

Brominated Flame Retardants in a Polycarbonate

Halogenated organic compounds are frequently added to polymers as flame retardants, especially in when they are used in furniture and electronics applications. Typical assays may include extraction of the additives with a solvent, but these additives are generally present in sufficient levels to be detected by thermal sampling means, including pyrolysis. Careful selection of temperature permits the delivery of the halogenated compounds to the column without dilution encountered with extractions.

The polycarbonate shown here was formulated with brominated bisphenol A as a flame retardant. When the polymer is pyrolyzed, as in Figure 1, brominated organics are seen in the pyrolysate, along with compounds from the polymer itself. The very large peaks for phenol at 7.5 minutes, cresol at 9 minutes and bisphenol A at 22.5 minutes are indicative of the polymer matrix itself. Within the pyrogram, however, are several brominated compounds which come from the flame retardant, including dibromophenols and brominated bisphenol A.

If the polycarbonate is heated to only 400°C instead of 600°C, the resulting chromatogram is simpler, the brominated compounds are less degraded and easier to see. Figure 2 shows that considerable bisphenol A is still produced from the polycarbonate itself under these conditions, as are some smaller phenolics, including 4-(1-Methyl-1-phenylethyl)-phenol, which elutes at 19 minutes.

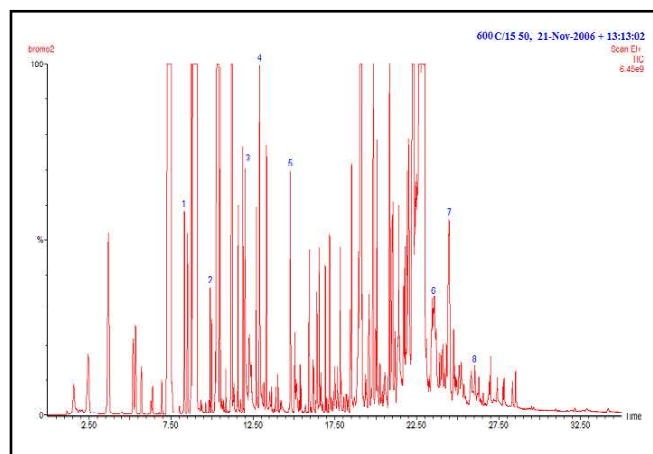


Figure 1. Polycarbonate at 600°C.

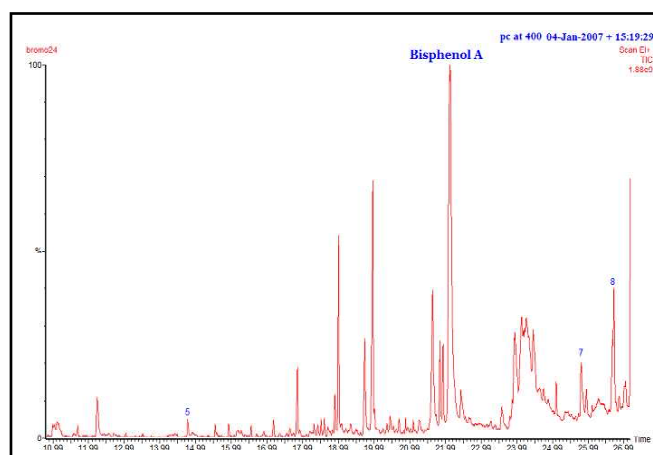


Figure 2. Polycarbonate at 400°C.

Table I. Peak Identification

1. Bromotoluene
2. Bromo-4-ethylbenzene
3. 4-Bromophenol
4. 2,4-Dibromophenol
5. 2,6-Dibromocresol
6. Bromobisphenol A
7. Dibromobisphenol A
8. Tribromobisphenol A

Equipment

These samples were analyzed using a CDS Model 5200 Pyroprobe, interfaced to a Clarus 500 gas chromatograph/mass spectrometer.

Model 5200 Conditions

Valve Oven: 300°C
Transfer Line: 325°C
Temperature: 750°
Time: 15 seconds
Trap: Tenax
Trap Desorb: 300°C for 4 minutes

GC Conditions

Carrier: Helium
Column: Rxi-5ms (30m X 0.25mm)
Detector: Clarus 500 MS

GC Program:
Initial: 40°C for 2 minutes
Ramp: 10°C/min.
Final: 300°C

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

M. P. Di Cortemiglia, G. Camino and L. Costa, Mechanism of action and pyrolysis of brominated fire retardants in acrylonitrile-butadiene-styrene polymers, J. Anal. Appl. Pyrolysis, 11 (1987) 511-526.

Additional literature on this and related applications may be obtained by contacting your local CDS Analytical representative, or directly from CDS at the address below.

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