

Application Note 8270389

Simulated Distillation of a Heavy Gasoil and FCC Feed according to IP 480

Introduction

The IP 480 standard specifies a method for the determination of the boiling range distribution of petroleum products by capillary gas chromatography using flame ionization detection. The standard is applicable to materials having a vapor pressure low enough to permit sampling at ambient temperature and a boiling range of at least 100 °C. The standard is applicable to distillates with initial boiling points (IBP) above 100 °C and final boiling points (FBP) below 750 °C, for example, middle distillates and lubricating base stocks.

Instrumentation:

GC: Bruker Simulated Distillation Analyzer for IP 480

based on the Bruker GC Gas Chromatograph

Injector: COC Cool On-Column with full

EFC control

Detection: FID with full EFC control

Autosampler: Bruker CP-8410 AutoSampler

Software:

GC Control and Data Handling: CompassCDS Software

Simulated Distillation Calculations: SimDist plug-in software

fully integrated into CompassCDS Chromatography

Software

Materials and Reagents

Sample: Heavy Gasoil, FCC Feed

Column: BR-1HT column, 5 m x 0.53 mm x 0.09 µm

Calibration: Mixture of n-paraffins (approx 1 %) dissolved in carbon disulfide

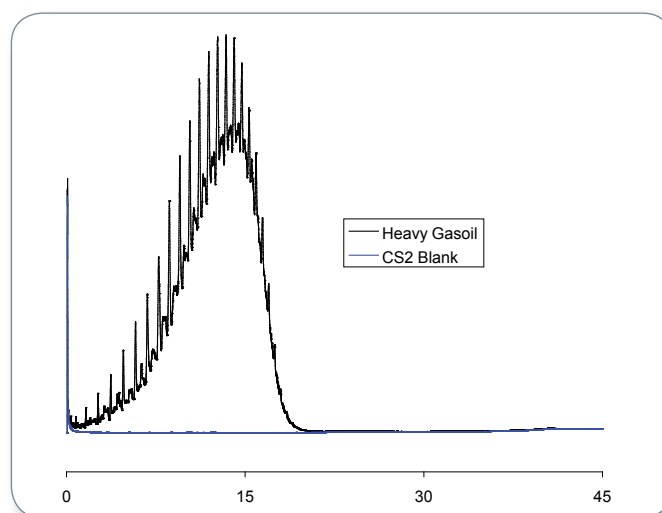


Figure 2: Heavy gasoil and CS₂ blank.

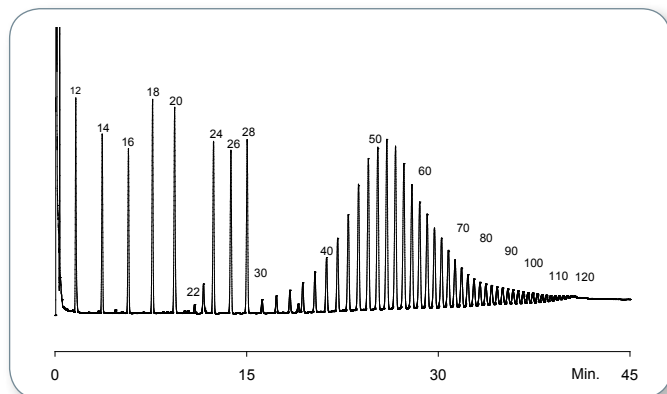


Figure 1: Polywax 1000 spiked with n-alkanes, calibration mix.

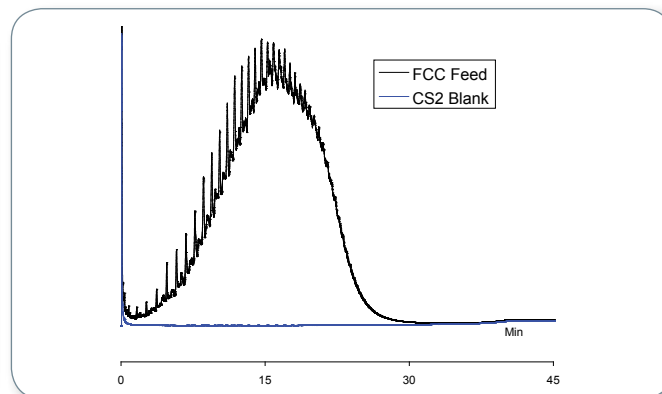


Figure 3: FCC feed and CS₂ blank.

Sample Preparation

The calibration mix is prepared by dissolving 0.1 g polywax 1000 in 7 mL CS₂ and adding 10 µL of an equal volume mixture of n-alkanes, all according to the method. The samples are obtained by making a 2 to 3 % (m/v) solution in CS₂.

Conditions

Sample Size: 1 µL
 Carrier Gas: Helium, 19 mL/min
 Oven Program: 35 °C @ 10 °C/min to 430 °C
 Injector Program: 100 °C @ 15 °C/min to 430 °C
 Detection: 450 °C

Results and discussion

The software relates boiling point to the retention time using the n-alkane calibration mix. Baseline and solvent signal correction is done using an analysis of the pure solvent (CS₂). The solvent analysis is subtracted from the sample analysis resulting in a net signal of the fully eluting sample. Area normalization is used to calculate the percentage eluted sample versus boiling point. The results of both samples are illustrated in table 1 and 2 including sequential analyses of both samples. This shows the good repeatability of the SimDist analyzer for IP 480.

Table 1: Reproducibility values of heavy gasoil analysis.

% Off Report								
% Off	File 1 °C	File 2 °C	File 3 °C	File 4 °C	File 5 °C	Average °C	St.dev. °C	
IBP	239.8	239.0	239.6	239.2	239.7	239.46	0.344	
1%	254.3	254.0	254.1	254.1	254.1	254.12	0.110	
5%	297.0	296.7	297.0	296.8	297.1	296.92	0.164	
10%	320.2	320.0	320.2	320.1	320.3	320.16	0.114	
15%	336.7	336.6	336.7	336.6	336.7	336.66	0.055	
20%	348.7	348.7	348.8	348.7	348.8	348.74	0.055	
25%	359.6	359.7	359.6	359.6	359.7	359.64	0.055	
30%	368.7	368.8	368.8	368.7	368.9	368.78	0.084	
35%	376.0	376.1	376.0	376.0	376.1	376.04	0.055	
40%	383.2	383.3	383.2	383.2	383.3	383.24	0.055	
45%	389.4	389.5	389.4	389.4	389.5	389.44	0.055	
50%	395.6	395.8	395.7	395.6	395.8	395.70	0.100	
55%	402.0	402.2	402.0	402.0	402.1	402.06	0.089	
60%	407.9	408.1	407.9	407.9	408.0	407.96	0.089	
65%	414.2	414.4	414.2	414.2	414.3	414.26	0.089	
70%	419.8	420.0	419.8	419.7	419.9	419.84	0.114	
75%	425.8	426.0	425.7	425.7	425.9	425.82	0.130	
80%	431.9	432.1	431.8	431.8	432.0	431.92	0.130	
85%	438.7	438.9	438.6	438.6	438.8	438.72	0.130	
90%	446.5	446.6	446.3	446.4	446.5	446.46	0.114	
95%	457.0	456.9	456.6	456.6	456.7	456.76	0.182	
99%	473.4	472.7	472.3	472.3	472.4	472.62	0.466	
FBP	478.8	477.7	477.3	477.3	477.4	477.70	0.636	

Conclusion

The chromatograms from the calibration mix for both heavy gasoil and FCC feed provide firm evidence of the solid performance of the Bruker Simulated Distillation Analyzer. The reproducibility values shown are consistent with those prescribed in the IP 480 method.

Table 2: Reproducibility values of FCC feed analysis.

% Off Report	File 1 °C	File 2 °C	File 3 °C	File 4 °C	File 5 °C	Average °C	St.dev. °C
IBP	255.0	255.0	255.9	255.6	255.6	255.4	0.402
1%	269.5	269.5	270.2	270.1	270.2	269.9	0.367
5%	315.9	315.9	316.3	316.3	316.3	316.1	0.219
10%	343.6	343.6	344.0	344.0	344.1	343.9	0.241
15%	362.7	362.7	363.1	363.1	363.2	363.0	0.241
20%	377.8	377.8	378.2	378.1	378.2	378.0	0.205
25%	390.4	390.4	390.7	390.6	390.7	390.6	0.152
26%	392.8	392.8	393.0	393.0	393.1	392.9	0.134
27%	394.9	394.9	395.2	395.1	395.2	395.1	0.152
28%	397.4	397.4	397.7	397.6	397.7	397.6	0.152
29%	399.9	399.8	400.1	400.0	400.2	400.0	0.158
30%	402.3	402.3	402.6	402.5	402.7	402.5	0.179
35%	413.2	413.2	413.4	413.4	413.5	413.3	0.134
40%	423.2	423.1	423.3	423.3	423.4	423.3	0.114
45%	432.8	432.7	432.9	432.8	433.0	432.8	0.114
50%	442.3	442.3	442.4	442.3	442.5	442.4	0.089
55%	451.8	451.8	451.9	451.8	452.0	451.9	0.089
60%	461.3	461.2	461.4	461.3	461.5	461.3	0.114
65%	470.8	470.8	470.9	470.8	471.0	470.9	0.089
70%	480.5	480.4	480.5	480.4	480.6	480.5	0.084
75%	491.0	491.0	491.0	491.0	491.2	491.0	0.089
80%	501.5	501.5	501.4	501.4	501.6	501.5	0.084
85%	512.6	512.6	512.5	512.5	512.7	512.6	0.084
90%	525.7	525.7	525.6	525.6	525.8	525.7	0.084
95%	542.6	542.6	542.4	542.4	542.5	542.5	0.100
99%	573.0	572.9	572.4	572.4	572.5	572.6	0.288
FBP	584.1	584.0	583.2	583.2	583.2	583.5	0.467

Reference

IP 480, 2007 "Determination of boiling range distribution by gas chromatography method - Part 1: Middle distillates and lubricating base oils," Energy Institute, London, UK.

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Keywords	Instrumentation & Software
IP 480	Bruker CP-8410 AutoSampler
Simulated Distillation	Bruker GC Gas Chromatograph
heavy gasoil	CompassCDS Chromatography Software
	Bruker Simdist Analyzer for IP 480

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