

1.9 Analysis of kerosene (1) - GCMS

•Explanation

The primary products of petroleum - gasoline, kerosene, light oils etc – are hydrocarbon mixtures refined through distillation. A Gas Chromatography Mass Spectrometer (GCMS) is used for qualitative determination, since measurement by Gas Chromatography (GC) using a capillary column produces a large number of peaks.

Fig. 1.9.1 is the TIC of kerosene by a non-polar column (methyl silicon). Chemical compounds up to toluene can be seen because of the small amount of gasoline contained in this kerosene.

Fig. 1.9.2 is a TIC chromatogram by a polar column. This kerosene is standard and compounds up to C₈-paraffin are not contained. As shown in Fig. 1.9.3 (polar column), paraffin hydrocarbons from C₉ to C₁₆ are contained, with C₁₀ and C₁₁ as the main components. A lot of aromatic hydrocarbons are contained as well.

•Analytical Conditions

Model : Shimadzu GCMS-QP1000EX
 Column ① : CBJ1 0.25mm × 30m i.d. df=0.25µm
 Column Temp. : 40°C (2min)-220°C (5°C/min)
 Column ② : CBP20 0.25mm × 30m i.d. df=0.25µm
 Column Temp. : 80°C (2min)-5°C/min-150°C
 -15°C/min-200°C
 Carrier Gas : He 50kPa
 Injector Temp. : 300°C
 Interface Temp. : 200°C
 Split : 1 : 50

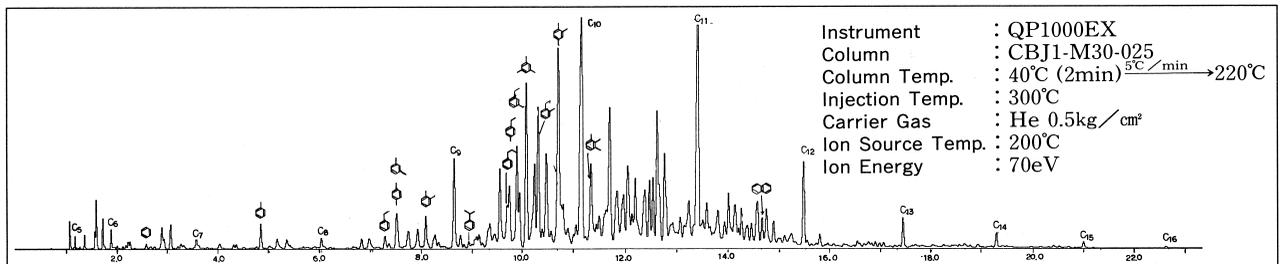


Fig. 1.9.1 TIC chromatogram by a non-polar column

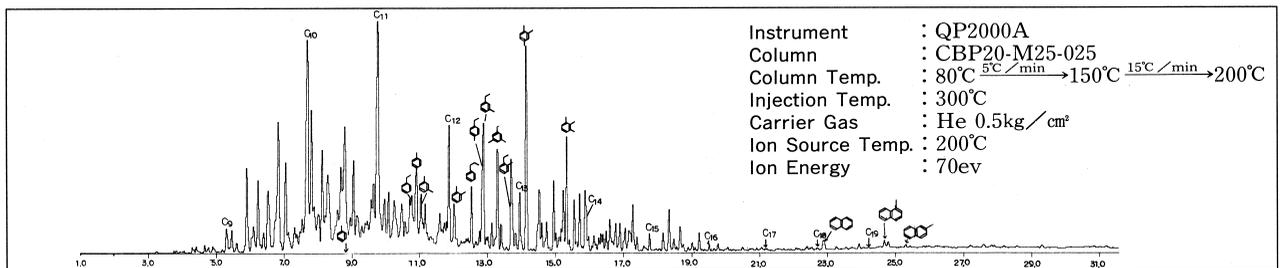


Fig. 1.9.2 TIC chromatogram by a polar column

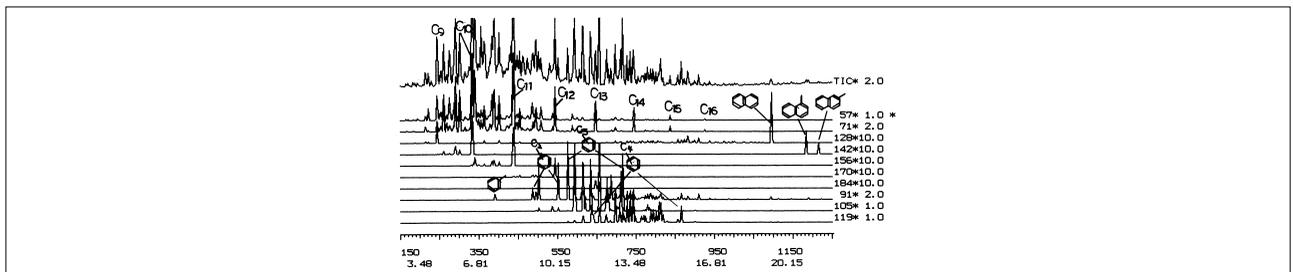


Fig. 1.9.3 Mass chromatogram by a polar column



1.9 Analysis of kerosene (2) - GCMS

Fig.1.9.4 is the mass chromatogram obtained by analysis with a non-polar column. C_3 -alkylbenzene is eluted from in between the main components of paraffin, n-nonane (C_9H_{20}) and n-decane ($C_{10}H_{22}$). Fig. 1.9.5 is the mass chromatogram obtained by a polar column (PEG). The component ratio of kerosene A and kerosene B differ somewhat, and the C_3 -alkylbenzene has moved to between n-undecane ($C_{12}H_{26}$) and n-tetradecane ($C_{14}H_{30}$), and there is less interference by paraffin hydrocarbons.

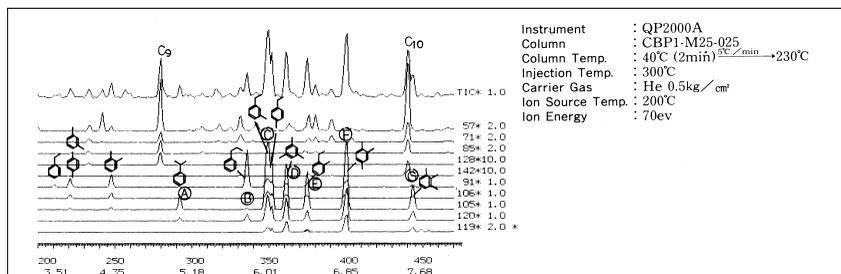


Fig. 1.9.4 Mass chromatogram by a non-polar column

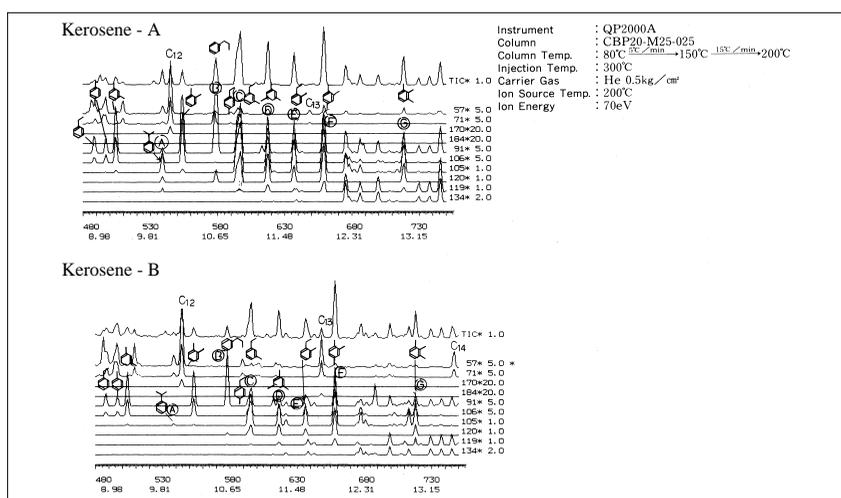


Fig. 1.9.5 Mass chromatogram by a polar column

As indicated in Fig. 1.9.6, there are 8 types of C_3 -alkylbenzene isomers. Identification from the mass spectra becomes extremely difficult. In this case, if a capillary column with good separation is used, C_3 -alkylbenzene can be completely separated, with the exception of m,p-ethylmethylbenzene, making identification from a mass chromatogram easy.

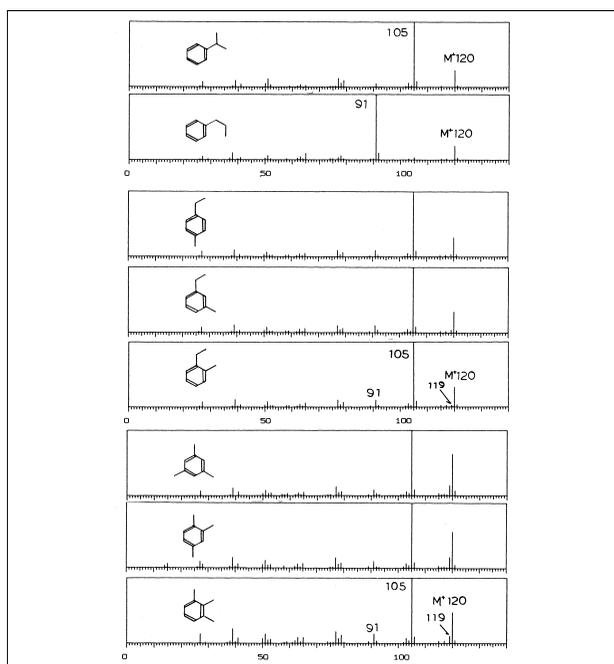


Fig. 1.9.6 Mass spectra of C_3 -alkylbenzene