure 3. Paper C, 600°C for 30 seconds.

FOR ADDITIONAL READING, WE RECOMMEND THESE PUBLICATIONS:

CDS Application Note #184a Pyrolysis GC-MS of Pharmaceutical Packaging

Sam, K. Multistep Thermal Characterization of Liquid-Filled Capsules and Medication
Packaging Using GC/MS. Am. Lab, April 2018.

Wampler, T. A Simple Polymer Identification Scheme Based on Pyrolysis-GC/MS. PCI Magazine, August 2008.