Analysis of a plastic bag containing calcium carbonate
Part 2: Pyrolysis (Py)-GC/MS and thermal desorption (TD)-GC/MS

[**Background**] In the previous note (PYA3-040E), evolved gas analysis (EGA)-MS of a shopping bag made of calcium carbonate and thermoplastics was reported (Fig. 1). In this note, the qualitative analysis of polymer types by pyrolysis (Py)-GC/MS and qualitative and quantitative analysis of additives by thermal desorption (TD)-GC/MS were conducted.

[**Experimental**] A Py-GC/MS system with a Multi-Shot Pyrolyzer (EGA/PY-3030D) directly interfaced with the GC inlet was used for the measurements. A freeze-ground shopping bag was used as a sample and placed in an Eco-Cup LF. For pyrolysis, the sample was introduced into the pyrolyzer furnace heated at 600 ºC for flash pyrolysis to obtain a pyrogram. For thermal desorption, volatiles were cryo-trapped using a MicroJet Cryo-Trap, and the trapped compounds were separated and analyzed to obtain a TD chromatogram. The additive of Irgafos 168 was determined by the standard addition method.

[**Results**] The pyrogram obtained from the flash pyrolysis of the sample is shown in Fig. 2 (a). The profile of the pyrogram indicates that the main component is polyethylene. TD chromatogram shown in Fig. 2 (b) indicates the presence of additives such as stearate metal salt, antioxidant, and polyethylene wax. Assuming that Irgafos168 undergoes the same reaction in TD-GC/MS as its oxide does, the quantification of Irgafos168 was conducted by the standard addition method, and the quantified value was 196 ppm.

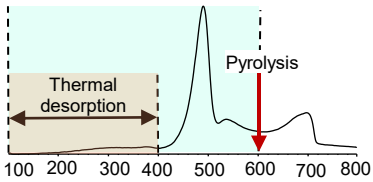

Fig. 1 EGA thermogram of sample

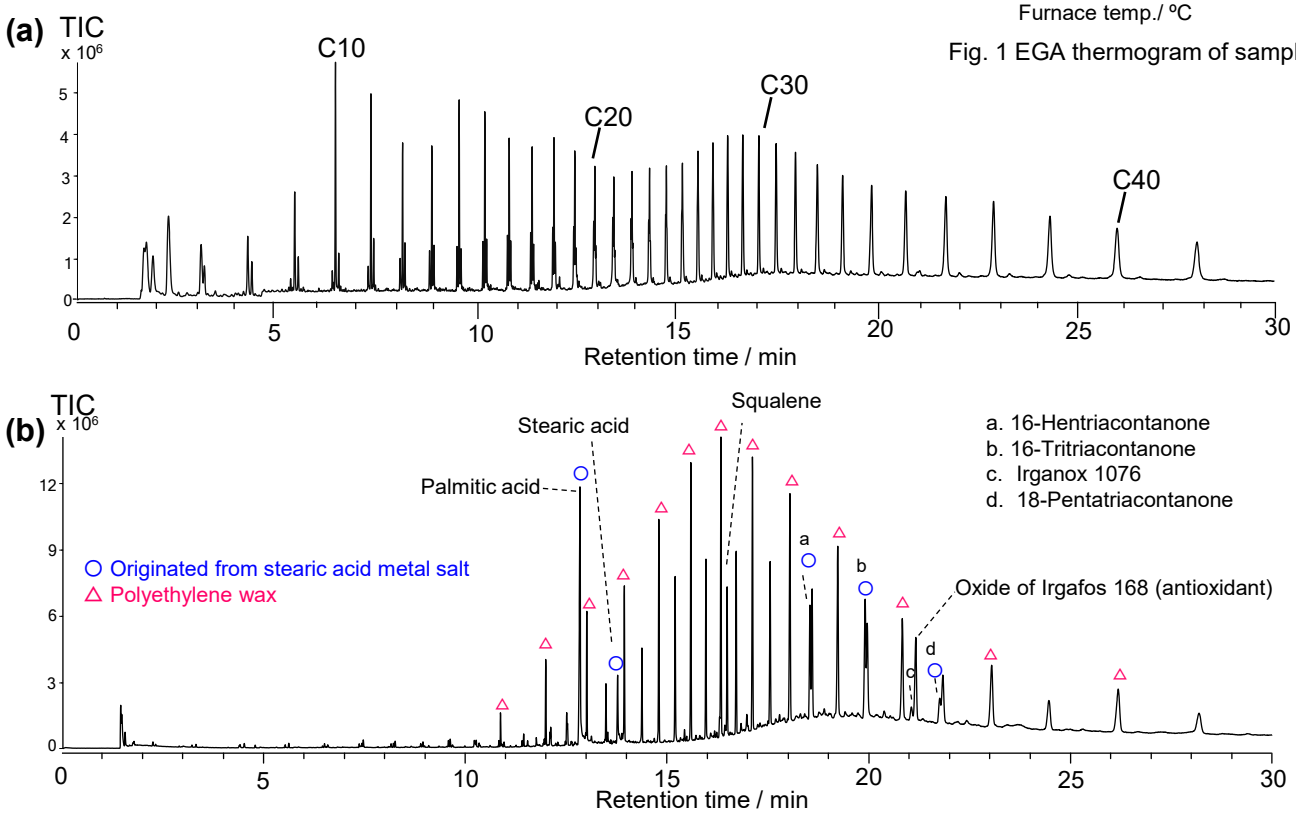

Fig. 2 (a) Pyrogram and (b) TD chromatogram of a sample

Furnace temp.: 600 ºC, Thermal desorption temp.: 100 - 400 ºC (20 ºC/min), GC injector temp.: 300 ºC
GC oven temp.: 40 (2 min hold) - 320 ºC (20 ºC/min), Split ratio: 1/100 (pyrolysis), 1/20 (thermal desorption)
Separation column: UA⁺-5 (5 % diphenyl 95 % dimethylpolysiloxane), *L*=30 m, i.d.=0.25 mm, df=0.25 µm
Column flow rate: 1.0 mL/min (He), MS scan range: *m/z* 29 – 800, Sample amount: 0.193 mg (pyrolysis), 1.108 mg (thermal desorption)

Keywords : Py-GC/MS, TD-GC/MS, Calcium carbonate, Limestone, Shopping bag

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

Applications : General polymer analysis

Related technical notes : PYA3-040E, PYA3-028E, PYA3-029E, PYA1-119E, PYA1-120E, PYA1-121E

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