

Compositional analysis of LDPE collected from household waste - Part 2: Sorted household waste plastic -

[Background] In the previous technical note (PYA1-168E), low-density polyethylene (LDPE) household waste, without sorting by quality, was analyzed to identify LDPE, non-LDPE polymers, additives, and other contaminants. In this note, LDPE wastes sorted for recycling purposes were analyzed as before by thermal desorption (TD)-GC/MS and pyrolysis (Py)-GC/MS.

[Experimental] Plastics sorted as recyclable LDPE were cryo-milled, and the resulting powder was analyzed by TD-GC/MS and Py-GC/MS.

[Results] The TD chromatogram (Fig. 1) showed not only the presence of low molecular weight compounds such as acetic acid, fatty acids and saturated hydrocarbons, but also peaks derived from polystyrene (PS). On the other hand, the pyrogram (Fig. 2) showed mainly PE-derived peaks, but PS- and polypropylene (PP)-derived peaks were also observed. These results indicate that even LDPE sorted for recycling contains various additives, contaminants, and other polymers.

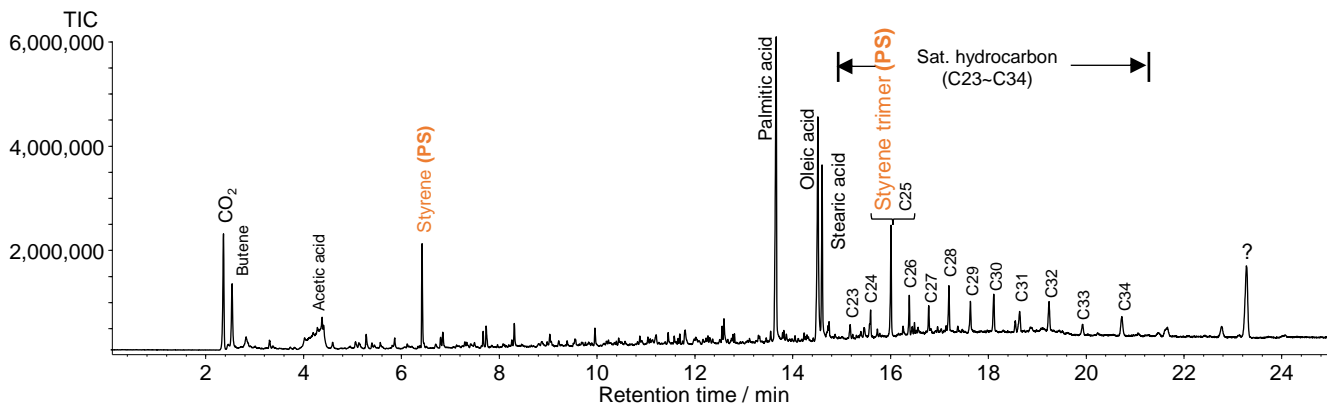


Fig. 1 TD chromatogram of sorted household waste LDPE.

Furnace temp.: 100 - 400 °C (40 °C/min, 1 min hold), ITF temp.: 300 °C, GC Inj. temp.: 300 °C, separation column: UA⁺-5 (5 % diphenyl-95 % dimethylpolysiloxane; L=30 m, i.d.=0.25 mm, df=0.25 µm), GC oven temp.: 40 (2 min hold) - 20 °C/min - 320 °C (14 min hold), split ratio: 1/5, column flow rate: 1 mL/min, GC/MS ITF temp.: 300 °C, MS scan range: m/z 29 - 600, MS scan speed: 4 scan/s, Sample amount: 1,000 µg.

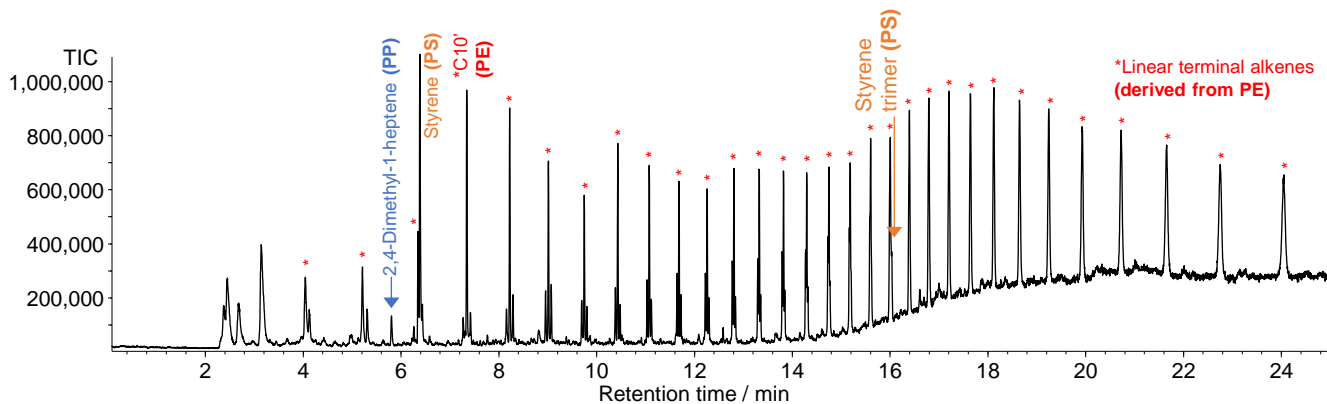


Fig. 2 Pyrogram of sorted household waste LDPE.

Furnace temp.: 600 °C, ITF temp.: 300 °C, GC Inj. temp.: 300 °C, Separation column: UA⁺-5 (5 % diphenyl-95 % dimethylpolysiloxane; L=30 m, i.d.=0.25 mm, df=0.25 µm), GC oven temp.: 40 (2 min hold) - 20 °C/min - 320 °C (14 min hold), Split ratio: 1/100, Column flow rate: 1 mL/min, GC/MS ITF temp.: 300 °C, MS scan range: m/z 29 - 600, MS scan speed: 4 scan/s, Sample amount: 100 µg.

Sample provided by Dr. Frank Malz, The Fraunhofer Society, Germany.

Keywords : Low-density polyethylene (LDPE), Sorting of plastic waste, Recycled plastics, TD-GC/MS, Py-GC/MS

Products used : Multi-Shot Pyrolyzer, Auto-Shot sampler, MicroJet Cryo-Trap, UA⁺-5, Eco-cup LF, Vent-free GC/MS adapter, F-Search, Cryogenic Mill (IQ MILL-2070)

Applications : Environmental analysis, Material recycling, General polymer analysis

Related technical notes : [PYA1-168E \(Part 1\)](#)

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