

Analysis of yellowing of a polyvinyl chloride sheet

Part 2: Heart-cut EGA-GC/MS

[Background] Part 1 (PYA3-021E) shows the analysis of white and yellowed surfaces of a polyvinyl chloride (PVC) sheet using evolved gas analysis MS (EGA-MS). This technical note describes the heart cut EGA-GC/MS (HC/EGA-GC/MS) analysis of the volatile fraction of the white and yellowed surfaces of the PVC sheet used in Part 1.

[Experimental] The sample and the analytical system used were identical to those described in Part 1, except that the EGA tube was replaced with a separation column (UA⁺-5). After the sample was introduced to the pyrolyzer furnace, the furnace was heated from 100 to 220°C at a ramp rate of 20 °C/min [inset]. Gases evolving from the sample as the temperature increases are cryo-trapped at the head of the separation column using a MicroJet Cryo-Trap. Trapped gases were separated and analyzed by GC/MS.

[Results] Chromatograms of the yellowed and white surfaces are shown in Fig. 1. HCl is only present in the yellowed surface. Peaks, thought to be thermal degradation products of a heat stabilizer, methyltin mercaptide, are observed in both chromatograms; however, they differ in relative peak intensities. These results show that the degree of degradation and the subsequent reduction in the concentration of the heat stabilizer is much greater for the yellowed-surface sample due to the “low temperature” elimination of HCl from the PVC polymer backbone.

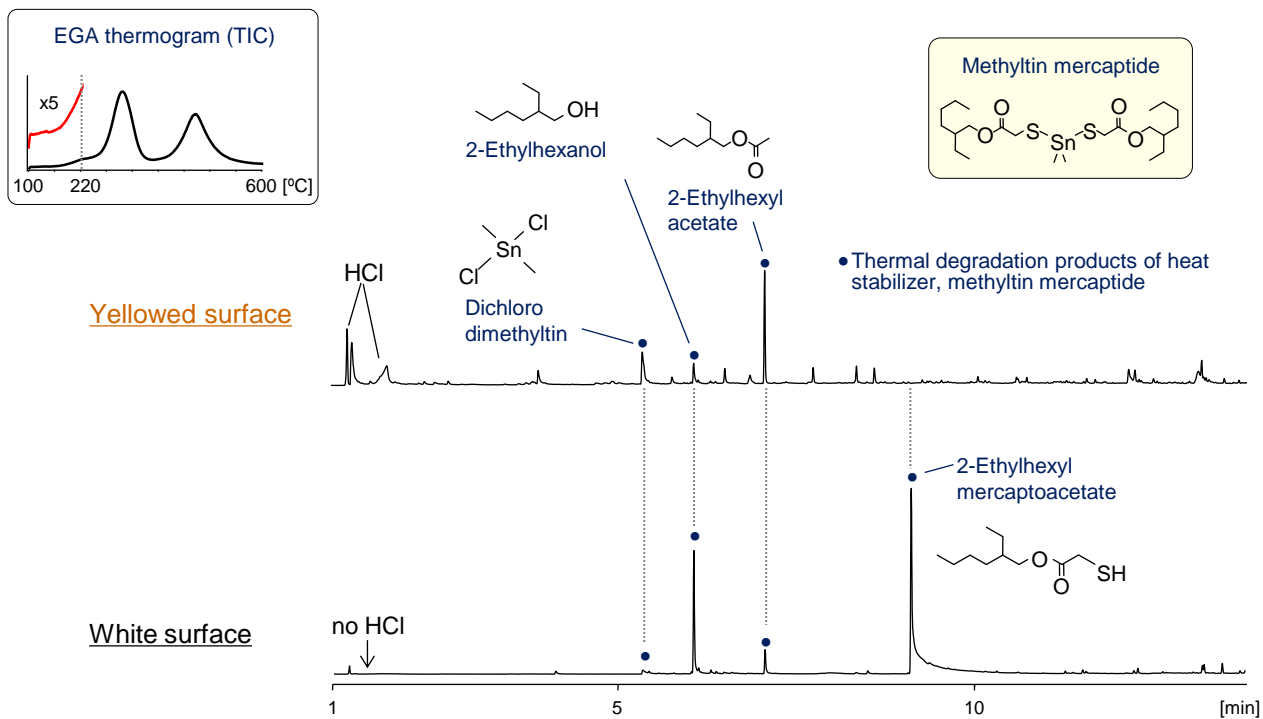


Fig. 1 Chromatograms of Zone 100-220°C obtained by HC/EGA-GC/MS

Sample wt.: 0.45 mg, furnace temp.: 100 – 220°C (20 °C/min), Cryo trapping by MicroJet Cryo-Trap, Separation column: UA⁺-5 (5% diphenyl 95% dimethylpolysiloxane, L=30 m, i.d.=0.25 mm, df=0.25 mm), Column flow rate: 1 mL/min, Split ratio: 1/20, GC oven temp.: 40°C (2 min hold) - 20 °C/min – 320°C (10 min hold)

Keywords : Polyvinyl chloride (PVC), Heart-cut analysis, Yellowing, degradation, additives

Product used : Multi-functional pyrolyzer, Auto-Shot Sampler, UA⁺-5, Eco-Cup LF, MicroJet Cryo-Trap, F-Search

Applications : Polymer analysis, degradation analysis

Related technical notes : [PYA3-021E](#)

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