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APPLICATIONS INFORMATION USING ADVANCED SAMPLE HANDLING TECHNOLOGY

A COMPARISON OF NYLONS BY PYROLYSIS GC

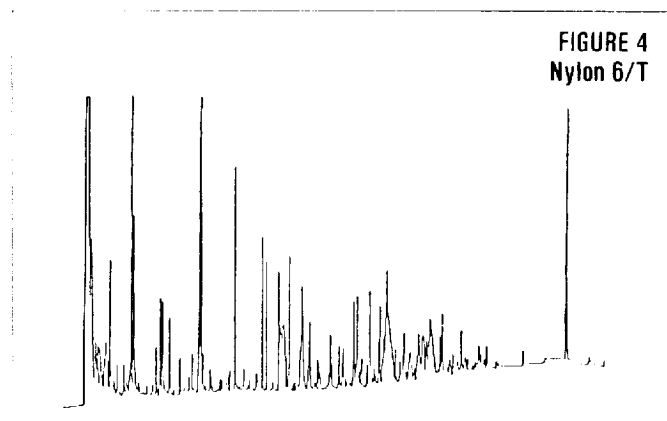
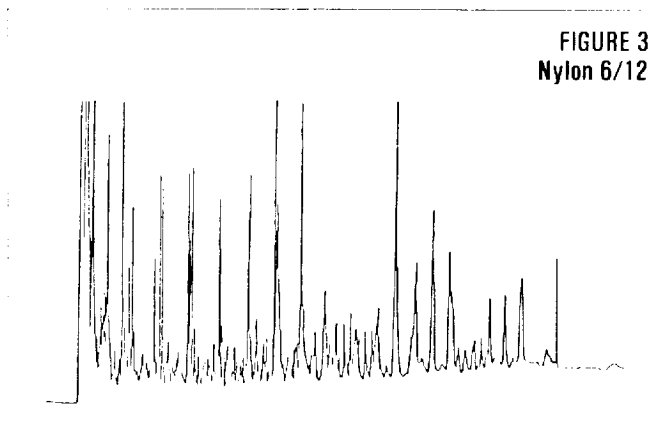
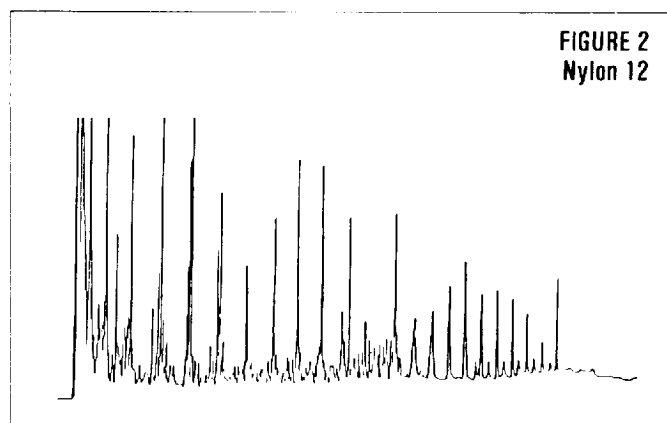
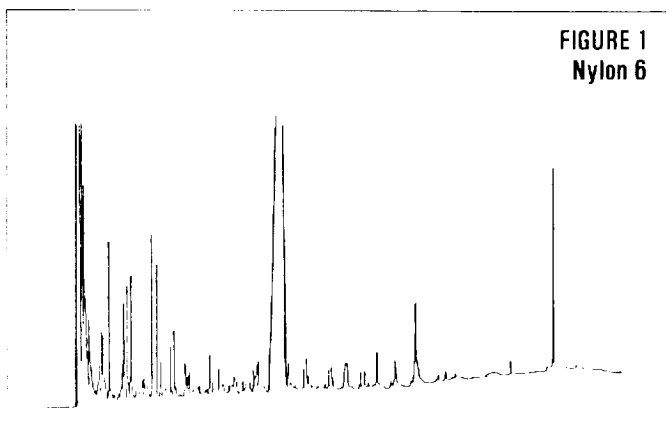
Aliphatic polyamides have had extensive use in industry in the form of fibers and plastics. Synthetic polyamides known as Nylons are used throughout the world. Since Nylons do not show appreciable volatility at normal GC temperatures, a more intense thermal treatment is necessary for their analysis by GC. Pyrolysis gas chromatography is a method which volatil-

izes these hard polyamides. The sample is rapidly heated in order to cleave the polymer linkages and produce smaller, more volatile molecules which are readily analyzed by gas chromatography.

Nylons are classified into two categories according to the manner in which they are composed. Nylon 6 and Nylon 12 (Figures 1 and 2) are Ω -amino-

carboxylic acid type Nylons, whereas, Nylon 6/12 and Nylon 6/T (Figures 3 and 4) are diamine-dicarboxylic acid type Nylons. When pyrolyzed, polyamides fragment to form mononitriles, amides, mononitriles containing one amide group, and hydrocarbons. The primary product in the pyrolysis of Nylon 6 is Σ -caprolactam,

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formed by the cleavage of the C-N bond in the polymer backbone. Nylon 12 pyrolyzes to give mostly mononitrile pyrolysates.

The chromatogram of Nylon 6/12 (Figure 3) shows an abundance of a dinitrile at a relatively late retention time. The remainder of the chromatogram shows many doublets corresponding to the presence of mononitriles.

Nylon 6/T is distinguished from Nylon 6/12 in that Nylon 6/T forms aromatic nitriles when pyrolyzed which are generated from the terephthalamide portion of the polymer chain.

The reaction of Nylon to the thermal treatment of pyrolysis makes the qualitative identification of Nylon samples quick and easy by generating a reproduc-

ible fingerprint for each particular Nylon. Pyrolysis can also be used quantitatively in the analysis of Nylons in a number of different matrices. A wealth of information can be gathered about Nylon samples using pyrolysis gas chromatography.

EQUIPMENT

PYROLYSIS

CDS Model 120 Pyroprobe

Pyrolysis temperature: 850°C

Interface temperature: 285°C

GAS CHROMATOGRAPHY

Column: 50m x .025mm,

fused silica capillary, SE-54

Initial temperature: 50°C for 3 minutes

Program rate: 8°C/minute to 285°C

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

Huffman, F. and L. Peebles. *Journal of Polymer Science, A-1*, 9:1807, (1971).

Nagaya, T. et al. Studies on thermal degradation of aliphatic polyamides by pyrolysis glass capillary gas chromatography.

Journal of Analytical Applied Pyrolysis, 4, 117-131, (1982).

Smith, S. *Journal of Polymer Science*, 30:459, (1958).

Additional literature may be obtained from your Chemical Data Systems representative, or by writing to the CDS Applications Lab.

ABOUT CDS

CDS Analytical, Inc. is a leader in the design and manufacture of laboratory instruments for sample preparation and analysis. With 25 years experience in the field, CDS is dedicated to providing the best possible instruments for both research and routine analysis. Well known in the field of analytical pyrolysis, CDS manufactures the Pyroprobe 1000 and 2000 for the introduction and analysis of solid materials by GC, MS and FT-IR. CDS offers a complete line of purge and trap instruments for the analysis of volatile organic compounds in the environmental, food and pharmaceutical areas, as well as custom systems for complex, multicomponent materials investigation. Our customers, their requirements and applications are important to us. To help meet their needs, we offer a wide range of analytical information and the services of our applications laboratory. If you would like additional information, please contact us at the address below, or call us at 1 800 541 6593.

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