Composition analysis of coal tar by thermal desorption GC/MS
Part 1: Evolved gas analysis (EGA)-MS

[**Background**] Coal tar is an oily substance obtained by high-temperature carbonization of coal. It is composed of numerous compounds, including various aromatic compounds. It has been characterized by various physical property measurement methods and instrumental methods of analysis. This note describes a preliminary study on the composition analysis of coal tar by thermal desorption (TD)-GC/MS. First, evolved gas analysis (EGA)-MS measurements of two coal tar samples were carried out to determine the optimal furnace temperature for TD and to explore the compositions from the averaged mass spectra of the segmented temperature zones of the measured EGA curves.

[**Experimental**] A GC/MS system equipped with a Multi-Shot Pyrolyzer (EGA/PY-3030D) directly connected to the GC inlet was used for measurements. The GC inlet was connected to the mass detector through a deactivated metal tube (UADTM-2.5N) and a Vent-free GC/MS adapter. Two coal tar samples were obtained from different manufacturers, designated A and B. Approximately 0.5 mg of the coal tar sample was put in an Eco-Cup, and EGA-MS measurement was done.

[**Results**] Fig. 1 shows the EGA curves and 2-dimensional mass chromatograms of the two coal tar samples. As shown in Fig. 1, samples A and B show the peak temperatures at 113 ºC and 126 ºC in Zone A, and 204 ºC and 215 ºC in Zone B, respectively. From this result, clear differences were observed between the EGA curves of the two samples. Fig. 2 shows the averaged mass spectrum of Sample A in each temperature zone. Because the averaged mass spectra of the two samples were nearly identical, only the results for Sample A are shown in Fig. 2. The averaged mass spectra of Zones A, B, C, and D revealed the existence of naphthalene (molecular ion *m/z* 128), phenanthrene (molecular ion *m/z* 178) and pyrene (molecular ion *m/z* 202), benzopyrene (molecular ion *m/z* 252), and benzoperylene (molecular ion *m/z* 276), respectively, suggesting that each Zone contains polycyclic aromatic compounds. Since the most of evolved gases are released below 450 ºC for both samples, the next note will report on qualitative analysis of coal tar samples by TD-GC/MS at a furnace temperature of 450 ºC.

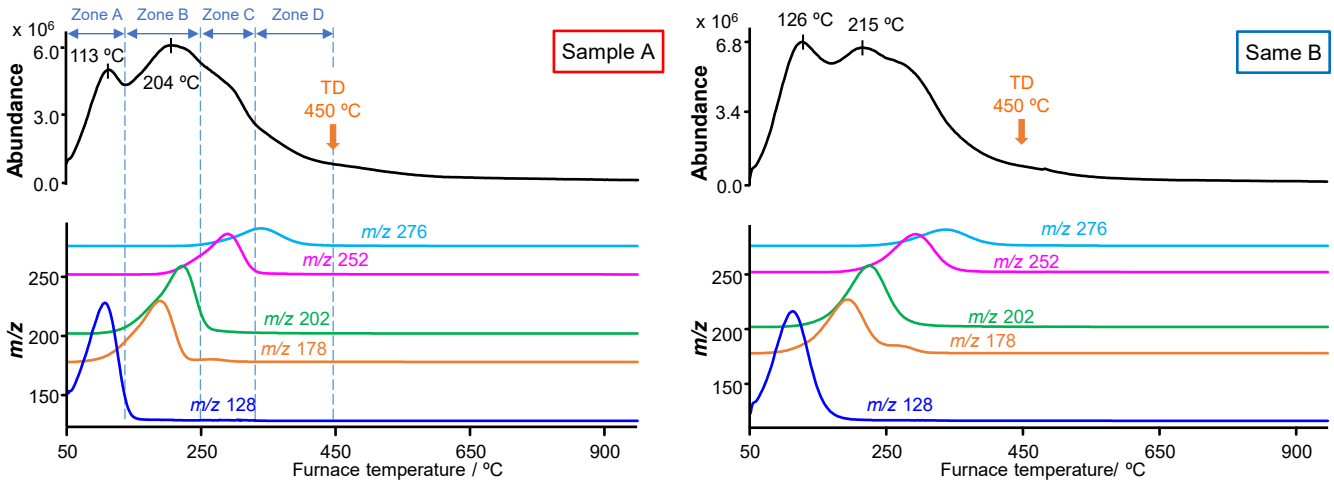

Fig. 1 EGA curves and 2-dimensional mass chromatograms of two coal tar samples from different manufacturers.

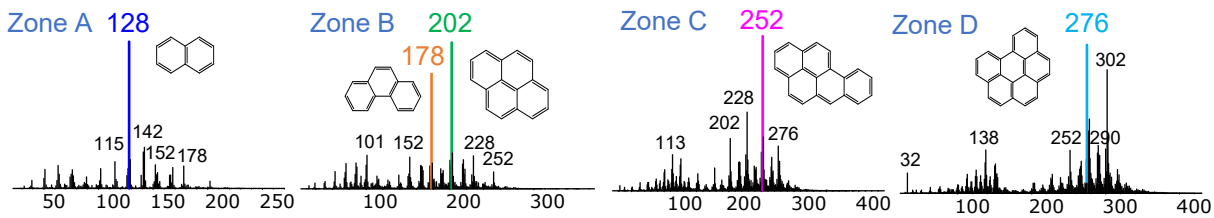

Fig. 2 Averaged mass spectra of Sample A for temperature zones of A to D.

Furnace temp.: 50 - 900 ºC (20 ºC/min), EGA tube: UADTM-2.5N (*L*=2.5 m, i.d.=0.15 mm), Tube flow rate: 1 mL/min (He), Split ratio: 1/50, GC oven temp.: 300 ºC, MS scan range: *m/z* 29 - 600, MS scan rate: ca. 0.2 scan/s, Amount of sample: ca. 0.5 mg.

Keywords :	Coal tar, Composition analysis, EGA-MS, Evolved gas analysis
Products used :	Multi-Shot Pyrolyzer, UADTM-2.5N, Eco-Cup LF, F-Search, Vent-free GC/MS adapter
Applications :	General polymer analysis
Related technical notes :	PYA1-183E (Part2)

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