

Pyrolysis-GC/MS in the Analysis of Fiber Blends

Application Note

Fibers

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Fiber blends are like other polymer blends or mixtures when analyzed by Py-GC/MS in that the individual polymers pyrolyze independently, and the resulting pyrogram contains pyrolysates from each of the constituents. Figure 1 illustrates this process for a blend of Polyethylene terephthalate (PET) and Polyacrylonitrile (PAN). The top pyrogram in Figure 1 is PET only, showing the typical pyrolysis products, including benzoic acid, listed in Table 1. The bottom pyrogram is for PAN only, and has large peaks for acrylonitrile monomer and dimer. The blended fiber is in the middle, and has the characteristic peaks of both the individual fibers. Since the pyrolysis products of each polymer rarely interact with each other, comparing the amount of a product generated from one fiber to a compound from the other can be used to determine the relative amounts of each of the polymers present.

Figure 2 shows the pyrogram of a cotton/polyester blend fabric listed as 30% cotton. The fabric was actually made using two different fibers. One of the fibers was pure PET, shown in the upper pyrogram. The other fiber contained the cotton, but was a blend itself that also contained PET. Consequently there are peaks from the cellulose in the cotton (specifically furfural and levoglucosan) as well as the benzoic and terephthalic acid products from the PET.

Table 1

Peak #	Compound
1	Vinyl benzoate
2	Benzoic acid
3	Divinyl terephthalate
4	Terephthalic acid monovinyl ester
5	Furfural
6	Levoglucosan
7	Acrylonitrile
8	Hexene dinitrile

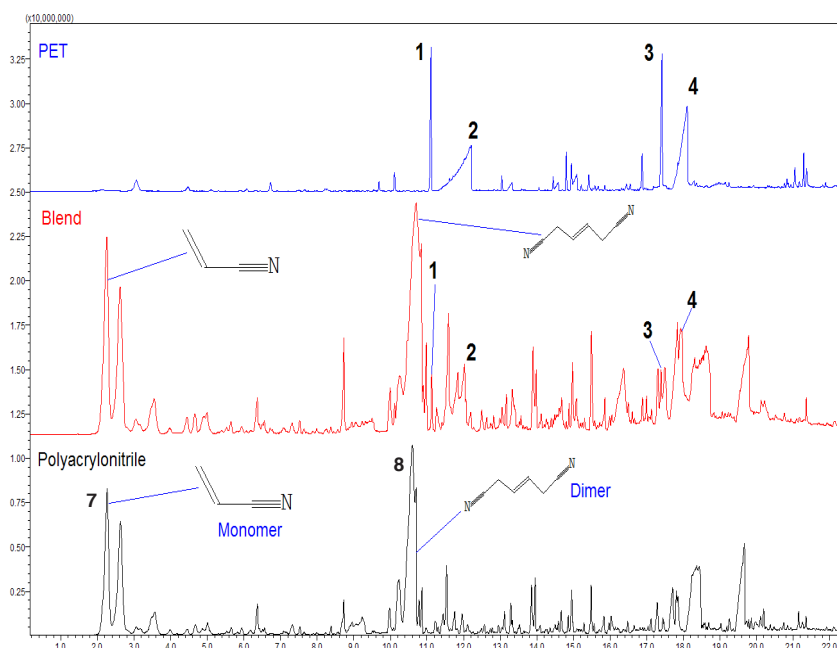


Figure 1. PAN/PET Fiber Blends.

Instrument Conditions

Pyroprobe

Pyrolysis Setpoint: 750°C 15s
Valve Oven: 300°C

GC/MS

Column: 5% phenyl (30m x 0.25mm x .25µm)
Carrier: Helium, 75:1 split
Injector: 300°C
Oven: 40°C for 2 min
10°C/min to 325°C

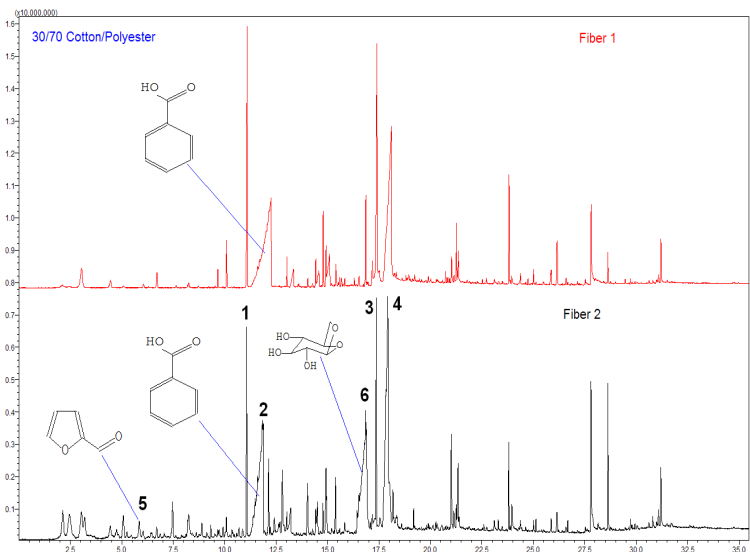


Figure 2. Cotton/polyester fiber blends

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

T. P. Wampler, Introduction to pyrolysis-capillary gas chromatography,
J.Chrom. A, 842 (1999) 207-220.