



## Analysis of Hair Samples by Pyrolysis GC

### Application Note

Forensics

**Author:**  
**T. Wampler**

Pyrolysis gas chromatography is a technique for applying GC to the analysis of solid samples. The sample materials are first heated to the point of bond dissociation, producing volatile fragments of the original solid, and it is these fragments which are then analyzed by the gas chromatograph. This technique has been applied by forensic laboratories to the analysis of trace evidence samples, such as paint flakes from automobile accidents, as well as by laboratories concerned with the manufacture and quality control of synthetic polymers. It is also a useful tool in the analysis of threads and fibers, both synthetic (the Nylons, for example), and natural such as cotton (cellulose), wool and silk (proteins), and hair samples.

Figure 1 is a pyrogram produced by pyrolyzing a 15mm length of human hair. The sample was placed into a quartz tube, which was inserted into the platinum coil of a Pyroprobe, and heated to 700°C for 10 seconds. The resulting pyrolysates were cryogenically focused onto the head of the capillary column prior to starting the GC program, which provided the sensitivity of splitless capillary analysis without sacrificing resolution.

Figure 2 shows the pyrogram which is produced when the same technique is applied to a sample of canine hair. The first 15 minutes of the two chromatograms are very similar, having the same major peaks in roughly the same relative abundance. There are some noticeable differences between 20 and 30 minutes, where two peaks which are only minor constituents in the human sample become major peaks in the pyrogram of canine hair (at retention times of 22 and 27 minutes). There are also many minor differences which may be due more to distinctions in secondary characteristics (pigmentation, oils, etc.) than to differences in the actual protein structure of the hair itself.

#### **Equipment:**

##### **PYROLYSIS**

Pyroprobe and cryogenic refocuser at the injection port of the gas chromatograph

Pyrolysis temperature: 700°C for 10 seconds

Interface temperature: 275°C

Cryogenic temperature: -100°C for 10 minutes

Desorption temperature: 275°C for 10 minutes

GC Conditions:

Varian 3700 equipped with FID

Column: 50m x 0.25mm SE-54

Program: 50°C for 2 minutes, then 6° C/min to 290° C

Carrier: Helium at 20psi

For more information on this and related applications, we recommend the following readings:

T. Munson, and J. Vick, "Comparison of Human Hair by Pyrolysis Capillary Gas Chromatography and Gas Chromatography Mass Spectrometry," J.A.A.P, 8, (1985), 493-501.

T. Wampler, and E. Levy, "Cryogenic Focusing of Pyrolysis Products for Direct (Splitless) Capillary Gas Chromatography," J.A.A.P., 8, (1985), 65-72.

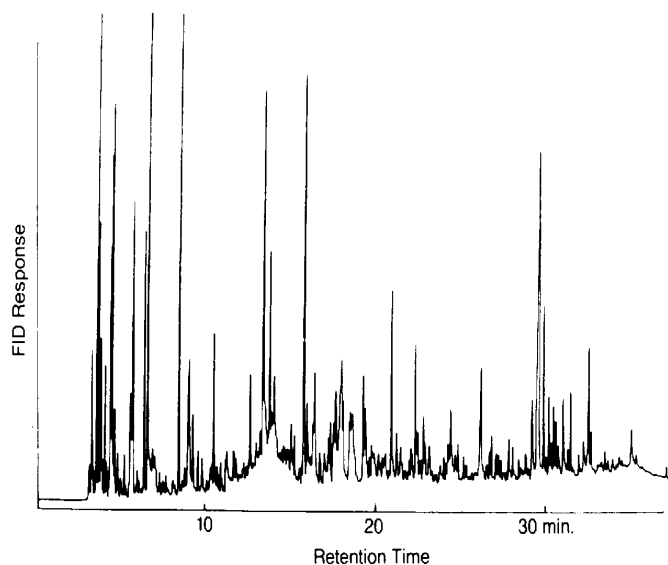


Figure 1: Pyrolysis of Human Hair, 700°C for 10 seconds with Cryofocusing.

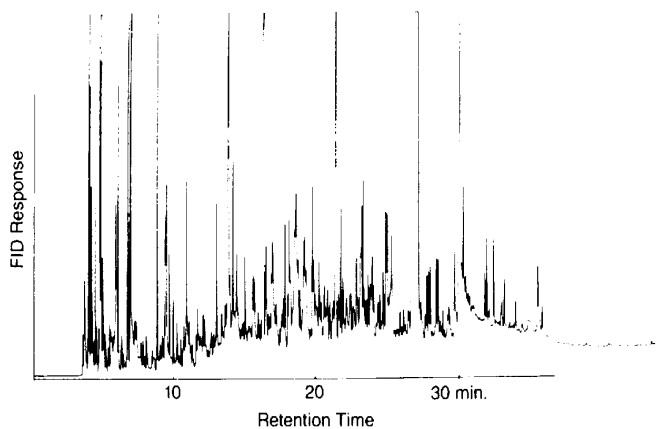


Figure 2: Pyrolysis of Dog Hair, 700°C for 10 seconds with Cryofocusing