Analytical Pyrolysis of Surfactants

Application Note
Surfactants

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Surfactants have long since been used by industry and society as a whole. With increasing environmental concern about the world's water supply, the analysis of water for solvents and other pollutants is becoming more and more essential. Volatile organic compounds are easily analyzed by purge and trap analysis of aqueous samples, however, there are still other pollutants which have a higher affinity for water and can't be liberated by this method. Surfactants are a group of pollutants which fit into this classification. In this case dynamic headspace and pyrolysis can be used to facilitate surfactant analysis.

There is a wide range of active agents within the general group of surfactants. Some surfactants are anionic, cationic or nonionic. Figures 1 and 2 show the use of dynamic headspace and pyrolysis respectively in the analysis of a cationic surfactant. The dynamic headspace chromatogram displays the solvents and fragrances which are liberated from the sample when it is heated to 200°C for 10 minutes. Having been stripped of the solvents, fragrances and water, only the higher boiling components remain. Upon pyrolysis at 750°C for 10 seconds, both qualitative and quantitative information can be obtained about the surfactant.

In this case the surfactant was an n-alkyl dimethyl (benzyl and ethyl benzyl) ammonium chloride. The Alkyl groups were composed of n-C12, 14, 15 & 1s. From this pyrolysis, certain key peaks can be identified. Fragments containing n-C12, n-C14, n-C16 and n-C1s are observed while there are small amounts of benzene and ethyl benzene.

The presence of a high ratio of straight chain hydrocarbons to benzene or ethyl benzene indicates the increased bond stability due to the presence of the alkyl group. Thus the alkyl groups are preferentially cleaved. Dynamic headspace and pyrolysis can be seen as an informative method in the analysis of surfactants of all types. The fragmentation patterns generated upon pyrolysis will provide structural detail as well as quantitative data.

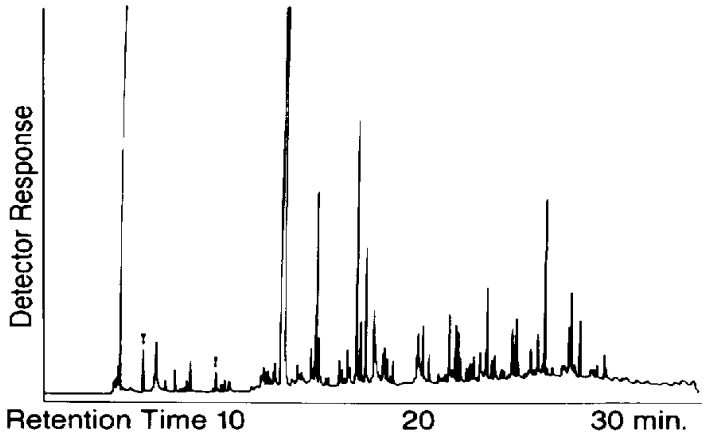

Figure 1. Dynamic Headspace of Bathroom Cleaner, 200°C for 10 minutes.

Instrument Conditions
Pyroprobe

Desorption:	200°C for 10 minutes
Pyrolysis:	750°C for 10 seconds
Interface:	300°C
Cryofocus:	-100°C

GC-FID

Column:	50 x 0.25mm SE-54
Injector:	300°C
Carrier:	Helium
Oven:	40°C for 2 minutes then 8°C/min to 290°C

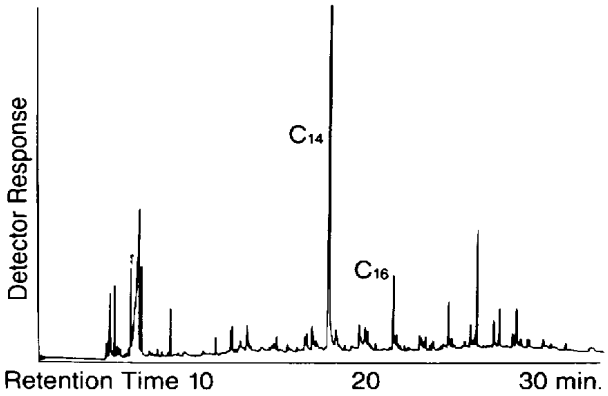

Figure 2. Pyrolysis of Bathroom Cleaner after Headspace Analysis

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

Tsuge, S., Sugimura, Y, and Nagaya, T, J. Appl. Anal. Pyrol., 1, 221-229 (1980).

Audisio, G., and Baja, G.,Makromol. Chem., 176, 991-998(1975).