Analysis of a Biodegradable Plastic Bag

Part 1: Evolved Gas Analysis (EGA)-MS

[Background] Biodegradable plastics are plastics that fully decompose to naturally existing small molecules through the actions of living microorganisms and enzymes. The use of biodegradable plastics will contribute to sustainability and reduction of the environmental impact associated with disposal of petroleum-based plastics. This note reports the analysis of a commercially available biodegradable plastic shopping bag (Fig. 1) by evolved gas analysis (EGA)-MS.

[Experimental] The unprinted part of a biodegradable plastic bag was cut into small pieces using a utility knife and was placed in an Eco-Cup LF as a sample. The analysis was done using a GC/MS system with a Multi-Shot Pyrolyzer (EGA/PY-3030D) which was directly interfaced with the GC injector. A deactivated metal tube (UADTM-2.5N) was used to connect the GC injector to the MS detector. EGA thermogram was obtained by EGA-MS measurement.

[Results] In the EGA thermogram shown in Fig. 2 (a), a broad peak at 420 ºC was observed. The EGA thermogram is divided into three zones, and the averaged mass spectra of Zones B and C are respectively shown in Fig. 2 (b) and (c). The averaged mass spectrum of Zone B is similar to the mass spectrum of PLA standard; therefore, species in Zone B is ascribed to PLA. Major peaks in the mass spectrum of Zone C correspond to those of PBSA and PBT as shown in Fig. 2 (c). However, the prominent peak at *m/z* 73 in PBSA is absent, and further investigation is required.

Fig. 1 Plastic bag and enlarged view of logo

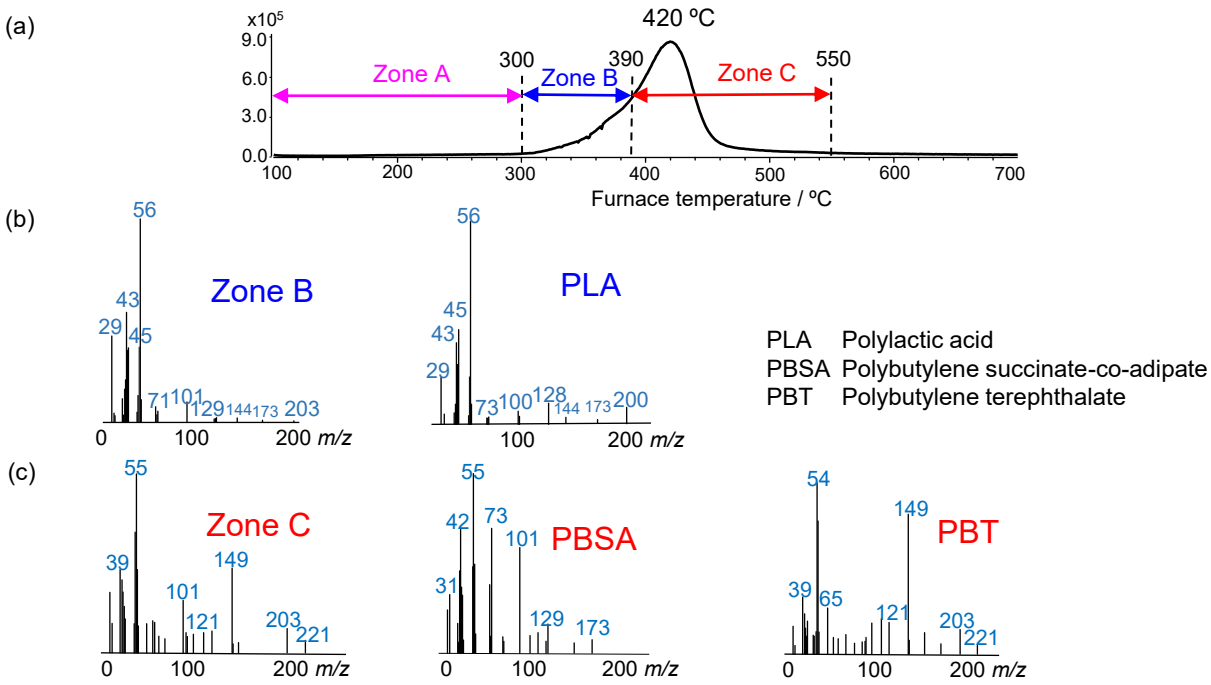

Fig. 2 (a) Thermogram of the sample, (b) Mass spectra of Zone B and PLA, (c) Mass spectra of Zone C and PBT and PBSA

Py furnace temp.: 100 – 700 ºC (20 ºC/min), GC inj. temp.: 300 ºC, GC oven temp.: 300 ºC
Split ratio: 1/50, EGA tube: deactivated metal capillary tube (*L*=2.5 m, i.d.= 0.15 mm)
Column flow rate: 1.0 mL/min (He), MS scan range: *m/z* 29 – 550, Sample amount: 200 µg

Keywords : EGA-MS, Biodegradable plastic, Shopping bag

Products used : Multi-functional Pyrolyzer, Eco-Cup LF, UADTM-2.5N, Vent-free GC/MS adapter, F-Search

Applications : Biodegradable plastics industry, General polymer analysis

Related technical notes : PYA1-121E

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Frontier Laboratories Ltd.
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