PYROLYSIS

EFFECTS OF INCREASING PYROLYSIS TEMPERATURE ON THE BREAKDOWN OF N-BUTYLBENZENE

INTRODUCTION

An SGE Pyrojector system was used to study the pyrolysis products of n-butylbenzene. The n-butylnezene was dissolved in pentane and analysed using a range of pyrolysis temperatures.

DESCRIPTION AND COMMENTS

The SGE Pyrojector involves a heated chamber into which a sample is introduced, vapourised and pyrolysed. A flow of carrier gas is maintained through the pyrolysis chamber and then to the head of the capillary column. A splitter system was used so only a fraction of the sample was transferred onto the column, while the remainder was allowed to vent.

The flow through the pyrolysis chamber is controlled by a pressure differential between the head of the pyrolysis chamber and the head of the column. The greater the pressure differential the greater the flow through chamber.

The rate at which the sample travels through the pyrolysis chamber (transit time) may directly affect the extent of pyrolysis, i.e. the shorter the transit time, the lower the time during which the sample is subjected to the pyrolysis temperature. Pyrolysis may not occur if the transit time is too short. On the other hand, if the transit time is too long, secondary pyrolysis may occur. Peak broadening due to slow sampling onto the column may also result from low flow rates (long transit times).

A pressure differential of 2 psi was set between the head of the pyrolysis unit (7 psi) and the head of the column (5 psi).

DISCUSSION

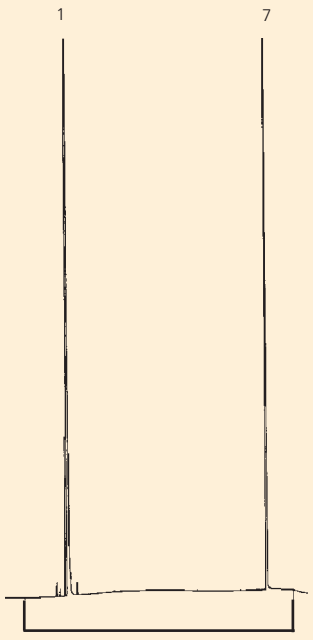
These results, together with those obtained in other studies, indicate that;

- Pyrolysis of liquids and solids can be studied simply and effectively. A high level of resolution and reproducibility is easily attainable.
- The degree of pyrolysis increases as the temperature increases as indicated by pyrograms 1-4.

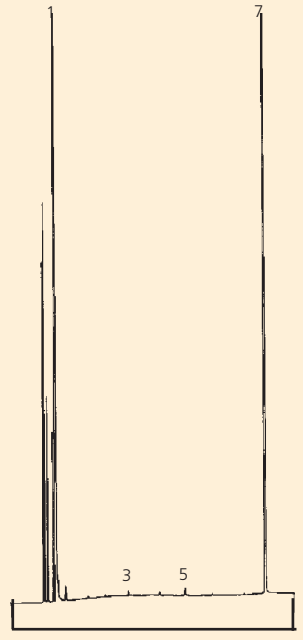
INSTRUMENTATION AND CONDITIONS

Pyrolysis Temperature:	600°C-900°C
Phase:	BP1, 0.5µm film
Column:	25 metres x 0.32 mm ID
	Initial Temperature: 40°C for 1 minute
Program Rate:	10°C/min
Final Temperature:	130°C for 1 minute
Detector:	Flame ionization
Carrier Gas:	Hydrogen
Linear Carrier Velocity:	35 cm/sec. at 40°C
Split Ratio:	100:1
Injection Mode:	Pyrolysis split
Sensitivity:	256 x 10^{-12} AFS
Sample:	n-Butylbenzene in pentane (2.5% v/v)
Injection Volume:	0.4µL
Pressure Differential:	2 psi

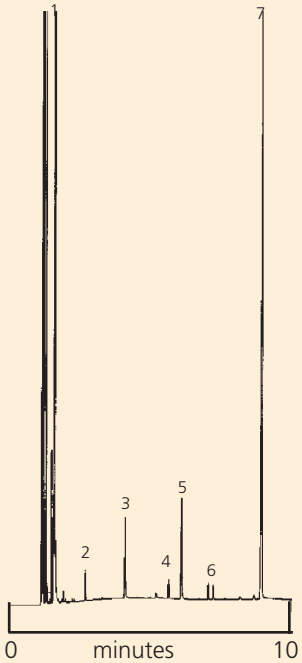
PYROGRAM 1.
Pyrolysis Temperature 600°C



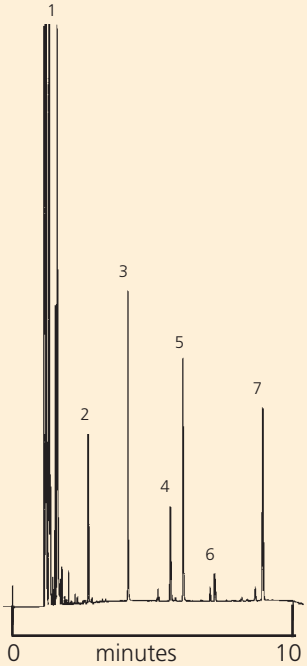
PYROGRAM 2.
Pyrolysis Temperature 700°C



PYROGRAM 3.
Pyrolysis Temperature 800°C



PYROGRAM 4.
Pyrolysis Temperature 900°C



- Transit times within the pyrolysis chamber (under the standard conditions listed above) are sufficient to achieve primary and secondary pyrolysis which can be controlled by the temperature setting. This is exemplified by the pyrograms obtained at 800°C and 900°C. At 800°C there is a pattern of pyrolysis products at which 900°C is not reproduced in the same ratio. Peak 5 (styrene), at 900°C has decreased relative to the other major pyrolysis products, indicating secondary pyrolysis.

- There is no loss of peak shape or resolution over a wide range of temperatures, as shown in pyrograms 1-4.

- It is possible to observe rearrangement reactions as indicated by the presence of styrene (peak 5) in the breakdown (pyrolysis) of n-butyl benzene.

Components	
1.Pentane	4. Ethylbenzene
2.Benzene	5.Styrene
3.Toluene	6.n-Propylbenzene
	7.n-Butylbenzene

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