Brominated Flame Retardants in a Polycarbonate

Application Note
Environment

Author:

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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 pyolyzed, 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.

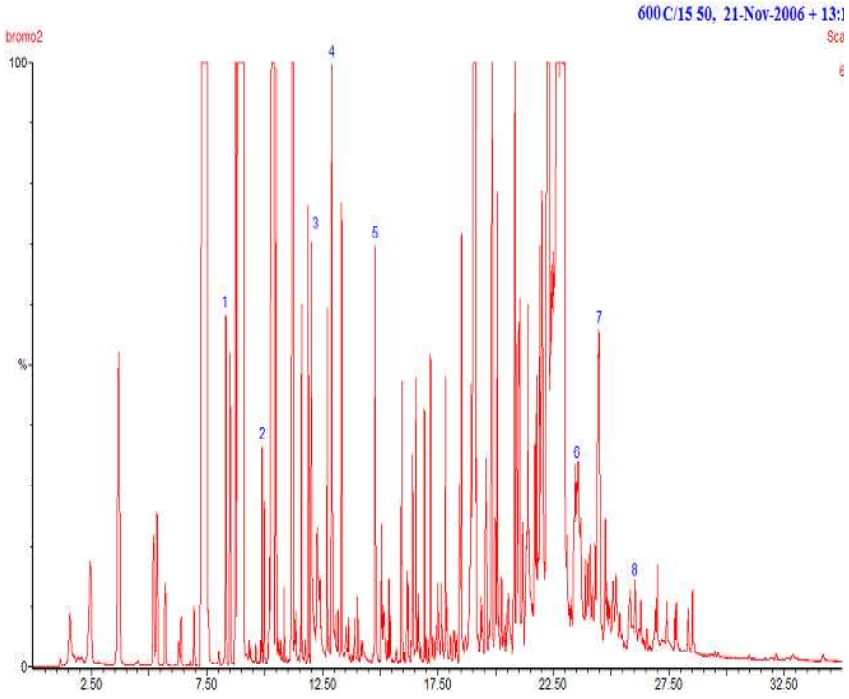

Figure 1. Polycarbonate at 600°C.

Instrument Conditions
Pyroprobe

Pyrolysis: 400°C, 600°C

Valve Oven: 300°C
Transfer Line: 325°C

GC/MS

Column: 5% phenyl (30m x 0.25mm)
Carrier: Helium, 50:1 split
Injector: 300°C
Oven: 40°C for 2 minutes
10°C/min to 300°C
Mass Range: 35-550

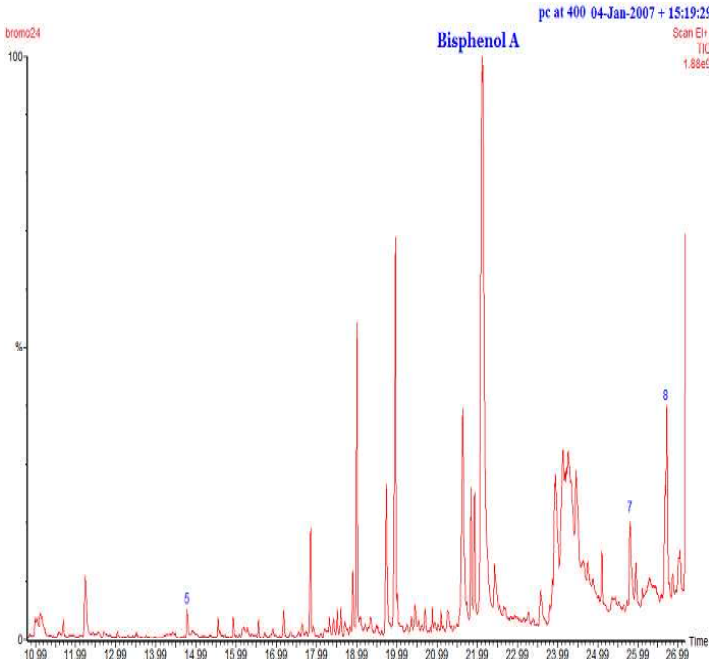

Figure 2. Polycarbonate at 400°C.

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

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.