Application Note

Separation of Aromatics in Diesel Fuel by Supercritical Fluid Chromatography (ASTM D5186)

Introduction

Many components including aliphatic hydrocarbons and aromatic hydrocarbons such as paraffins and olefins are contained in petroleum fuel such as gasoline, gas oil, etc. Analyzing these components is very important because these components greatly affect the efficiency of the fuel and the amount of environmental pollutant which is discharged from engine after burning. Separation analysis methods such as High Performance Liquid Chromatography (HPLC), Gas Chromatography (GC) or Supercritical Fluid Chromatography (SFC) are widely used for analyzing petroleum fuel.

Jasco PU-2080-CO2

Among those methods, Supercritical Fluid Chromatography has been used to derive an ASTM (The American Society for Testing and Material) method because the components in petroleum fuel can be separated with high resolution and can be analyzed in a short time with high stability.

This time polycyclic aromatic components in diesel fuel were analyzed using Supercritical Fluid Chromatography system in accordance with ASTM D5186 as reported below.

Keyword: SFC, 5 µm, Diesel fuel, ASTM 5186, Hexadecane, Toluene, Tetralin, Naphthalene

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Experimental Equipment:

CO2 Delivery Pump	PU-2080-CO2
Reagent pump:	X-LC 3159AS (4.6 mmI.D. x 250 mmL, 5 µm) (0.5 µL injection model)*1
Column Oven:	CO-2060
Detector:	FID (GC-390B)
Back Pressure Regulator:	BP-2080

*1 0.5 µL injection model of autosampler is a custom made product.

Conditions:

Column:	FCpak SIL-PA (4.6 mmI.D. x 250 mmL, 5 µm)
Eluent:	Carbon dioxide
Flow rate:	2.0 mL/min
Column Temperature:	35 °C
Back Pressure:	20 MPa
Injection Volume:	0.5 µL
Standard Sample:	Hexadecane=75 mass%, Toluene=20 mass%, Tetraline=3 mass%, Naphthalene=2 mass%
Oven:	200 °C, FID; 350 °C

Results

Overlapped chromatograms (n = 10) of standard mixture is shown in figure 1, and the result of retention time repeatability is shown as in Table 1. The repeatability obtained was less than 0.2% and the resolution of Hexadecane and Toluene was 11.2, and the resolution of Tetralin and Naphthalene, 4.9.

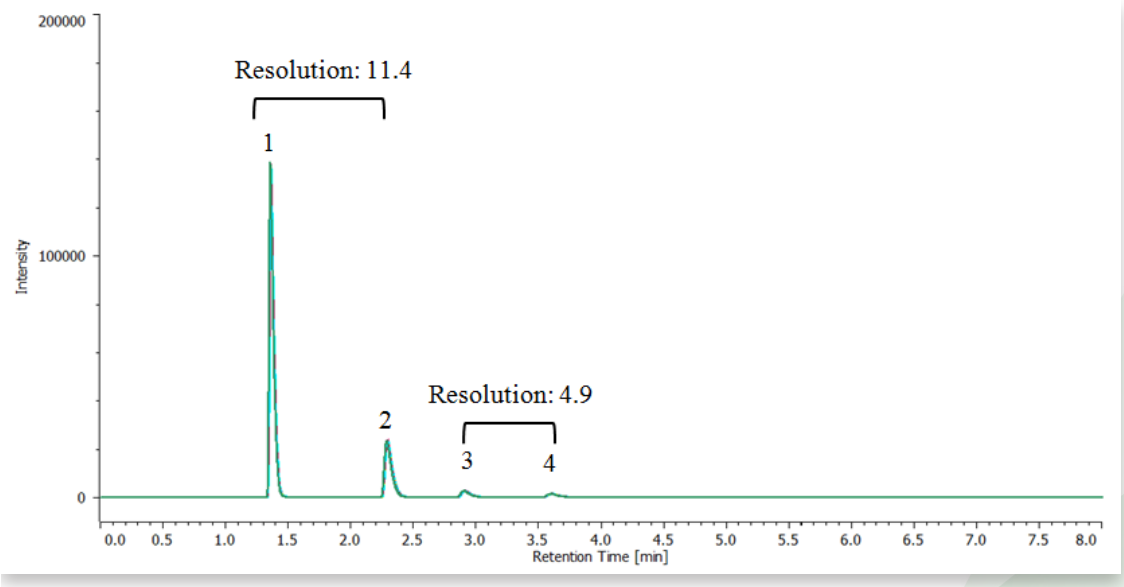

Figure 1 Chromatogram of the Standard Mixture 1.Hexadecane, 2.Toluene, 3.Tetralin, 4.Naphthalene

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Table 1 Retention Time Repeatability of Standard Mixture (n=10)

	Hexadecane	Toluene	Tetraline	Naphthalene
1	1.362	2.293	2.908	3.602
2	1.363	2.295	2.910	3.603
3	1.363	2.295	2.912	3.602
4	1.363	2.295	2.912	3.607
5	1.367	2.298	2.915	3.608
6	1.363	2.293	2.908	3.602
7	1.360	2.290	2.905	3.597
8	1.363	2.293	2.908	3.598
9	1.360	2.290	2.903	3.597
10	1.358	2.287	2.902	3.590
Sum	13.623	22.930	29.083	36.005
Average	1.362	2.293	2.908	3.601
S.D.	0.0024	0.0033	0.0041	0.0053
CV%	0.175	0.145	0.141	0.148

The chromatogram of commercially available gas oil is shown as in figure 2. The area percent of each component was: non-aromatics: 71.8%, and aromatics: 28.2%.

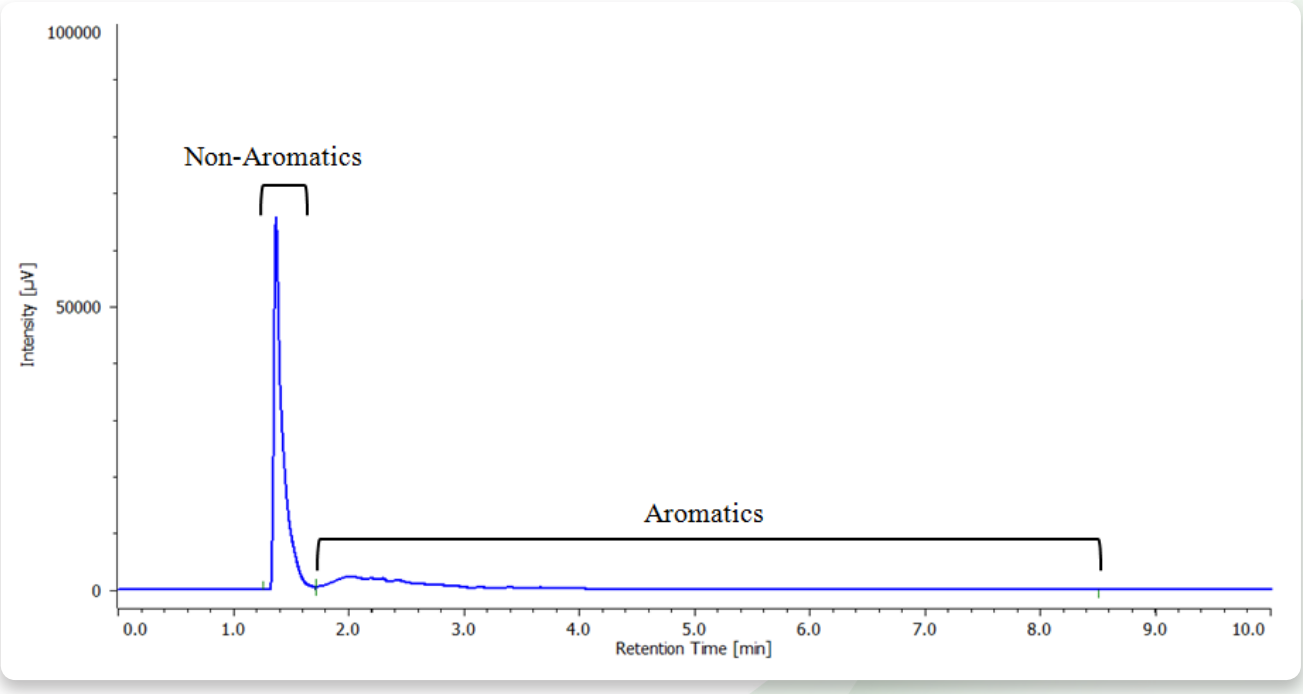

Figure 2 Chromatogram of Gas Oil

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