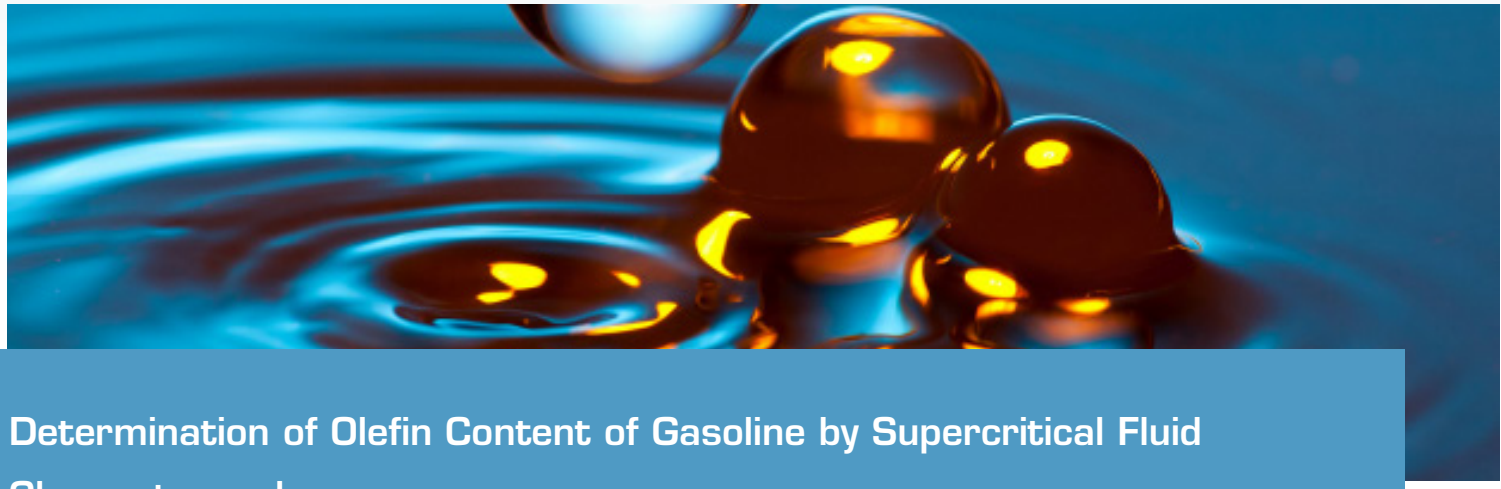
Application Note



Determination of Olefin Content of Gasoline by Supercritical Fluid Chromatography

Introduction

Gasoline is produced by fractional distillation of petroleum at a boiling point between 30°C and 200°C. It contains hydrocarbons such as paraffin, olefin, and aromatics, carbon numbers of which are between 4 and 10. Characterization of gasoline requires the determination of the contents of those hydrocarbons.

American Society for Testing and Materials (ASTM) announced a method, D6550-00: Standard Test Method for Determination of Olefin Content of Gasolines by Supercritical-Fluid Chromatography. We have established an analysis system in accordance with this method.

JASCO HPLC 2000

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Introduction

A JASCO HPLC 2000 series was used for the measurement. The system consisted of a PU-2080-CO2 liquefied carbon dioxide delivery pump, an AS-2059-SF autosampler, an HV-2080-01 column switching valve (2 sets), a CO-2060 column oven, a flame ionization detector, a BP-2080 back-pressure regulator, and ChromNAV data system.

Separation columns were a SFCpak SIL PA silica gel column (4.6 mm ID x 250 mmL, 5 mm) and a SFCpak SIL AGS silver-coated silica gel column (4.6 mm ID x 50 mmL, 5 µm).

The operation for the measurement was carried out as follows:

1. Connect the silica gel and silver-coated silica gel columns, and deliver liquefied carbon dioxide.

2. Inject sample to elute paraffin first.

3. Disconnect the silver-coated silica gel column from the flow path by using the column switching valves, and elute aromatics adsorbed on the silica gel column. By using the column switching valves, disconnect the silica gel column and connect the silver-coated silica gel column again, and elute olefin adsorbed on the silver-coated silica gel column.

Results and Discussion

Figure 1 illustrates a schematic of the system. Switching the two columns allowed separation of paraffin, aromatics, and olefin. Effluent from the columns was divided by a splitter and a portion of the effluent was introduced into the FID detector.

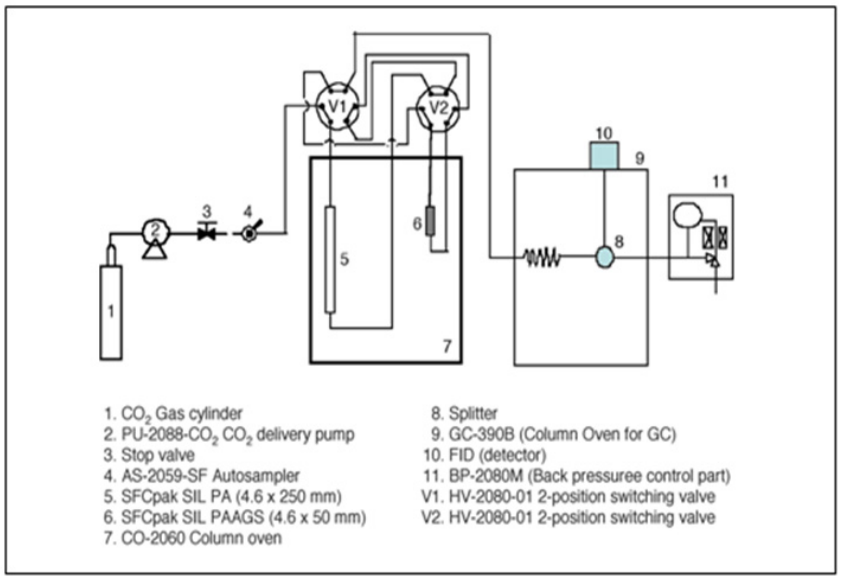

Figure 1. Schematic of the SFC system. Components: 1=liquefied carbon dioxide cylinder, 2=liquefied carbon oxide delivery pump, 3=stop valve, 4=autosampler, 5=silica gel column, 6=silver-coated silica gel column, 7=column oven, 8=splitter, 9=oven for FID, 10=FID, V1 and V2=column switching valve.

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Figure 2 shows a SFC chromatogram of a standard mixture of hexadecane, toluene, and octadecene. Hexadecane was selected as the paraffin, toluene as the aromatic, and octadecene as the olefin.

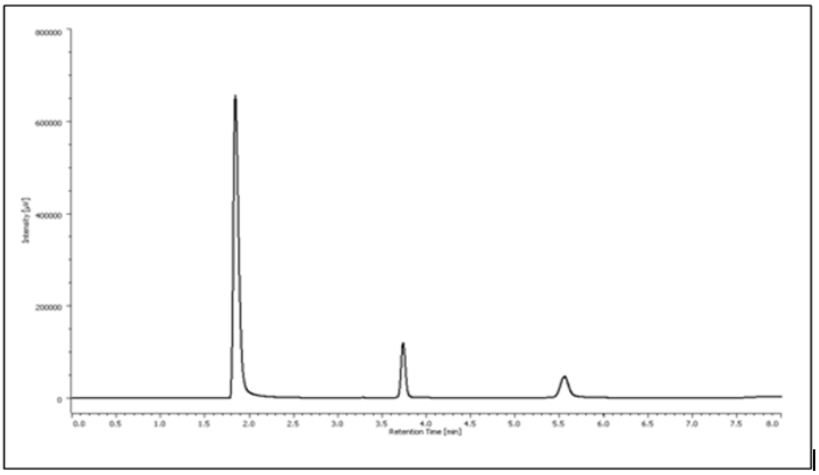

Figure 2. SFC chromatogram of standard mixture. Peaks: 1=hexadecane, 2=toluene, 3=octadecene.Conditions: separation column=SFCpak SIL-PA (4.6 mmID x 250 mmL, 5 µm) and SFCpak SIL PA-AGS (4.6 mmID x 50 mmL, 5 µm), flow rate of liquefied carbon dioxide=2 mL/min, injection volume=1 mL

Figure 3 shows a SFC chromatogram obtained by direct injection of commercially available gasoline. The olefin content of the gasoline was quantified to be 21.1% by comparing peak areas.

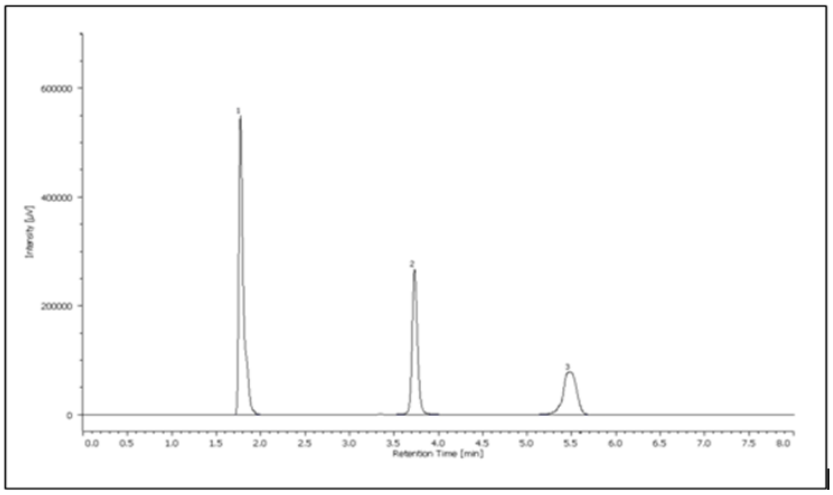

Figure 3. SFC chromatogram of commercially available gasoline. The chromatographic conditions are the same as in Figure 2.

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