Pyrolysis Gas Chromatography of Amino Acids

Application Note

Amino Acids

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Pyrolysis GC has been employed to analyze many solid materials by gas chromatography, including fuel sources, paints, fibers and many synthetic polymers. Biochemicals may also be analyzed using pyrolysis GC, but the polar nature of many biopolymers produces pyrolysates which may be adsorbed or destroyed by the metal surfaces used in some pyrolysis systems. The use of a glass lined pyrolysis system greatly increases the sensitivity and recovery of trace polar compounds, permitting the use of smaller samples. Samples were placed into quartz tubes and pyrolyzed in the quartz lined interface of the Pyroprobe. The pyrolysates were transferred through glass lined stainless steel tubing to an internal trap, then backflushed without splitting to the gas chromatograph, where they were refocused cryogenically directly onto the capillary column.

Figure 1 shows the chromatogram resulting from the pyrolysis of Phenylalanine at 700° C. Aromatic hydrocarbons could be produced by splitting off benzene, by breaking the bond between the two carbons to form toluene, or by removing both of the functional groups to form ethyl benzene. That the CH2-CH bond is the most favored site for bond breaking can be seen readily from the predominance of toluene over the other species in the pyrogram.

In the case of Tyrosene, production of any aromatic hydrocarbons would involve the removal of the -OH group from the benzene ring - an unlikely pathway at best. This is easily seen in the pyrogram of Tyrosene (Figure 2) which shows almost no benzene, toluene or ethyl benzene at all. On the other hand, scission of the bond para to the -OH would produce phenol, and breaking the CHrCH bond would result in methyl phenol - clearly the favored cleavages.

Instrument Conditions

Pyroprobe

Pyrolysis: 700°C 10 seconds
Interface: 275°C
Trap: Tenax at 35°C
Desorb: 275°C for 15 minutes
Cryofocus: -100°C 15 minutes then 250°C 10 minutes
Valve Oven: 275°C

GC- FID

Column: 50m x 0.25mm SE-54
Program: 50°C for 2min
7°C/min to 290°C
Carrier: Helium at 20psi

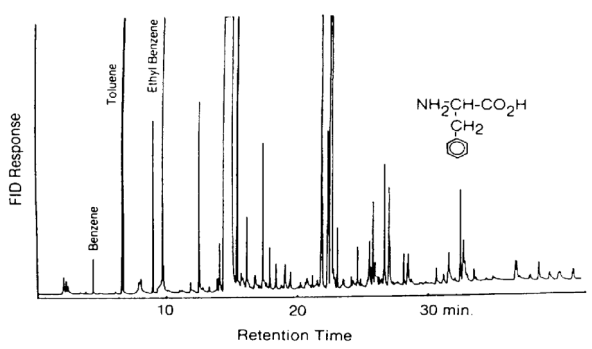

Figure 1: Phenylalanine 700°C for 10 seconds

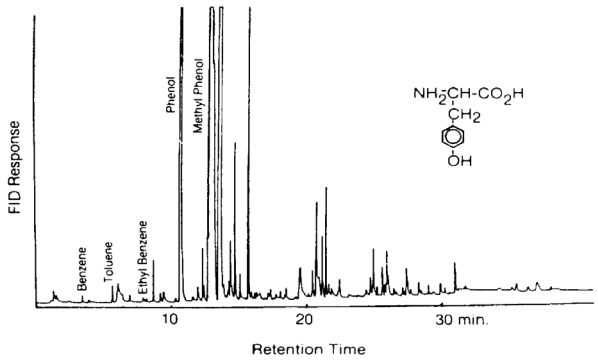

Figure 2: Tyrosine700°C for 10 seconds

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

J. Piskoz, D. Radlein, D. Scott, "On the Mechanism of the Rapid Pyrolysis of Cellulose," J.A.A.P., 9, (1986) 121.

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

D. Knorr, T. Wampler, and R.
Teutonicao, "Formation of Pyrazines by Chitin Pyrolysis," J. Food Sci., 50, (6),
1762.

H. Stern, A. Kotula and M. Pierson, "Differentiation of Selected Enterobacteriaceae by Pyrolysis-Gas-Liquid Chromatography," Appl. and Envrokn. Micro., Dec. 1979, 1098.
H. Engman, H. Mayfield

W. Bertsch, "Classification of Bacteria by Pyrolysis Capillary Column Gas Chromatography-Mass Spectrometry and Pattern Recognition," J.A.A.P., (1984) 139.

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