

Application Data Sheet

No.4

GC

Gas Chromatography

Analysis of Crude Oil Samples in Compliance with ASTM D5307 Using the Shimadzu Simulated Distillation Gas Chromatograph System

In the ASTM D5307 test method, crude oil containing components with boiling points to temperatures in excess of 538 °C (C44 or equivalent) are analyzed by a simulated distillation GC system by the internal standard method. A detailed boiling point distribution graph is created for the fraction with boiling points lower than 538 °C. The fraction with boiling points above 538 °C is calculated as a residual percentage (mass %). The Shimadzu simulated distillation gas chromatograph system, consisting of the GC-2014 and the LabSolutions distillation GC analysis software, is compliant with ASTM D5307, and combines comfortable operability with high-level functionality. This data sheet describes an example of the distillation GC analysis of crude oil samples in compliance with ASTM D5307, utilizing the Shimadzu distillation gas chromatograph system.

Instruments Used and Analysis Conditions

Instruments Used	
Software	LabSolutions Distillation GC Analysis Software
Gas chromatograph	GC-2014AF (100 V)
Low-temperature control solenoid valve unit	CRG-2010 (CO ₂)
Auto injector	AOC-20i
Analysis Conditions	
Column	OV-1, 3 % Chromosorb -W 80-100 mesh HP
Column temperature	-30 °C - 10 °C /min - 350 °C (30 min)
Carrier gas flow rate	40 mL/min (nitrogen)
Injection port temperature	350 °C
FID temperature	350 °C
Hydrogen flow rate	40 mL/min (55 kPa)
Air flow rate	400 mL/min (40 kPa)
Injection volume	1 µL

Results

1. Analysis of Standard Solutions for Calibration

Two standard solutions were measured, one a mixture of n-C3 to n-C-9, and one a mixture of everything from n-C10 to n-C44.

Fig. 1 shows a chromatogram consisting of an overlay of the two data sets.

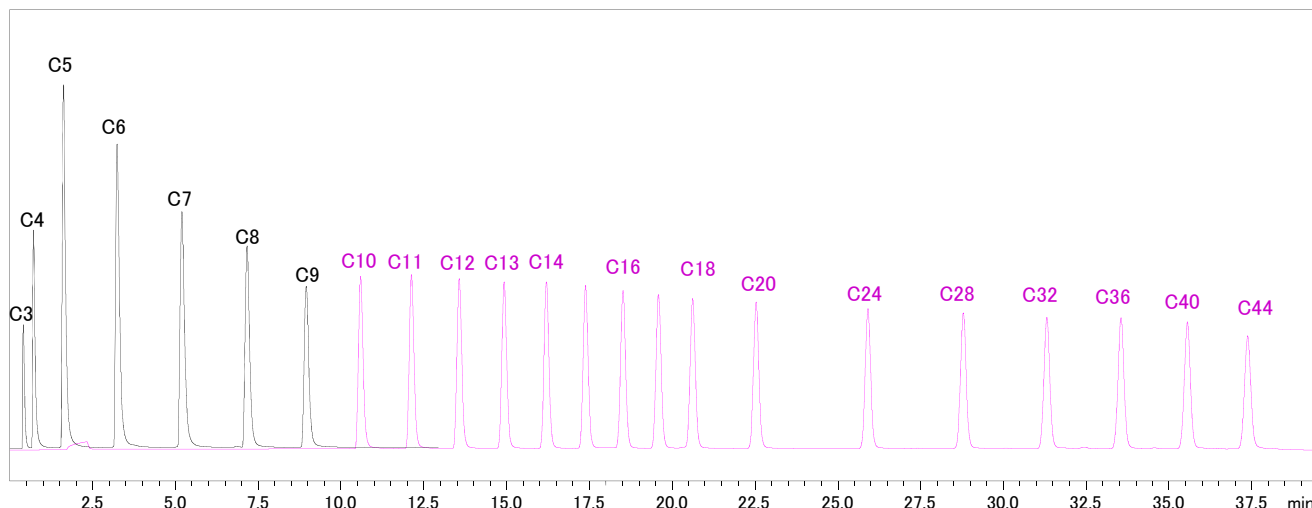


Fig. 1: Chromatogram of the Standard Solutions for Calibration

2. Analysis of the Crude Oil Samples

The internal standard substances (n-C14, 15, 16, 17) were added to the crude oil. The mixture was diluted with carbon disulfide and then measured. In the same way, a sample of crude oil only was diluted with carbon disulfide and then measured. Fig. 2 shows the comparative chromatograms of the two solutions. With the internal standard method, two types of solutions are analyzed in this manner, and the distillation characteristics are obtained utilizing both sets of data.

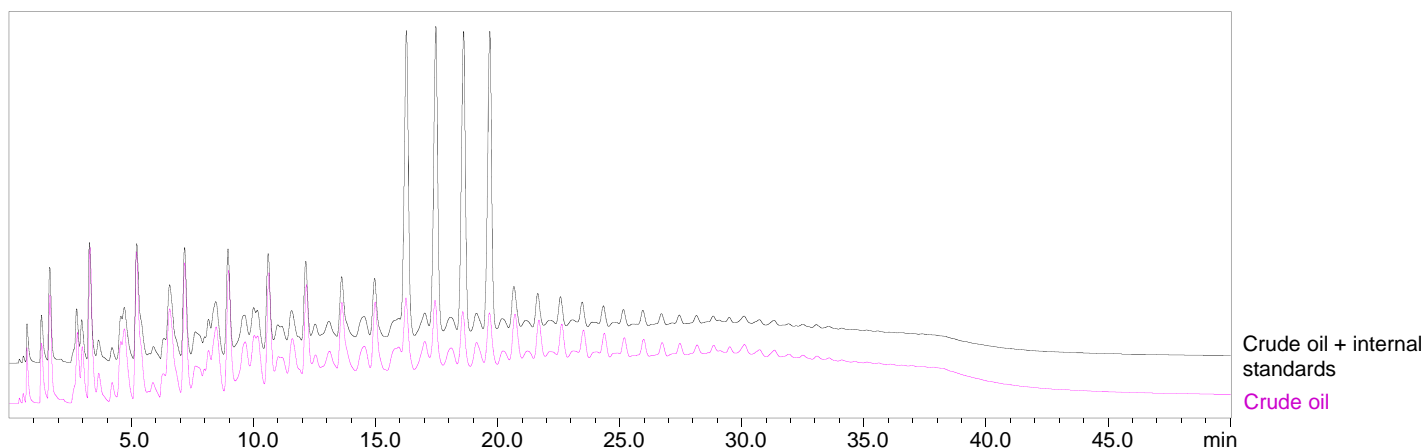


Fig. 2: Comparative Chromatograms for Crude Oil Samples

Utilizing the LabSolutions distillation GC analysis software, distillation characteristics can be analyzed automatically via the internal standard method. Table 1 shows the distillation characteristics for the crude oil sample repeatedly analyzed twice. An overlay of the respective distillation characteristic curves is shown in Fig. 3.

With this software, it is possible to display a comparison of distillation characteristics curves for up to 16 samples, simplifying everyday product data management and comparisons with previously accumulated data.

Table 1: Distillation Characteristics for Crude Oil Samples

Distillate volume (mass %)	Temperature (°C)	
	1st	2nd
IBP	27	27
1	38	38
2	65	66
3	72	73
4	91	91
5	98	98
10	142	143
15	175	175
20	211	213
25	247	248
30	279	280
35	311	312
40	343	344
45	375	376
50	408	410
55	441	443
60	475	477
65	513	514
Residual material	32%	32%

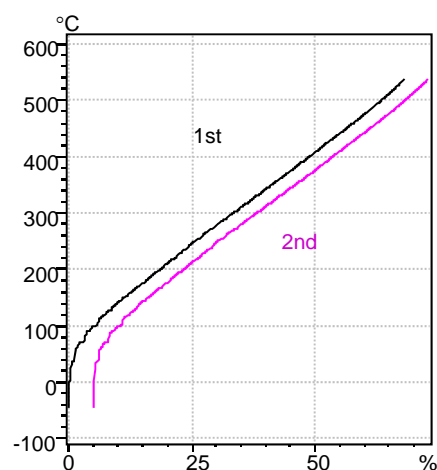


Fig. 3: Distillation Characteristics Curves
For comparison, the second distillation characteristic curve has been shown shifted.