Analysis of brominated flame retardants in a waste plastic using thermal desorption (TD)-GC/MS - Part 1 Qualitative analysis

[Background] Recycling of plastic wastes is an increasing social concern as a method of reducing negative environmental impact and resource depletion. During the reprocessing of plastic wastes, the recycled plastics may be contaminated by originally formulated additives such as brominated flame retardants (BFRs), and some of them are restricted by the RoHS Directive (2011/65/EU). In this report, a waste plastic foam (Fig. 1) was analyzed by TD-GC/MS to detect BFRs.

[Experimental] TD experiments were carried out using a pyrolysis-GC/MS system with a Multi-Shot Pyrolyzer (EGA/PY-3030D) directly interfaced to the GC injector. Sample was cut into thin slices which were placed in a sample cup. The sample cup was free-fallen into the furnace and subsequently heated to 350ºC. The thermally desorbed components were once cryo-trapped by a MicroJet Cryo-Trap (MJT-1035E) at the head of a separation column, then sent to the separation column by a He carrier gas and detected by the mass spectrometer.

[Results] A TD chromatogram of the sample and the 50-fold expanded chromatogram are shown in Fig.1. Peaks for styrene oligomers were easily recognized. Also, six brominated compounds, including tetrabromobisphenol A (TBBPA), a general-purpose BFR, were observed. In addition, various brominated compounds, that were formed during the TD process or recycling process of the waste plastic containing BFRs, were observed. The quantitative analysis of TBBPA contained in the sample is described in Technical Note PYA1-096E.

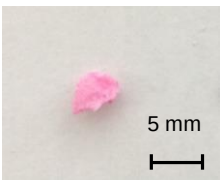

Fig. 1 Waste plastic foam

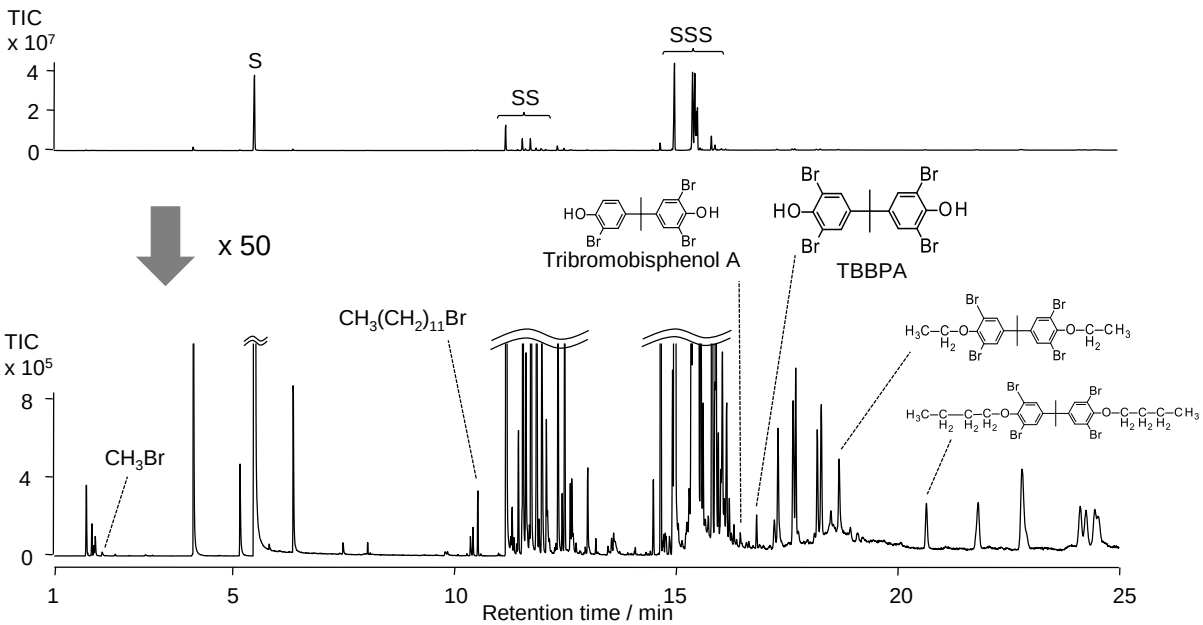

Fig. 2 TD chromatograms of sample

Py furnace temp.: 177 – 350ºC (2 min hold, 70 ºC/min), Separation column: UA+-5 (5% diphenyl 95% dimethylpolysiloxane, *L*=30 m, i.d.=0.25 mm, df=0.25 µm), Column flow rate: 1 mL/min (He), Split ratio: 1/20, GC oven temp.: 40 (2 min) – 320ºC (10 min hold, 20 ºC/min), Sample amount: ca.1 mg,
Thermally desorbed components were cryo-trapped using MicroJet Cryo-Trap. S, SS, and SSS represent monomer, dimer, and trimer of styrene, respectively.

Keywords : Recycled polymer, Thermal desorption-GC/MS, Polystyrene, Brominated flame retardant

Products used : Multi-functional pyrolyzer, Auto-Shot Sampler, MicroJet Cryo-Trap, Vent-free GC/MS adapter, UA+-5, Eco-Cup LF

Applications : General polymer analysis, Quality assurance

Related technical notes : PYA1-096E, PYA1-052E

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