

Analysis of a Biodegradable Plastic Bag

Part 2: Pyrolysis (Py)-GC/MS and Thermal desorption (TD)-GC/MS

[Background] In the previous note (PYA3-029E), the results on evolved gas analysis (EGA)-MS were reported for the analysis of a biodegradable plastic shopping bag. This note reports identification of polymers in the biodegradable plastic bag by using pyrolysis (Py)-GC/MS. Identification and quantification of an additive are also reported using thermal desorption (TD)-GC/MS.

[Experimental] All measurements were done using a GC/MS system with a Multi-Shot Pyrolyzer (EGA/PY-3030D) which was directly interfaced with the GC injector. A part of a plastic shopping bag was cut into small pieces using a utility knife and was placed in an Eco-Cup LF as a sample. For pyrolysis, the sample was introduced into the pyrolyzer furnace preheated at 550 °C, and a pyrogram was obtained. In TD measurement, the volatile components were temporarily cryo-trapped using a MicroJet Cryo-Trap, and the trapped components were separated and analyzed by GC/MS to obtain a TD chromatogram. An additive, erucamide, was determined by the standard addition method.

[Results] The pyrogram of the sample is shown in Fig. 1 (a). The pyrolyzates of PBSA, PLA, and PBAT were detected. In particular, the presence of a characteristic pyrolyzate Peak e, which contains both succinic acid and adipic acid, indicates the existence of a PBSA copolymer. The TD chromatogram is shown in Fig. 1 (b). Oligomers of PBSA and additive erucamide were detected. The content of erucamide was determined to be 705 ppm by the standard addition method.

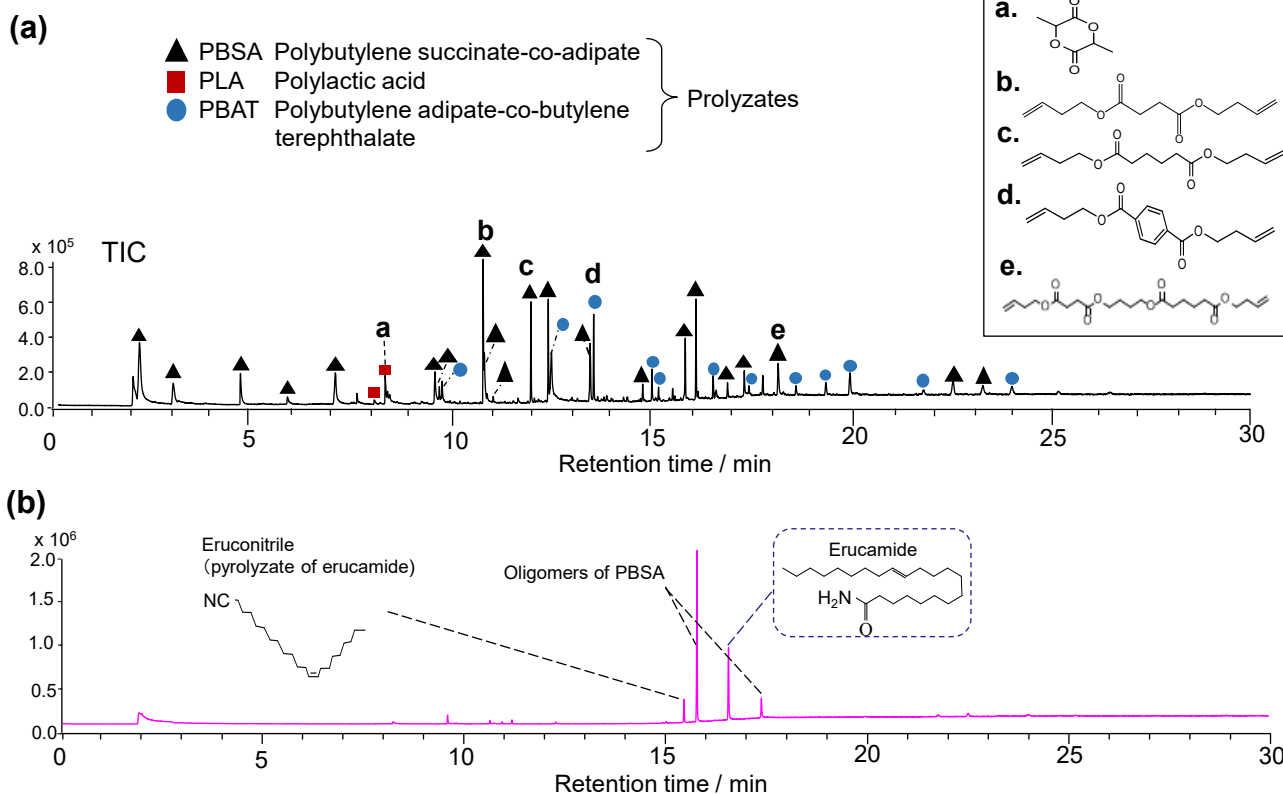


Fig. 1 (a) Pyrogram and (b) TD chromatogram of a biodegradable plastic sample

Furnace temp.: 550 °C, Thermal desorption temp.: 100 - 300 °C (40 °C/min), GC injector temp.: 300 °C
GC oven temp.: 40 °C (2 min hold) - 320 °C (20 °C/min), Split ratio: 1/100
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 - 600, Sample amount: 200 μg (pyrolysis), 100 μg (TD)

Keywords : Py-GC/MS, TD-GC/MS, Plastic bag, Biodegradable plastic

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

Applications : Biodegradable plastics, General polymer analysis

Related technical notes : PYA3-029E (Part 1)

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