

Fast analysis of Boiling Point Distributions in Petroleum Fractions using Simulated Distillation (ASTM D2887-B)

José Marques Jorge & Eric Vermeulen – Advanced Projects & Custom Solutions



INTRODUCTION

In many regions ASTM D 2887 may be used for determining the boiling point distribution of petroleum products, feedstocks and fractions that have a final boiling point of 538°C or lower

This provides insight into composition and allows for the determination of intrinsic product value

While Physical Distillation is still considered the reference method for distillation, and therefore mandatory in many countries for qualifying fuels, Simulated Distillation (SIMDIST) by gas chromatography offers some significant advantages over the physical procedure, making this technique quite useful.

Analysis by GC typically has the better precision, higher throughput, less hands-on time and lower cost per sample

Also, SIMDIST requires considerably less sample to be run and can generally be considered the safer of the two techniques.

In addition to the standard analytical method (procedure A), a second procedure is described in ASTM D2887 (procedure B), which is the accelerated (or fast) method, which is the subject of this application note.

This application note demonstrates a solution for D 2887 procedure B for analyzing Petroleum products covering a boiling point range from 36°C to 545°C

This procedure is also suited for biodiesels.

For gasolines, method D 7096 should be used.

- Boiling range distributions obtained by this test method are essentially equivalent to those obtained by true boiling point (TBP) distillation (see method ASTM D2892).
- The results are not equivalent to results from low efficiency distillations such as those obtained with methods ASTM D86 or D1160.

EXPERIMENTAL

The SCION SIMDIST analyzer comprises of either a 456-GC or a 436-GC, configured with a cool on column (COC) injector, a 5m x 0,53mm x 2.65µm SIMDIST column, and a Flame Ionization Detector (FID).

Analytical conditions for the SIMDIST analysis can be found in table 1.

A qualitative mixture of normal paraffins covering the range from C5 up to C44 (1% wt. each in CS₂) was used to determine the relationship of boiling point (BP) versus retention times (RT).

Injector	Cold-on-Column Start @ 100°C 35°C/min End @ 350°C
Column	5m x 0,53mm x 2,65µm SIMDIST (SC37791) w/ Ret. Gap
Oven Program	Start @ 40°C 35°C/min End @ 350°C hold 1 min.
Carrier	Helium @ 35ml/min
Detector	FID @ 350°C
Inj. Volume	0,1µl
Software	Compass CDS w/ Eclipse SIMDIST

Table 1. Analytical conditions

RESULTS

Figures 1 and 2 show a chromatogram of the normal paraffins calibration standard and the resulting RT vs BP calibration curve as used for this analysis.

In order to check that the requirements of ASTM D2887 are met using this configuration, Reference Gasoil No. 2 was analysed 11 times, consecutively.

Figure 3 shows a chromatogram of this Reference Gasoil, with table 2 showing the analytical results set out against the reference values and maximum allowable deviations.

All results obtained via this method, using this configuration fall within the allowed limits for ASTM D2887.

% Off	°C	Allowable Difference (°C)	Result °C
IBP	106	7	105,2
10	196	4,4	194,7
20	233	5	230,1
30	267	4,8	263,6
40	298	4,3	295,3
50	321	4,3	319,5
60	342	4,3	341,5
70	358	4,3	359,0
80	378	4,3	378,8
90	406	4,3	407,8
FBP	496	11,8	499,6

Table 2. Results, reference values and allowable difference

% Off	r (°C)	R (°C)
IBP	0,14	0,47
10	0,25	0,63
20	0,28	0,78
30	0,43	1,10
40	0,31	0,94
50	0,21	0,79
60	0,16	0,47
70	0,15	0,47
80	0,10	0,31
90	0,12	0,31
FBP	0,23	0,63

Table 3. Obtained Precision

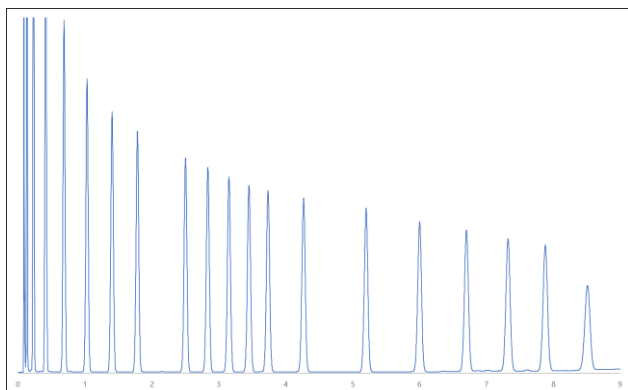


Figure 1. D2887 Cal. STD (C5-C44)

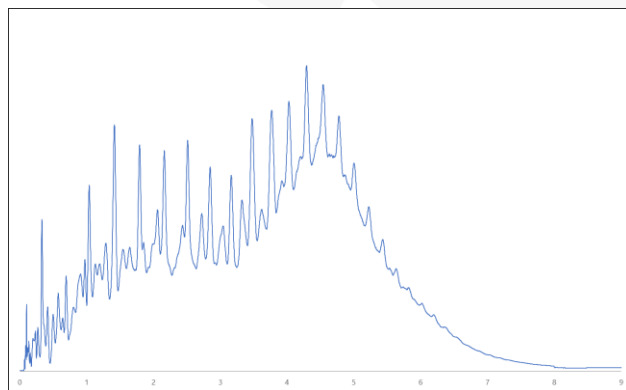


Figure 3. Reference Gasoil No. 2

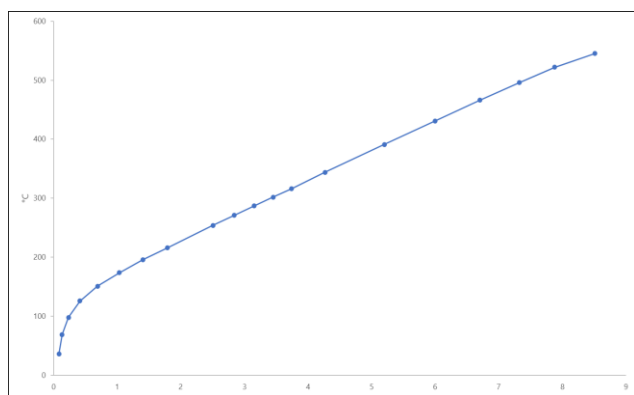


Figure 2. RT (min) vs. BP (°C)

CONCLUSION

The obtained results demonstrate that this Scion Instruments SIMDIST configuration for ASTM D2887 procedure B passes the criteria set forth in the referenced method, with an analysis time that is 4x faster than procedure A.

Please note that:

- The gas chromatographic simulation of this determination can be used to replace conventional distillation methods for control of refining operations.

SCION Instruments

UK

Livingston Business Centre
Kirkton South Road, Livingston
West Lothian EH54 7FA
Scotland, UK
Phone +44 1506 300 200
sales-eu@scioninstruments.com

The Netherlands

Amundsenweg 22-24
4462 GP Goes,
The Netherlands
Phone +31 (0) 113 287 600
sales-eu@scioninstruments.com