Results of Proficiency Test
Base Oil
May 2018

Organised by: Institute for Interlaboratory Studies
Spijkenisse, The Netherlands

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CONTENTS

1 INTRODUCTION

Since 2013, the Institute for Interlaboratory Studies (iis) organizes a proficiency test for Base Oil. During the annual proficiency testing program 2017/2018, it was decided to continue the round robin for the analysis of Base Oil.
In this interlaboratory study 58 laboratories in 34 different countries registered for participation. See appendix 2 for the number of participants per country. In this report, the results of the 2018 Base Oil proficiency test are presented and discussed. This report is also electronically available through the iis website www.iisnl.com.

2 SET UP

The Institute for Interlaboratory Studies (iis) in Spijkenisse, The Netherlands, was the organizer of this proficiency test (PT). Sample analyses for fit-for-use and homogeneity were subcontracted to an ISO/IEC 17025 accredited laboratory. It was decided to send one sample of Base Oil (1 litre bottle, labelled #18075).
The participants were requested to report rounded and unrounded test results. The unrounded test results were preferably used for statistical evaluation.

2.1 ACCREDITATION

The Institute for Interlaboratory Studies in Spijkenisse, the Netherlands, is accredited in agreement with ISO/IEC 17043:2010 (R007), since January 2000, by the Dutch Accreditation Council (Raad voor Accreditatie). This PT falls under the accredited scope. This ensures strict adherence to protocols for sample preparation and statistical evaluation and 100% confidentiality of participant's data. Feedback from the participants on the reported data is encouraged and customer's satisfaction is measured on regular basis by sending out questionnaires.

2.2 PROTOCOL

The protocol followed in the organization of this proficiency test was the one as described for proficiency testing in the report 'iis Interlaboratory Studies: Protocol for the Organization, Statistics and Evaluation' of March 2017 (iis-protocol, version 3.4). This protocol is electronically available through the iis website www.iisnl.com, from the FAQ page.

2.3 CONFIDENTIALITY STATEMENT

All data presented in this report must be regarded as confidential and for use by the participating companies only. Disclosure of the information in this report is only allowed by means of the entire report. Use of the contents of this report for third parties is only allowed by written permission of the Institute for Interlaboratory Studies. Disclosure of the identity of one or more of the participating companies will be done only after receipt of a written agreement of the companies involved.

2.4 SAMPLES

The necessary bulk material of Base Oil was obtained from a local supplier. The 200-litre bulk material (Full Synfluid PAO 8cSt) was homogenized and a part of this bulk was transferred into 74 amber glass bottles of 1 litre (labelled #18075). The homogeneity of the subsamples #18075 was checked by determination of Density at 15°C in accordance with ASTM D4052 and Kinematic Viscosity at 40°C in accordance with ASTM D445 on 8 stratified randomly selected samples.

	Density at 15°C in kg/L	Kinematic Viscosity at 40°C in mm^2/s
Sample #18075-1	0.83174	46.87
Sample #18075-2	0.83175	46.87
Sample #18075-3	0.83175	46.87
Sample #18075-4	0.83175	46.86
Sample #18075-5	0.83176	46.87
Sample #18075-6	0.83176	46.86
Sample #18075-7	0.83175	46.85
Sample #18075-8	0.83175	46.87

Table 1: homogeneity test results of Base Oil subsamples #18075

From the above test results, the repeatabilities were calculated and compared with 0.3 times the corresponding reproducibility of the target test method, in agreement with the procedure of ISO 13528, Annex B2 in the next table:

	Density at 15°C in kg/L	Kinematic Viscosity at 40°C in mm^2/s
r (observed)	0.00002	0.02
reference test method	ASTM D4052:18	ASTM D445:17a
0.3 x R (ref. test method)	0.00005	0.19

Table 2: evaluation of the repeatabilities of subsamples #18075

The calculated repeatabilities were less than 0.3 times the corresponding reproducibilities of the reference test methods. Therefore, homogeneity of the subsamples #18075 was assumed.

To each of the participating laboratories, one sample of 1 L an amber glass bottle (labelled #18075) was sent on April 25, 2018. An SDS was added to the sample package.

2.5 STABILITY OF THE SAMPLES

The stability of Base Oil, packed in amber glass bottles, was checked. The material was found sufficiently stable for the period of the proficiency test.

2.6 ANALYSES

The participants were requested to determine on sample #18075: Acid Number (Total), Air-release time at 50°C, Color ASTM, Conradson Carbon Residue, Ramsbottom Carbon Residue, Density at 15°C, Evaporation loss by Noack test, Flash Point C.O.C., Kinematic Viscosity at 40°C and at 100°C, Viscosity Index, Viscosity Stabinger at 40°C and at 100°C, Pour Point (manual and automated), Rust prevention (synthetic seawater), Sulphur, Water content by KF and Water Separability at 54°C.

It was explicitly requested to treat the sample as if it was a routine sample and to report the test results using the indicated units on the report form and not to round the test results, but report as much significant figures as possible. It was also requested not to report 'less than' test results, which are above the detection limit, because such test results cannot be used for meaningful statistical calculations.

To get comparable test results, a detailed report form and a letter of instructions are prepared. On the report form the reporting units are given as well as the reference test methods that will be used during the evaluation. The detailed report form and the letter of instructions are both made available on the data entry portal www.kpmd.co.uk/sgs-iis/. The participating laboratories are also requested to confirm the sample receipt on this data entry portal. The letter of instructions can also be downloaded from the iis website www.iisnl.com.

3 RESULTS

During five weeks after sample dispatch, the test results of the participants were gathered via the data entry portal www.kpmd.co.uk/sgs-iis/. The reported test results are tabulated per determination in appendix 1 of this report. The laboratories are presented by their code numbers.

Directly after the deadline, a reminder was sent to those laboratories that had not reported test results at that moment.
Shortly after the deadline, the available test results were screened for suspect data. A test result was called suspect in case the Huber Elimination Rule (a robust outlier test) found it to be an outlier. The laboratories that produced these suspect data were asked to check the reported test results (no reanalyses). Additional or corrected test results are used for data analysis and original test results are placed under 'Remarks' in the test result tables in appendix 1. Test results that came in after the deadline were not taken into account in this screening for suspect data and thus these participants were not requested for checks.

3.1 STATISTICS

The protocol followed in the organization of this proficiency test was the one as described for proficiency testing in the report 'iis Interlaboratory Studies: Protocol for the Organisation, Statistics and Evaluation' of March 2017 (iis-protocol, version 3.4).
For the statistical evaluation, the *unrounded* (when available) figures were used instead of the rounded test results. Test results reported as '<…' or '>…' were not used in the statistical evaluation.

First, the normality of the distribution of the various data sets per determination was checked by means of the Lilliefors-test a variant of the Kolmogorov-Smirnov test and by the calculation of skewness and kurtosis. Evaluation of the three normality indicators in combination with the visual evaluation of the graphic Kernel density plot, lead to judgement of the normality being either ‘unknown’, ‘OK’, ‘suspect’ or ‘not OK’.
After removal of outliers, this check was repeated. If a data set does not have a normal distribution, the (results of the) statistical evaluation should be used with due care.

According to ISO 5725 the original test results per determination were submitted to Dixon’s, Grubbs’ and/or Rosner’s outlier tests. Outliers are marked by D(0.01) for the Dixon’s test, by G(0.01) or DG(0.01) for the Grubbs’ test and by R(0.01) for the Rosner’s test. Stragglers are marked by D(0.05) for the Dixon’s test, by G(0.05) or DG(0.05) for the Grubbs’ test and by R(0.05) for the Rosner’s test. Both outliers and stragglers were not included in the calculations of averages and standard deviations.

For each assigned value, the uncertainty was determined in accordance with ISO13528. Subsequently the calculated uncertainty was evaluated against the respective requirement based on the target reproducibility in accordance with ISO13528. In this PT, the criterion of ISO13528, paragraph 9.2.1 was met for all evaluated tests, therefore, the uncertainty of all assigned values may be negligible and need not be included in the PT report.

Finally, the reproducibilities were calculated from the standard deviations by multiplying them with a factor of 2.8.

3.2 GRAPHICS

In order to visualise the data against the reproducibilities from literature, Gauss plots were made, using the sorted data for one determination (see appendix 1). On the Y-axis, the reported test results are plotted. The corresponding laboratory numbers are on the X-axis.

The straight horizontal line presents the consensus value (a trimmed mean). The four striped lines, parallel to the consensus value line, are the +3s, +2s, -2s and -3s target reproducibility limits of the selected reference test method. Outliers and other data, which were excluded from the calculations, are represented as a cross. Accepted data are represented as a triangle.

Furthermore, Kernel Density Graphs were made. The Kernel Density Graph is a method for producing a smooth density approximation to a set of data that avoids some problems associated with histograms. Also, a normal Gauss curve was projected over the Kernel Density Graph for reference.

3.3 Z-SCORES

To evaluate the performance of the participating laboratories the z-scores were calculated. As it was decided to evaluate the performance of the participants in this proficiency test (PT) against the literature requirements, e.g. ASTM reproducibilities, the z-scores were calculated using a target standard deviation. This results in an evaluation independent of the variation in this interlaboratory study.
The target standard deviation was calculated from the literature reproducibility by division with 2.8. In case no literature reproducibility was available, other targets values were used. In some cases, a reproducibility based on former iis proficiency tests could be used.

When a laboratory did use a test method with a reproducibility that is significantly different from the reproducibility of the reference test method used in this report, it is strongly advised to recalculate the z-score, while using the reproducibility of the actual test method used, this in order to evaluate whether the reported test result is fit-for-use.

The z-scores were calculated according to:

$z_{(target)}$ = (test result - average of PT) / target standard deviation

The $z_{(target)}$ scores are listed in the result tables of appendix 1.

Absolute values for z<2 are very common and absolute values for z>3 are very rare.
The usual interpretation of z-scores is as follows:

	$\lvert z \rvert < 1$	good
$1 <$	$\lvert z \rvert < 2$	satisfactory
$2 <$	$\lvert z \rvert < 3$	questionable
$3 <$	$\lvert z \rvert$	unsatisfactory

4 EVALUATION

In this proficiency test, no problems were encountered during the dispatch of the samples. One participant did not report any test results at all and two participants reported test results after the final reporting date. In total 57 participants reported 462 test results. Observed were 19 outlying results, which is 4.1% of the numerical results. In proficiency studies, outlier percentages of 3% - 7.5% are quite normal.

Not all original data sets proved to have a normal Gaussian distribution. These are referred to as “not OK” or “suspect”. The statistical evaluation of these data sets should be used with due care, see also paragraph 3.1.

4.1 EVALUATION PER TEST

In this section, the results are discussed per test. The test methods, which were used by the various laboratories, were taken into account for explaining the observed differences when possible and applicable. These methods are also in the tables together with the original data. The abbreviations, used in these tables, are listed in appendix 3.

In the iis PT reports, ASTM methods are referred to with a number (e.g. D189) and an added designation for the year that the method was adopted or revised (e.g. D189:06). If applicable, a designation in parentheses is added to designate the year of reapproval (e.g. D189:06(2014). In the results tables of appendix 1 only the method number and year of adoption or revision e.g. D189:06 will be used.

Acid Number (Total): This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in full agreement with the requirements of ASTM D974:14e2.

Air-release time: This determination was not problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is in full agreement with the requirements of ASTM D3427:15.

Color: This determination was not problematic. No statistical outliers were observed. The consensus value of the group was L0.5.

Conradson CR: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of ASTM D189:06(2014).

Ramsbottom CR: This determination was problematic. No statistical outliers were observed. However, the calculated reproducibility is not in agreement with the requirements of ASTM D524:15.

Density at 15°C: This determination was problematic for a number of laboratories. Four statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers is in full agreement with the requirements of ASTM D4052:18.

Evaporation loss by Noack test: This determination was not problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is in agreement with the requirements of ASTM D5800-B:18.

Flash Point C.O.C.: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of ASTM D92:16b.

Kin.Visco.at 40°C: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of ASTM D445:17a.

Kin.Visco.at 100°C: This determination was not problematic. Three statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers is in agreement with the requirements of ASTM D445:17a.

Viscosity Index: This determination was not problematic. Two statistical outliers were observed and one other test result was excluded from the statistical evaluation. The calculated reproducibility after rejection of the suspect data is in full agreement with ASTM D2270:10(2016).

Visco. Stabinger at 40°C: This determination was not problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is in agreement with the requirements of ASTM D7042:16e3.

Visco. Stabinger at 100°C: This determination was problematic. Two statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is not in agreement with the requirements of ASTM D7042:16e3.

Pour Point manual: This determination was very problematic. No statistical outliers were observed. However, the calculated reproducibility is not at all in agreement with the requirements of ASTM D97:17b.

Pour Point automated: This determination was problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is not in agreement with the requirements of ASTM D5950:14.

Rust prevention: Regretfully, only six participants reported a test result. Five participants reported the presence of rust (Fail / Severe rusting) and 1 participant reported “Pass”.

Sulphur: The consensus value of the group was below the application range (3 mg/kg – 4.6 %M/M) of ASTM D2622:16. Therefore, no significant conclusions were drawn.

Water: This determination was not problematic. Three statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers is in agreement with the requirements of ASTM D6304:16e1.

Water separability: This determination was not problematic. In total, only one statistical outlier was observed. All calculated reproducibilities after rejection of the statistical outlier are in agreement with the requirements of ASTM D1401:18.

ASTM D1401 describes complete break only as '40-40-0', whereas a complete break also was interpreted as 'no emulsion layer present'. Most reporting participants reported the complete break as 40-40-0.

4.2 PERFORMANCE EVALUATION FOR THE GROUP OF LABORATORIES

A comparison has been made between the reproducibility as declared by the relevant reference test method and the reproducibility as found for the group of participating laboratories that participated. The average results, calculated reproducibilities and reproducibilities derived from literature reference test methods (in casu ASTM standards) are compared in the next table.

Parameter	unit	n	average	2.8 * sd	R(lit)
Acid Number, Total	mg KOH/g	22	0.015	0.039	0.04
Air-release time at 50°C	min	5	0.5	0.9	0.9
Color ASTM		47	L0.5	n.a.	n.a.
Conradson Carbon Residue	%M/M	11	0.006	0.010	0.020
Ramsbottom Carbon Residue	%M/M	7	0.034	0.045	0.025
Density at 15°C	kg/L	52	0.8319	0.0005	0.0005
Evaporation loss by Noack	%M/M	19	3.66	0.58	0.63
Flash Point C.O.C.	°C	46	260	12	18
Kinematic Viscosity at 40°C	mm^2/s	51	46.94	0.45	0.64
Kinematic Viscosity at 100°C	mm^2/s	48	7.958	0.053	0.151
Viscosity Index		45	140.94	2.15	2
Stabinger Viscosity at 40°C	mm^2/s	11	46.93	0.30	0.27
Stabinger Viscosity at 100°C	mm^2/s	10	7.959	0.047	0.037
Pour Point manual	°C	12	-52.1	18.5	9
Pour Point automated (Δ 1°C)	°C	17	-62.2	6.1	4.5
Rust Prevention (synth. seawater)		5	fail	n.a.	n.a.
Sulphur	mg/kg	19	<3	n.a.	n.a.
Water	mg/kg	33	16.2	26.6	90.0
Water Separability at 54°C					
- Time to reach ≤ 3 ml	min	15	2.9	5.7	20
- Time to reach 37 ml of water	min	14	2.8	5.7	20
- Time complete break	min	15	3.6	4.7	20

Table 3: reproducibilities of tests on sample #18075

Without further statistical calculations it can be concluded that for a number of tests there is a good compliance of the group of participants with the relevant reference test methods. The tests that are problematic have been discussed in paragraph 4.1.

4.3 COMPARISON OF THE PROFICIENCY TEST OF MAY 2018 WITH PREVIOUS PTS

	May 2018	May 2017	May 2016	May 2015	May 2014
Number of reporting labs	57	56	50	43	43
Number of results reported	462	547	542	397	408
Statistical outliers	19	19	22	11	19
Percentage outliers	4.1%	3.5%	4.1%	2.8%	4.7

Table 4: comparison with previous proficiency tests

In proficiency tests, outlier percentages of 3% - 7.5% are quite normal.

The performance of the determinations of the proficiency tests was compared to the requirements of the respective reference test methods. The conclusions are given in the following table:

Parameter	May 2018	May 2017	May 2016	May 2015	May 2014
Acid Number, Total	+/-	+	++	+	+/-
Air-release time at 50°C	+/-	+	+/-	+	n.e.
Color ASTM	n.e.	n.e.	+	n.e.	++
Conradson Carbon Residue	++	+	++	+	++
Ramsbottom Carbon Residue	-	+/-	+/-	-	--
Density at 15°C	+/-	+/-	+	-	++
Evaporation loss by Noack	+/-	+	+	+	--
Flash Point C.O.C.	+	+/-	+	+	+/-
Kinematic Viscosity at 40°C	+	++	++	+	--
Kinematic Viscosity at 100°C	++	+	++	++	--
Viscosity Index	+/-	-	--	-	--
Stabinger Viscosity at 40°C	+/-	-	-	--	--
Stabinger Viscosity at 100°C	-	-	-	--	--
Pour Point manual	--	+	++	++	-
Pour Point automated (Δ 1°C)	-	-	+	+/-	-
Rust Prevention (synth. seawater)	n.e.	n.e.	n.e.	n.e.	n.e.
Sulphur	n.e.	n.e.	+/-	n.e.	+
Water	++	++	++	++	++
Water Separability at 54°C	++	++	++	++	++

Table 5: comparison determinations against the respective reference test methods

The performance of the determinations against the requirements of the respective reference test methods is listed in the above table. The following performance categories were used:

++: group performed much better than the reference test method
+ : group performed better than the reference test method
+/-: group performance equals the reference test method
- : group performed worse than the reference test method
-- : group performed much worse than the reference test method
n.e.: not evaluated

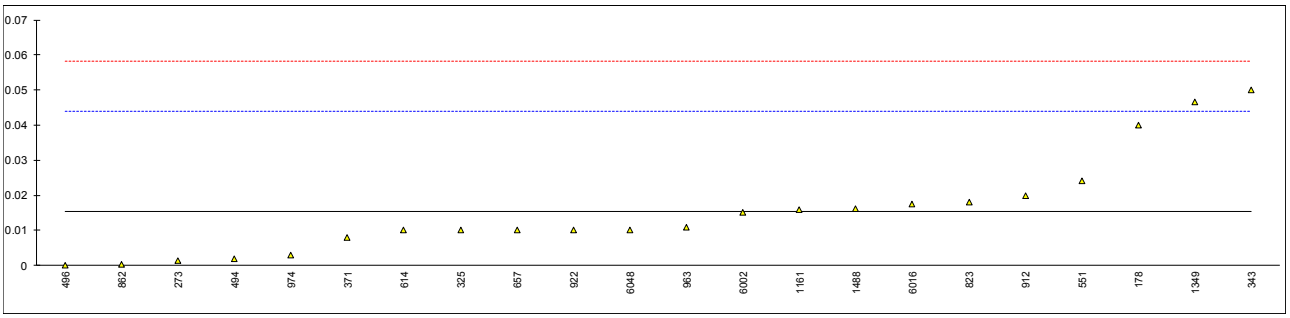
APPENDIX 1

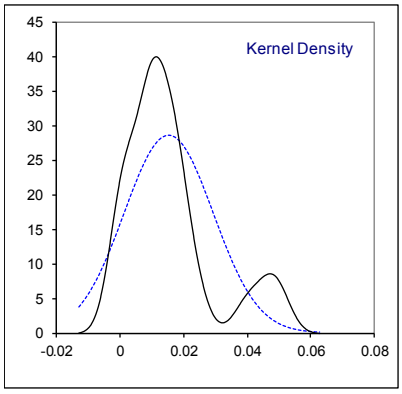
Determination of Acid Number (Total) on sample #18075; results in mg KOH/g

lab	method	value	mark	z(targ)	remarks
150	D974	<0.02		-----	
171	D974	<0.02		-----	
173		-----		-----	
178	D974	0.04		1.72	
179	D974	<0.01		-----	
237	D664-A	<0.1		-----	
273	D974	0.0015		-0.97	
323	D974	< 0.02		-----	
325	D664-A	0.01		-0.38	
329	D974	<0,02		-----	
333		-----		-----	
343	D664-A	0.05		2.42	
349	D664-A	<0,1		-----	
357	D664-A	< 0,05		-----	
369	D664-A	<0.05		-----	
371	D974	0.008		-0.52	
396		-----		-----	
432		-----		-----	
446		-----		-----	
485		-----		-----	
494	D664-A	0.002		-0.94	
496	D974	0.00		-1.08	
551	D974	0.024		0.60	
601		-----		-----	
603		-----		-----	
614	D974	0.01		-0.38	
657	D974	0.01		-0.38	
704	D974	< 0.02		-----	
823	D974	0.018		0.18	
862	D664-A	0.0003		-1.06	
874	D664-A	<0.1		-----	
875	D664-A	<0.1		-----	
886		-----		-----	
912	D974	0.02		0.32	
922	D664-A	0.010		-0.38	
962	D974	<0.02		-----	
963	D974	0.011		-0.31	
974	D974	0.0029		-0.88	
982		-----		-----	
1011		-----		-----	
1026		-----		-----	
1081		-----		-----	
1082		-----		-----	
1161	D664-A	0.016		0.04	
1191		-----		-----	
1320		-----		-----	
1349	D664-A	0.0467		2.19	
1461		-----		-----	
1488	ISO6618	0.0161		0.05	
1564		-----		-----	
1706		-----		-----	
1748		-----		-----	
1749		-----		-----	
1877		-----		-----	
6002	D664-A	0.015		-0.03	
6016	D664-A	0.0176		0.15	
6048	D974	0.01		-0.38	
6113		-----		-----	

	normality	not OK
	n	22
	outliers	0
	mean (n)	0.0154
	st.dev. (n)	0.01398
	R(calc.)	0.0391
	st.dev.(D974:14e2)	0.01429
	R(D974:14e2)	0.04

Compare R(D664-A:17a) = 0.1427

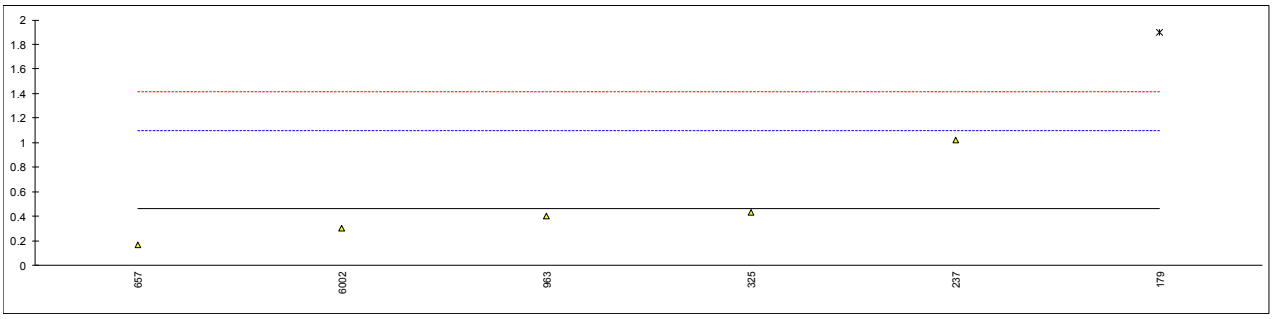

0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
496
862
273
494
974
371
614
325
657
922
6048
963
6002
1161
1488
6016
823
912
551
178
1349
343


Kernel Density
45
40
35
30
25
20
15
10
5
0
-0.02
0
0.02
0.04
0.06
0.08

Determination of Air-release time at 50°C on sample #18075; results in min

lab	method	value	mark	z(targ)	remarks
150		-----		-----	
171		-----		-----	
173		-----		-----	
178		-----		-----	
179	D3427	1.9	DG(0.05)	4.54	
237	D3427	1.02		1.75	
273		-----		-----	
323		-----		-----	
325	D3427	0.43333333		-0.10	
329		-----		-----	
333		-----		-----	
343		-----		-----	
349		-----		-----	
357		-----		-----	
369		-----		-----	
371		-----		-----	
396		-----		-----	
432		-----		-----	
446		-----		-----	
485		-----		-----	
494		-----		-----	
496	D3427	<0.1		-----	
551		-----		-----	
601		-----		-----	
603		-----		-----	
614	D3427	<1.0		-----	
657	D3427	0.17		-0.93	
704		-----		-----	
823		-----		-----	
862	D3427	<0.1		-----	
874		-----		-----	
875		-----		-----	
886		-----		-----	
912		-----		-----	
922		-----		-----	
962		-----		-----	
963	D3427	0.4		-0.20	
974		-----		-----	
982		-----		-----	
1011		-----		-----	
1026	D3427	<1		-----	
1081		-----		-----	
1082		-----		-----	
1161		-----		-----	
1191		-----		-----	
1320		-----		-----	
1349		-----		-----	
1461		-----		-----	
1488		-----		-----	
1564	D3427	<1.0		-----	
1706		-----		-----	
1748		-----		-----	
1749		-----		-----	
1877		-----		-----	
6002	ISO9120	0.3		-0.52	
6016		-----		-----	
6048		-----		-----	
6113		-----		-----	

normality	unknown
n	5
outliers	1
mean (n)	0.465
st.dev. (n)	0.3269
R(calc.)	0.915
st.dev.(D3427:15)	0.3165
R(D3427:15)	0.886


2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
657
6002
963
325
237
179

Determination of Color ASTM on sample #18075;

lab	method	value	mark	z(targ)	remarks
150	D6045	<0.5		-----	
171	D1500	L0.5		-----	
173	D1500	L0.5		-----	
178		-----		-----	
179	D1500	L0.5		-----	
237	D1500	L0.5		-----	
273	D1500	L0.5		-----	
323	D1500	L 0.5		-----	
325	D6045	L0.5		-----	
329	D1500	L0,5		-----	
333		-----		-----	
343	D1500	L0,5		-----	
349	D6045	L0,5		-----	
357	D1500	<0,5		-----	
369	D1500	L.0.5		-----	
371	D6045	L0.5		-----	
396	D1500	L 0,5		-----	
432	D1500	L0,5		-----	
446	D1500	L0.5		-----	
485	D1500	L 0.5		-----	
494	D1500	L0,5		-----	
496	D1500	L0.5		-----	
551	D1500	L0.5		-----	
601		-----		-----	
603	D1500	L0.5		-----	
614	D1500	<0.5		-----	
657	D1500	L0.5		-----	
704	D1500	L0.5		-----	
823	D1500	L0.5		-----	
862	D1500	L0.5		-----	
874	D1500	L0.5		-----	
875	D6045	<0.5		-----	
886		-----		-----	
912	D1500	<0.5		-----	
922	D1500	<0.5		-----	
962	D1500	L0.5		-----	
963	D1500	L0.5		-----	
974	D1500	L0.5		-----	
982	D1500	L 0.5		-----	
1011	D6045	L0.5		-----	
1026	D1500	L0.5		-----	
1081	D6045	0.0		-----	
1082		-----		-----	
1161	D1500	L0,5		-----	
1191		-----		-----	
1320		-----		-----	
1349		0		-----	
1461		-----		-----	
1488		-----		-----	
1564	D1500	L0.5		-----	
1706		-----		-----	
1748	D1500	0		-----	
1749	D1500	<0.5		-----	
1877	D6045	L0.5		-----	
6002	D1500	L0,5		-----	
6016	D1500	0.5		-----	
6048	D1500	0.0		-----	
6113		-----		-----	
	n	47			
	mean (n)	L0.5			

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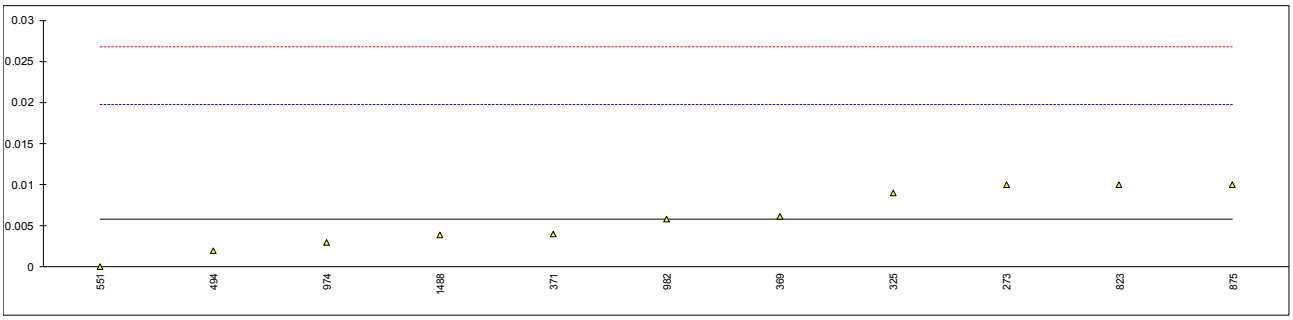
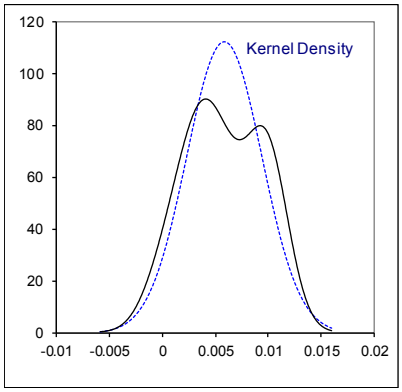
Determination of Conradson Carbon Residue on sample #18075; results in %M/M

lab	method	value	mark	z(targ)	remarks
150	D4530	<0.10		-----	
171	D189	<0.01		-----	
173		-----		-----	
178		-----		-----	
179	D189	<0.01		-----	
237	D189	<0.01		-----	
273	D189	0.01		0.60	
323	D4530	< 0.01		-----	
325	D4530	0.009		0.46	
329		-----		-----	
333		-----		-----	
343		-----		-----	
349	D189	<0,01		-----	
357		-----		-----	
369	D4530	0.0061		0.04	
371	D189	0.004		-0.26	
396		-----		-----	
432		-----		-----	
446		-----		-----	
485		-----		-----	
494	D4530	0.002		-0.54	
496		-----		-----	
551	D4530	0.00		-0.83	
601		-----		-----	
603		-----		-----	
614	D4530	<0.01		-----	
657	D4530	<0.10		-----	
704	D4530	< 0.10		-----	
823	D189	0.01		0.60	
862	D4530	<0.1		-----	
874	D4530	<0.10		-----	
875	D4530	0.01		0.60	
886		-----		-----	
912		-----		-----	
922	D4530	<0.01		-----	
962		-----		-----	
963		-----		-----	
974	D189	0.003		-0.40	
982	D189	0.0058		0.00	
1011		-----		-----	
1026		-----		-----	
1081		-----		-----	
1082		-----		-----	
1161		-----		-----	
1191		-----		-----	
1320		-----		-----	
1349		-----		-----	
1461		-----		-----	
1488	ISO6615	0.0039		-0.27	
1564		-----		-----	
1706		-----		-----	
1748		-----		-----	
1749		-----		-----	
1877		-----		-----	
6002		-----		-----	
6016		-----		-----	
6048		-----		-----	
6113		-----		-----	

	normality	OK	
	n	11	
	outliers	0	
	mean (n)	0.0058	
	st.dev. (n)	0.00355	
	R(calc.)	0.0099	
	st.dev.(D189:06)	0.00698	
	R(D189:06)	0.0195	Compare R(D4530:15) = 0.1407

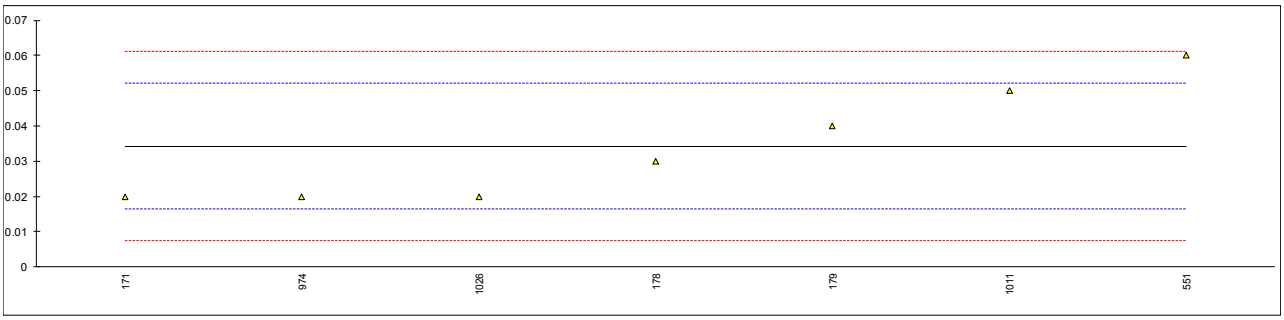

0.03
0.025
0.02
0.015
0.01
0.005
0
551
494
974
1488
371
982
369
325
273
823
875

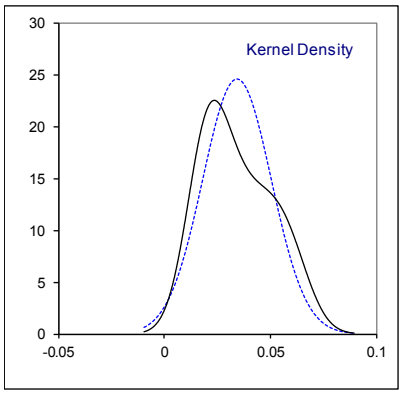

120
100
80
60
40
20
0
-0.01
-0.005
0
0.005
0.01
0.015
0.02
Kernel Density

Determination of Ramsbottom Carbon Residue on sample #18075; results in %M/M

lab	method	value	mark	z(targ)	remarks
150		-----		-----	
171	D524	0.02		-1.60	
173		-----		-----	
178	D524	0.03		-0.48	
179	D524	0.04		0.64	
237		-----		-----	
273		-----		-----	
323		-----		-----	
325		-----		-----	
329		-----		-----	
333		-----		-----	
343		-----		-----	
349		-----		-----	
357		-----		-----	
369		-----		-----	
371		-----		-----	
396		-----		-----	
432		-----		-----	
446		-----		-----	
485		-----		-----	
494		-----		-----	
496		-----		-----	
551	D524	0.06		2.87	
601		-----		-----	
603		-----		-----	
614		-----		-----	
657	D524	<0.10		-----	
704		-----		-----	
823		-----		-----	
862		-----		-----	
874		-----		-----	
875		-----		-----	
886		-----		-----	
912		-----		-----	
922		-----		-----	
962		-----		-----	
963		-----		-----	
974	D524	0.02		-1.60	
982		-----		-----	
1011	D524	0.05		1.76	
1026	D524	0.02		-1.60	
1081		-----		-----	
1082		-----		-----	
1161		-----		-----	
1191		-----		-----	
1320		-----		-----	
1349		-----		-----	
1461		-----		-----	
1488		-----		-----	
1564		-----		-----	
1706		-----		-----	
1748		-----		-----	
1749		-----		-----	
1877		-----		-----	
6002		-----		-----	
6016		-----		-----	
6048		-----		-----	
6113		-----		-----	

normality	unknown
n	7
outliers	0
mean (n)	0.0343
st.dev. (n)	0.01618
R(calc.)	0.0453
st.dev.(D524:15)	0.00895
R(D524:15)	0.0250

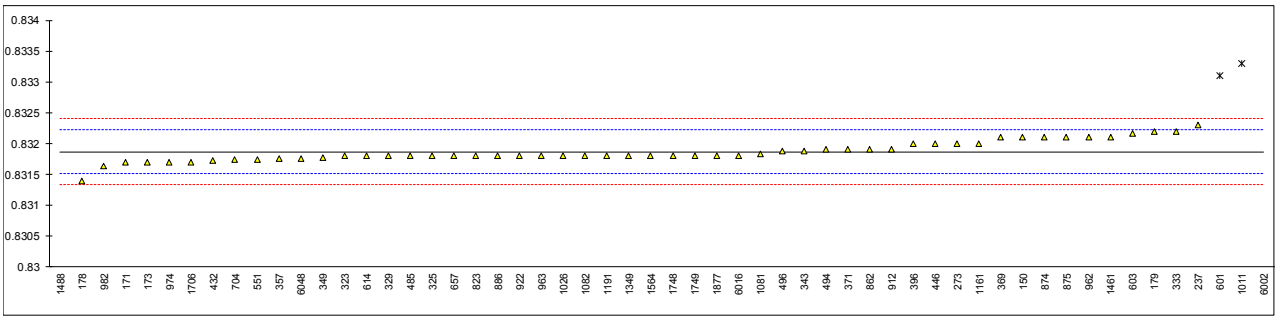

0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
171
974
1026
178
179
1011
551

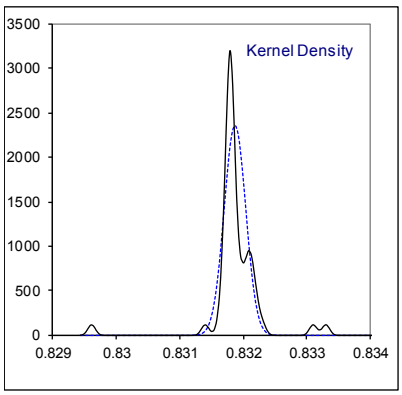

Kernel Density
30
25
20
15
10
5
0
-0.05
0
0.05
0.1

Determination of Density at 15°C on sample #18075; results in kg/L

lab	method	value	mark	z(targ)	remarks
150	D4052	0.8321		1.30	
171	D4052	0.8317		-0.94	
173	D4052	0.8317		-0.94	
178	D4052	0.8314		-2.62	
179	D4052	0.8322		1.86	
237	D4052	0.8323		2.42	
273	D4052	0.8320		0.74	
323	D4052	0.8318		-0.38	
325	D4052	0.83180		-0.38	
329	D4052	0.8318		-0.38	
333	D4052	0.8322		1.86	
343	D4052	0.83188		0.06	
349	D4052	0.83177		-0.55	
357	D4052	0.83175		-0.66	
369	D4052	0.8321		1.30	
371	D4052	0.8319		0.18	
396	D4052	0.8320		0.74	
432	D4052	0.83173		-0.78	
446	D4052	0.8320		0.74	
485	D4052	0.8318		-0.38	
494	D4052	0.8319		0.18	
496	D4052	0.83187		0.01	
551	D4052	0.83174		-0.72	
601	D1298	0.8331	C,R(0.01)	6.90	First reported 0.8328
603	D4052	0.83217		1.69	
614	D4052	0.8318	C	-0.38	First reported 0.8332
657	D4052	0.8318		-0.38	
704	D4052	0.83174		-0.72	
823	D4052	0.8318		-0.38	
862	D4052	0.8319		0.18	
874	D4052	0.8321		1.30	
875	D4052	0.8321		1.30	
886	D4052	0.8318		-0.38	
912	D4052	0.8319		0.18	
922	D4052	0.8318		-0.38	
962	D4052	0.8321		1.30	
963	D4052	0.8318		-0.38	
974	D4052	0.8317		-0.94	
982	D4052	0.83163		-1.34	
1011	D4052	0.8333	R(0.01)	8.02	
1026	D4052	0.8318	C	-0.38	First reported 831.8 kg/L
1081	D4052	0.83183		-0.22	
1082	ISO12185	0.8318		-0.38	
1161	ISO3675	0.8320		0.74	
1191	ISO12185	0.8318		-0.38	
1320		-----		-----	
1349	ISO12185	0.8318		-0.38	
1461	ISO3675	0.8321		1.30	
1488	ISO3675	0.82961	C,R(0.01)	-12.65	First reported 830.25 kg/m^3
1564	D4052	0.8318		-0.38	
1706	D4052	0.8317		-0.94	
1748	D4052	0.8318		-0.38	
1749	ISO12185	0.8318		-0.38	
1877	D4052	0.8318		-0.38	
6002	ISO3675	0.840	R(0.01)	45.54	
6016	D4052	0.83180		-0.38	
6048	ISO12185	0.83175		-0.66	
6113		-----		-----	

normality	OK
n	52
outliers	4
mean (n)	0.83187
st.dev. (n)	0.000169
R(calc.)	0.00047
st.dev.(D4052:18)	0.000179
R(D4052:18)	0.00050

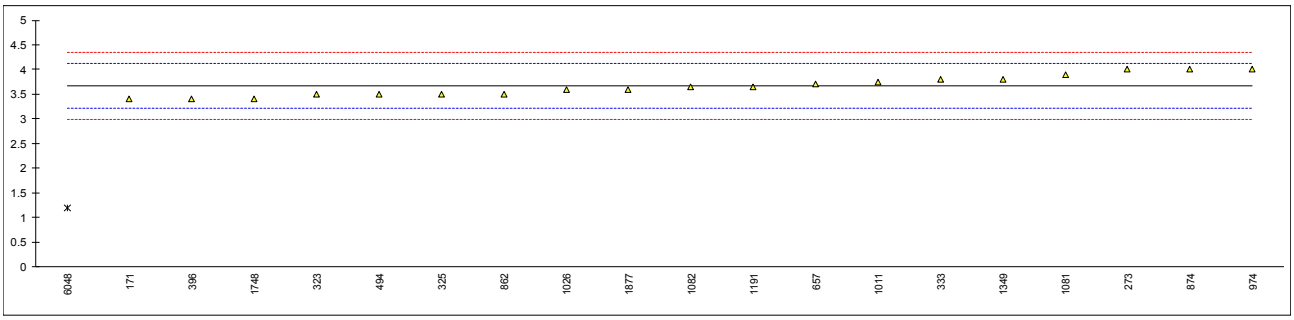

0.834
0.8335
0.833
0.8325
0.832
0.8315
0.831
0.8305
0.83
1488 178 982 171 173 974 1706 432 704 551 357 6048 349 323 614 329 485 325 657 823 886 922 963 1026 1082 1191 1349 1564 1748 1749 1877 6016 1081 496 343 494 371 862 912 396 446 273 1161 369 150 874 875 962 1461 603 179 333 237 601 1011 6002

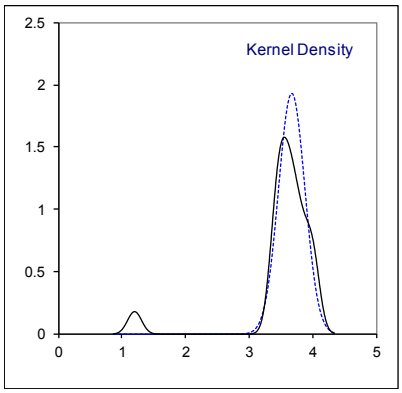

Kernel Density
3500
3000
2500
2000
1500
1000
500
0
0.829 0.83 0.831 0.832 0.833 0.834

Determination of Evaporation loss by Noack test on sample #18075; results in %M/M

lab	method	value	mark	z(targ)	remarks
150		-----		-----	
171	D5800 - B	3.4		-1.17	
173		-----		-----	
178		-----		-----	
179		-----		-----	
237		-----		-----	
273	D5800 - A	4.0		1.48	
323	D5800 - B	3.5		-0.73	
325	CEC L-40-93	3.5		-0.73	
329		-----		-----	
333	CEC L-40-93	3.8		0.60	
343		-----		-----	
349		-----		-----	
357		-----		-----	
369		-----		-----	
371		-----		-----	
396	D5800 - B	3.4		-1.17	
432		-----		-----	
446		-----		-----	
485		-----		-----	
494	D5800 - B	3.5		-0.73	
496		-----		-----	
551		-----		-----	
601		-----		-----	
603		-----		-----	
614		-----		-----	
657	D5800 - B	3.7		0.15	
704		-----		-----	
823		-----		-----	
862	D5800 - B	3.5		-0.73	
874	D5800 - B	4.0		1.48	
875		-----		-----	
886		-----		-----	
912		-----		-----	
922		-----		-----	
962		-----		-----	
963		-----		-----	
974	D5800 - A	4.0		1.48	
982		-----		-----	
1011	CEC L-40-93	3.75		0.37	
1026	CEC L-40-93	3.6		-0.29	
1081	D5800 - B	3.9		1.04	
1082	CEC L-40-93	3.64		-0.11	
1161		-----		-----	
1191	CEC L-40-93	3.65		-0.07	
1320		-----		-----	
1349	D5800 - B	3.8		0.60	
1461		-----		-----	
1488		-----		-----	
1564		-----		-----	
1706		-----		-----	
1748	D5800 - B	3.4		-1.17	
1749		-----		-----	
1877	D5800 - B	3.6		-0.29	
6002		-----		-----	
6016		-----		-----	
6048	DIN51581	1.2	R(0.01)	-10.89	
6113		-----		-----	

normality	OK
n	19
outliers	1
mean (n)	3.665
st.dev. (n)	0.2062
R(calc.)	0.577
st.dev.(D5800-B:18)	0.2264
R(D5800-B:18)	0.634

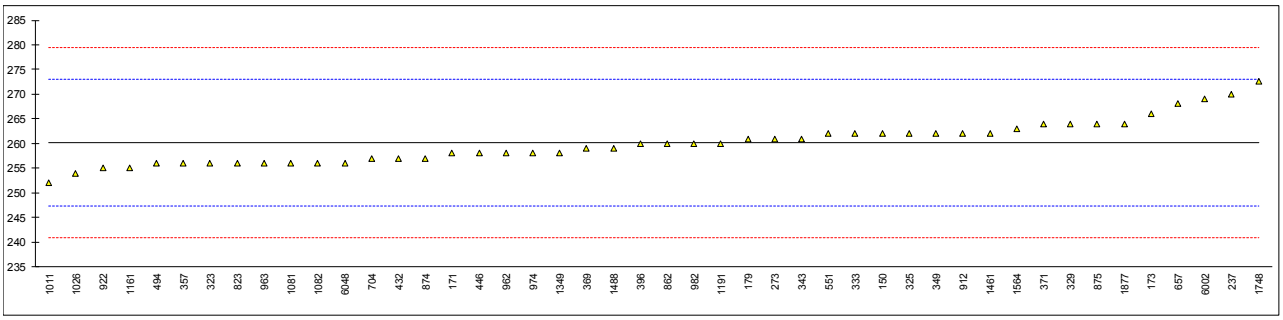

5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
6048
171
396
1748
323
494
325
862
1026
1877
1082
1191
657
1011
333
1349
1081
273
874
974

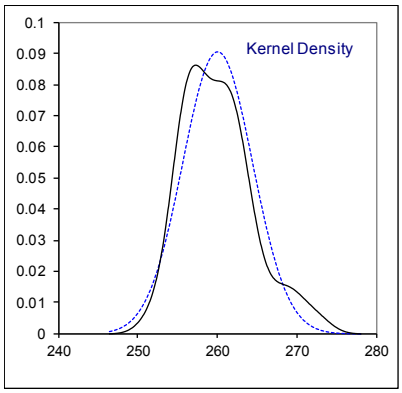

Kernel Density
2.5
2
1.5
1
0.5
0
0
1
2
3
4
5

Determination of Flash Point C.O.C. on sample #18075; results in °C

lab	method	value	mark	z(targ)	remarks
150	D92	262		0.30	
171	D92	258		-0.33	
173	D92	266		0.92	
178		-----		-----	
179	D92	261		0.14	
237	D92	270		1.54	
273	D92	261		0.14	
323	D92	256		-0.64	
325	D92	262		0.30	
329	D92	264		0.61	
333	D92	262		0.30	
343	D92	261		0.14	
349	D92	262		0.30	
357	D92	256.0		-0.64	
369	D92	259		-0.17	
371	D92	264		0.61	
396	D92	260		-0.02	
432	D92	257.0		-0.48	
446	D92	258		-0.33	
485		-----		-----	
494	D92	256		-0.64	
496		-----		-----	
551	D92	262		0.30	
601		-----		-----	
603		-----		-----	
614		-----		-----	
657	D92	268		1.23	
704	D92	257		-0.48	
823	D92	256		-0.64	
862	D92	260		-0.02	
874	D92	257		-0.48	
875	D92	264		0.61	
886		-----		-----	
912	D92	262		0.30	
922	D92	255		-0.79	
962	D92	258		-0.33	
963	D92	256		-0.64	
974	D92	258		-0.33	
982	D92	260.0		-0.02	
1011	D92	252		-1.26	
1026	D92	254		-0.95	
1081	D92	256.0		-0.64	
1082	ISO2592	256		-0.64	
1161	ISO2592	255.0		-0.79	
1191	ISO2592	260		-0.02	
1320		-----		-----	
1349	D92	258.1		-0.31	
1461	ISO2592	262		0.30	
1488	ISO2592	259		-0.17	
1564	D92	263		0.45	
1706		-----		-----	
1748	D92	272.6		1.94	
1749		-----		-----	
1877	D92	264		0.61	
6002	ISO2592	269		1.38	
6016		-----		-----	
6048	ISO2592	256		-0.64	
6113		-----		-----	

normality	OK
n	46
outliers	0
mean (n)	260.10
st.dev. (n)	4.397
R(calc.)	12.31
st.dev.(D92:16b)	6.429
R(D92:16b)	18

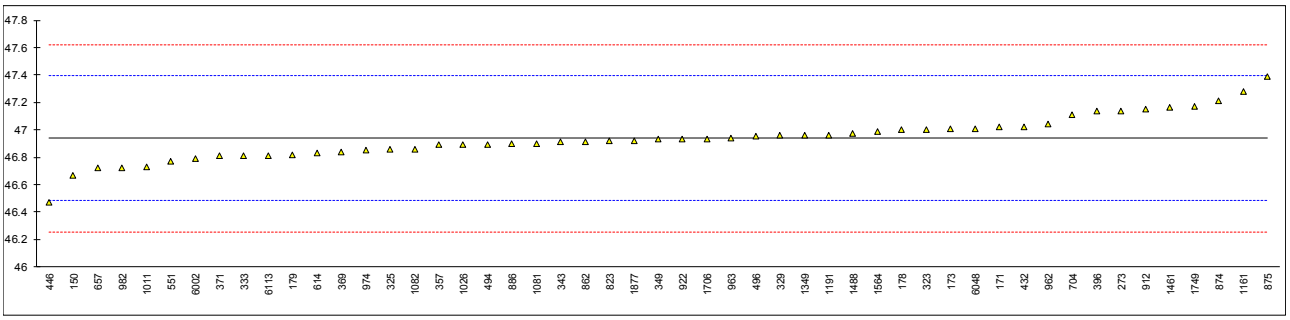

285
280
275
270
265
260
255
250
245
240
235
1011 1026 922 1161 494 357 323 823 963 1081 1082 6048 704 432 874 171 446 962 974 1349 369 1488 396 862 982 1191 179 273 343 551 333 150 325 349 912 1461 1564 371 329 875 1877 173 657 6002 237 1748

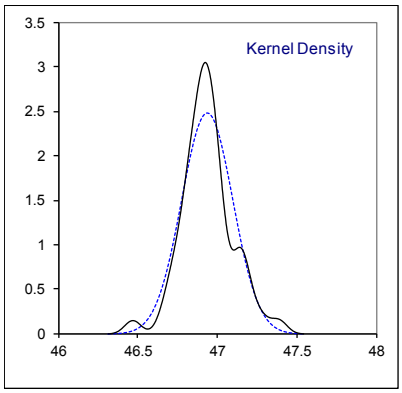

Kernel Density
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
240 250 260 270 280

Determination of Kinematic Viscosity at 40°C on sample #18075; results in mm^2/s

lab	method	value	mark	z(targ)	remarks
150	D445	46.666		-1.20	
171	D445	47.02		0.36	
173	D445	47.01		0.31	
178	D445	47.0		0.27	
179	D445	46.82		-0.52	
237		-----		-----	
273	D445	47.14		0.88	
323	D445	47.00		0.27	
325	D445	46.86		-0.35	
329	D445	46.96		0.09	
333	D445	46.81		-0.56	
343	D445	46.91		-0.13	
349	D445	46.93		-0.04	
357	D445	46.89		-0.21	
369	D445	46.84		-0.43	
371	D445	46.81		-0.56	
396	D445	47.14		0.88	
432	D445	47.02		0.36	
446	D445	46.47		-2.06	
485		-----		-----	
494	D445	46.895		-0.19	
496	D445	46.952		0.06	
551	D445	46.77		-0.74	
601		-----		-----	
603		-----		-----	
614	D445	46.83		-0.48	
657	D445	46.72		-0.96	
704	D445	47.108		0.74	
823	D445	46.92		-0.08	
862	D445	46.91		-0.13	
874	D445	47.21		1.19	
875	D445	47.39		1.98	
886	D445	46.9		-0.17	
912	D445	47.15		0.93	
922	D445	46.93		-0.04	
962	D445	47.04		0.44	
963	D445	46.94		0.01	
974	D445	46.85		-0.39	
982	D445	46.72		-0.96	
1011	D445	46.73		-0.92	
1026	D445	46.89		-0.21	
1081	D445	46.90		-0.17	
1082	D445	46.86		-0.35	
1161	ISO3104	47.28		1.50	
1191	ISO3104	46.963		0.11	
1320		-----		-----	
1349	D445	46.9611		0.10	
1461	ISO3104	47.1621		0.98	
1488	ISO3104	46.97199		0.15	
1564	D445	46.99		0.22	
1706	D445	46.934		-0.02	
1748		-----		-----	
1749	ISO3104	47.17		1.01	
1877	D445	46.92		-0.08	
6002	ISO3104	46.791		-0.65	
6016		-----		-----	
6048	ISO3104	47.01		0.31	
6113	D445	46.81		-0.56	

normality	suspect
n	51
outliers	0
mean (n)	46.939
st.dev. (n)	0.1612
R(calc.)	0.451
st.dev.(D445:17a)	0.2280
R(D445:17a)	0.638

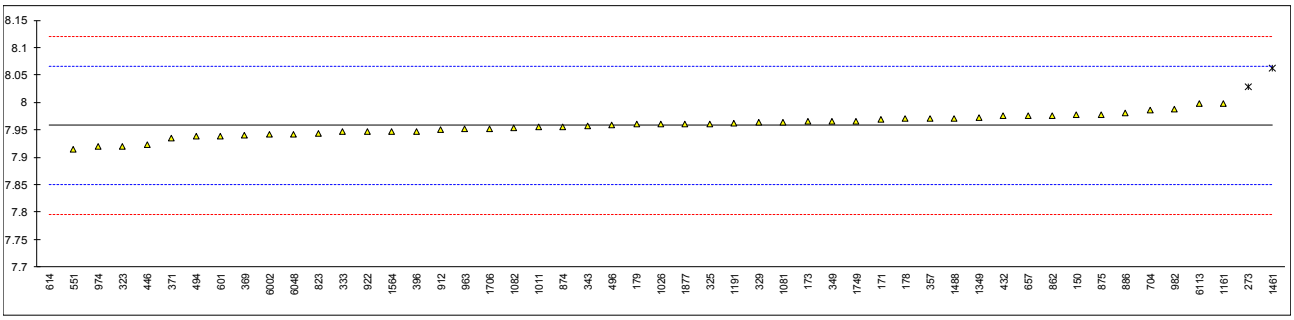

47.8
47.6
47.4
47.2
47
46.8
46.6
46.4
46.2
46
446 150 657 982 1011 551 6002 371 333 6113 179 614 369 974 325 1082 357 1026 494 886 1081 343 862 823 1877 349 922 1706 963 496 329 1349 1191 1488 1564 178 323 173 6048 171 432 962 704 396 273 912 1461 1749 874 1161 875

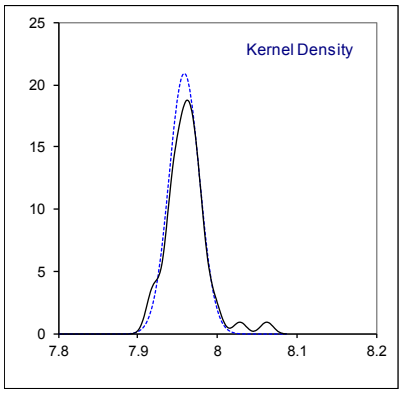

Kernel Density
3.5
3
2.5
2
1.5
1
0.5
0
46
46.5
47
47.5
48

Determination of Kinematic Viscosity at 100°C on sample #18075; results in mm^2/s

lab	method	value	mark	z(targ)	remarks
150	D445	7.977		0.35	
171	D445	7.969		0.20	
173	D445	7.965		0.13	
178	D445	7.97		0.22	
179	D445	7.960		0.04	
237		-----		-----	
273	D445	8.028	R(0.05)	1.30	
323	D445	7.920		-0.70	
325	D445	7.9605		0.05	
329	D445	7.964		0.11	
333	D445	7.946		-0.22	
343	D445	7.9566		-0.03	
349	D445	7.966		0.15	
357	D445	7.970		0.22	
369	D445	7.9408		-0.32	
371	D445	7.935		-0.43	
396	D445	7.947		-0.20	
432	D445	7.975		0.31	
446	D445	7.923		-0.65	
485		-----		-----	
494	D445	7.9377		-0.38	
496	D445	7.9587		0.01	
551	D445	7.915		-0.80	
601	D445	7.938		-0.37	
603		-----		-----	
614	D445	7.43	R(0.01)	-9.78	
657	D445	7.976		0.33	
704	D445	7.9854		0.51	
823	D445	7.943		-0.28	
862	D445	7.976		0.33	
874	D445	7.956		-0.04	
875	D445	7.977		0.35	
886	D445	7.98		0.41	
912	D445	7.951		-0.13	
922	D445	7.946		-0.22	
962		-----		-----	
963	D445	7.952		-0.11	
974	D445	7.919		-0.72	
982	D445	7.987		0.54	
1011	D445	7.955		-0.06	
1026	D445	7.96		0.04	
1081	D445	7.964		0.11	
1082	D445	7.954		-0.07	
1161	ISO3104	7.998		0.74	
1191	ISO3104	7.9629		0.09	
1320		-----		-----	
1349	D445	7.9728		0.27	
1461	ISO3104	8.0618	R(0.01)	1.92	
1488	ISO3104	7.97098		0.24	
1564	D445	7.946		-0.22	
1706	D445	7.952		-0.11	
1748		-----		-----	
1749	ISO3104	7.966		0.15	
1877	D445	7.960		0.04	
6002	ISO3104	7.9415		-0.31	
6016		-----		-----	
6048	ISO3104	7.942		-0.30	
6113	D445	7.997		0.72	

normality	OK
n	48
outliers	3
mean (n)	7.9580
st.dev. (n)	0.01906
R(calc.)	0.0534
st.dev.(D445:17a)	0.054001
R(D445:17a)	0.1512

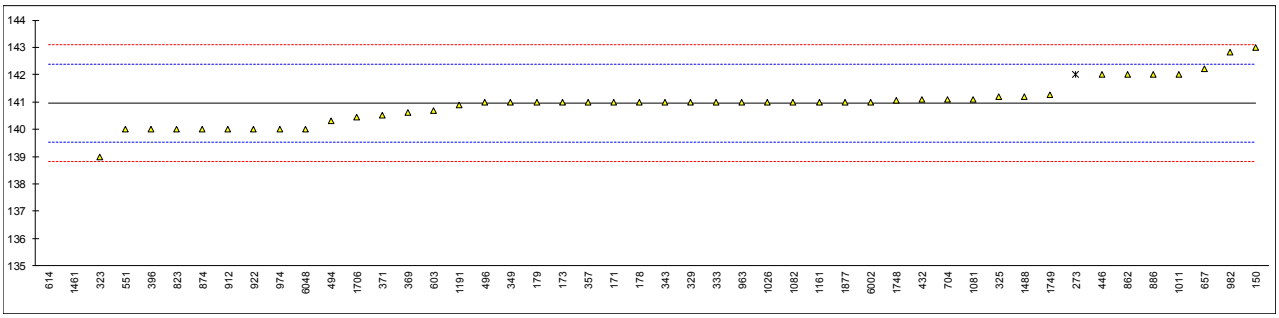

8.15
8.1
8.05
8
7.95
7.9
7.85
7.8
7.75
7.7
614 551 974 323 446 371 494 601 369 6002 6048 823 333 922 1564 396 912 963 1706 1082 1011 874 343 496 179 1026 1877 325 1191 329 1081 173 349 1749 171 178 357 1488 1349 432 657 862 150 875 886 704 982 6113 1161 273 1461

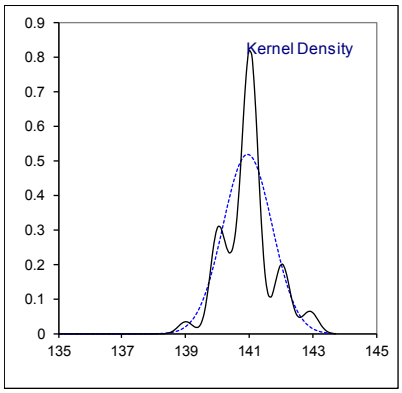

Kernel Density
25
20
15
10
5
0
7.8
7.9
8
8.1
8.2

Determination of Viscosity index on sample #18075

lab	method	value	mark	z(targ)	remarks
150	D2270	143		2.88	
171	D2270	141		0.08	
173	D2270	141		0.08	
178	D2270	141		0.08	
179	D2270	141		0.08	
237		-----		-----	
273	D2270	142	ex	1.48	Excluded, outlier in viscosity at 100°C
323	D2270	139		-2.72	
325	D2270	141.2		0.36	
329	D2270	141	C	0.08	First reported 129
333	D2270	141		0.08	
343	D2270	141	C	0.08	First reported 130.39
349	D2270	141		0.08	
357	D2270	141		0.08	
369	D2270	140.6		-0.48	
371	D2270	140.53		-0.58	
396	D2270	140		-1.32	
432	D2270	141.1		0.22	
446	D2270	142		1.48	
485		-----		-----	
494	D2270	140.3		-0.90	
496	D2270	141		0.08	
551	D2270	140		-1.32	
601		-----		-----	
603	D2270	140.7		-0.34	
614	D2270	122	R(0.01)	-26.52	
657	D2270	142.2		1.76	
704	D2270	141.1		0.22	
823	D2270	140		-1.32	
862	D2270	142		1.48	
874	D2270	140		-1.32	
875		-----		-----	
886	D2270	142		1.48	
912	D2270	140		-1.32	
922	D2270	140		-1.32	
962		-----		-----	
963	D2270	141		0.08	
974	D2270	140		-1.32	
982	D2270	142.81		2.61	
1011	D2270	142		1.48	
1026	D2270	141		0.08	
1081	D2270	141.1		0.22	
1082	D2270	141		0.08	
1161	D2270	141		0.08	
1191	D2270	140.9		-0.06	
1320		-----		-----	
1349		-----		-----	
1461	ISO2909	131	C,R(0.01)	-13.92	First reported 144
1488	ISO2909	141.2		0.36	
1564		-----		-----	
1706	D2270	140.44		-0.71	
1748	D2270	141.06		0.16	
1749	D2270	141.27	C, E	0.46	First reported 130.06, Calculation error? (iis calc. 140.14)
1877	D2270	141		0.08	
6002	ISO2909	141		0.08	
6016		-----		-----	
6048	ISO2909	140		-1.32	
6113		-----		-----	

normality	suspect
n	45
outliers	2 (+1ex)
mean (n)	140.94
st.dev. (n)	0.769
R(calc.)	2.15
st.dev.(D2270:10)	0.714
R(D2270:10)	2

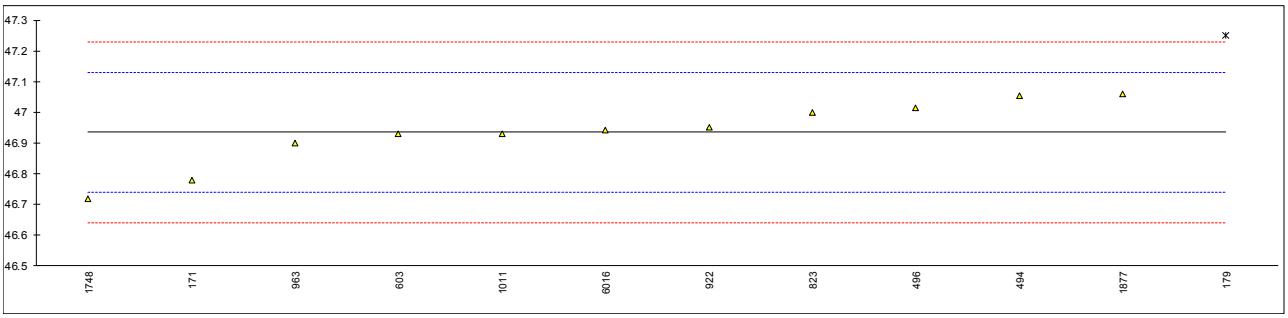

144
143
142
141
140
139
138
137
136
135
614 1461 323 551 396 823 874 912 922 974 6048 494 1706 371 369 603 1191 496 349 179 173 357 171 178 343 329 333 963 1026 1082 1161 1877 6002 1748 432 704 1081 325 1488 1749 273 446 862 886 1011 657 982 150

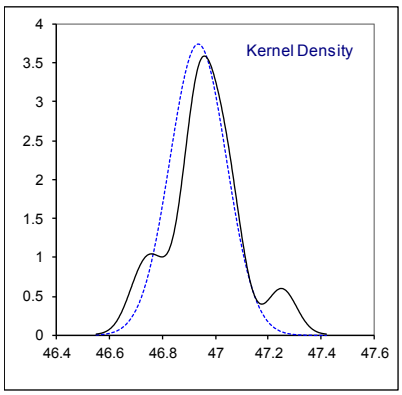

Kernel Density
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
135 137 139 141 143 145

Determination of Viscosity Stabinger at 40°C on sample #18075; results in mm²/s

lab	method	value	mark	z(targ)	remarks
150		-----		-----	
171	D7042	46.78		-1.58	
173		-----		-----	
178		-----		-----	
179	D7042	47.25	DG(0.05)	3.22	
237		-----		-----	
273		-----		-----	
323		-----		-----	
325		-----		-----	
329		-----		-----	
333		-----		-----	
343		-----		-----	
349		-----		-----	
357		-----		-----	
369		-----		-----	
371		-----		-----	
396		-----		-----	
432		-----		-----	
446		-----		-----	
485		-----		-----	
494	D7042	47.055		1.23	
496	D7042	47.015		0.82	
551		-----		-----	
601		-----		-----	
603	D7042	46.9290		-0.05	
614		-----		-----	
657		-----		-----	
704		-----		-----	
823	D7042	47.00		0.67	
862		-----		-----	
874		-----		-----	
875		-----		-----	
886		-----		-----	
912		-----		-----	
922	D7042	46.95		0.16	
962		-----		-----	
963	D7042	46.90		-0.35	
974		-----		-----	
982		-----		-----	
1011	D7042	46.93		-0.04	
1026		-----		-----	
1081		-----		-----	
1082		-----		-----	
1161		-----		-----	
1191		-----		-----	
1320		-----		-----	
1349		-----		-----	
1461		-----		-----	
1488		-----		-----	
1564		-----		-----	
1706		-----		-----	
1748	D7042	46.717		-2.22	
1749		-----		-----	
1877	D7042	47.06		1.28	
6002		-----		-----	
6016	D7042	46.942		0.08	
6048		-----		-----	
6113		-----		-----	

normality	OK
n	11
outliers	1
mean (n)	46.934
st.dev. (n)	0.1067
R(calc.)	0.299
st.dev.(D7042:16e3)	0.0979
R(D7042:16e3)	0.274

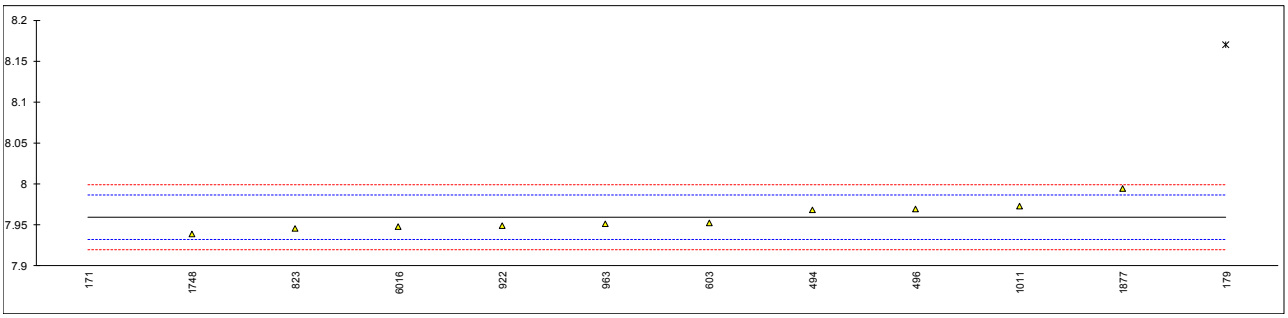

47.3
47.2
47.1
47
46.9
46.8
46.7
46.6
46.5
1748
171
963
603
1011
6016
922
823
496
494
1877
179

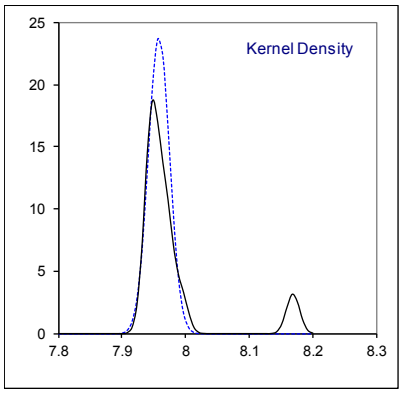

Kernel Density
4
3.5
3
2.5
2
1.5
1
0.5
0
46.4
46.6
46.8
47
47.2
47.4
47.6

Determination of Viscosity Stabinger at 100°C on sample #18075; results in mm^2/s

lab	method	value	mark	z(targ)	remarks
150		-----		-----	
171	D7042	6.156	G(0.01)	-134.85	
173		-----		-----	
178		-----		-----	
179	D7042	8.170	G(0.01)	15.78	
237		-----		-----	
273		-----		-----	
323		-----		-----	
325		-----		-----	
329		-----		-----	
333		-----		-----	
343		-----		-----	
349		-----		-----	
357		-----		-----	
369		-----		-----	
371		-----		-----	
396		-----		-----	
432		-----		-----	
446		-----		-----	
485		-----		-----	
494	D7042	7.9685		0.71	
496	D7042	7.9697		0.79	
551		-----		-----	
601		-----		-----	
603	D7042	7.9526		-0.48	
614		-----		-----	
657		-----		-----	
704		-----		-----	
823	D7042	7.946		-0.98	
862		-----		-----	
874		-----		-----	
875		-----		-----	
886		-----		-----	
912		-----		-----	
922	D7042	7.949		-0.75	
962		-----		-----	
963	D7042	7.951		-0.60	
974		-----		-----	
982		-----		-----	
1011	D7042	7.973		1.04	
1026		-----		-----	
1081		-----		-----	
1082		-----		-----	
1161		-----		-----	
1191		-----		-----	
1320		-----		-----	
1349		-----		-----	
1461		-----		-----	
1488		-----		-----	
1564		-----		-----	
1706		-----		-----	
1748	D7042	7.9387		-1.52	
1749		-----		-----	
1877	D7042	7.994		2.61	
6002		-----		-----	
6016	D7042	7.9482		-0.81	
6048		-----		-----	
6113		-----		-----	

normality	OK
n	10
outliers	2
mean (n)	7.9591
st.dev. (n)	0.01676
R(calc.)	0.0469
st.dev.(D7042:16e3)	0.01337
R(D7042:16e3)	0.0374

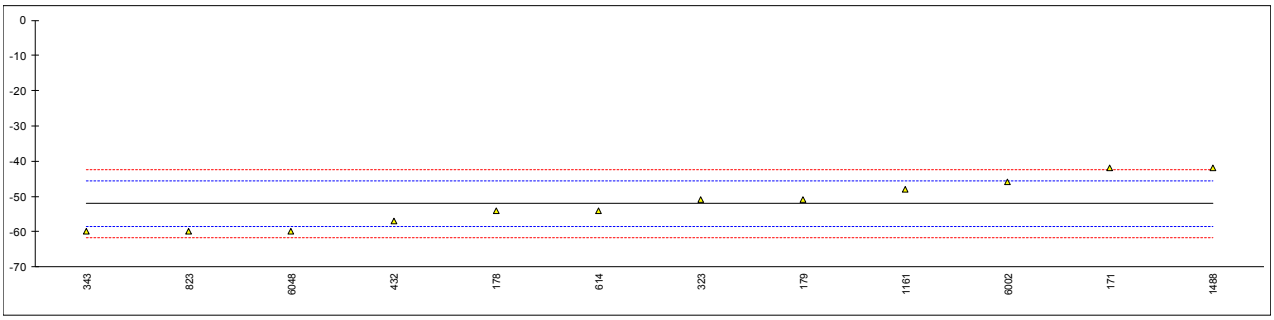

8.2
8.15
8.1
8.05
8
7.95
7.9
171
1748
823
6016
922
963
603
494
496
1011
1877
179

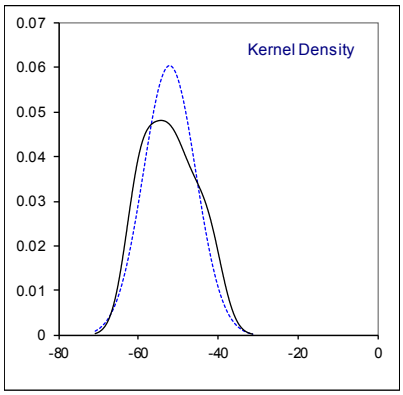

Kernel Density
25
20
15
10
5
0
7.8
7.9
8
8.1
8.2
8.3

Determination of Pour Point manual on sample #18075; results in °C

lab	method	value	mark	z(targ)	remarks
150	D97	<-36		-----	
171	D97	-42		3.14	
173		-----		-----	
178	D97	-54		-0.60	
179	D97	-51		0.34	
237	D97	<-23		-----	
273	D97	<-30		-----	
323	D97	-51		0.34	
325		-----		-----	
329		-----		-----	
333		-----		-----	
343	D97	-60		-2.46	
349		-----		-----	
357		-----		-----	
369	D97	< -42		-----	
371	D97	< -42		-----	
396	D97	<-33		-----	
432	D97	-57		-1.53	
446		-----		-----	
485		-----		-----	
494		-----		-----	
496		-----		-----	
551		-----		-----	
601		-----		-----	
603		-----		-----	
614	D97	-54		-0.60	
657		-----		-----	
704	D97	< -42		-----	
823	D97	-60		-2.46	
862	D97	<-57		-----	
874	D97	<-39		-----	
875	D97	<-56		-----	
886		-----		-----	
912	D97	<-42		-----	
922	D97	<-51		-----	
962		-----		-----	
963		-----		-----	
974	D97	<-42		-----	
982		-----		-----	
1011		-----		-----	
1026	D97	<-45		-----	
1081		-----		-----	
1082		-----		-----	
1161	ISO3016	-48		1.27	
1191		-----		-----	
1320		-----		-----	
1349		-----		-----	
1461		-----		-----	
1488	ISO3016	-42		3.14	
1564		-----		-----	
1706		-----		-----	
1748		-----		-----	
1749		-----		-----	
1877		-----		-----	
6002	ISO3016	-46		1.89	
6016		-----		-----	
6048	D97	-60		-2.46	
6113		-----		-----	

normality	OK
n	12
outliers	0
mean (n)	-52.08
st.dev. (n)	6.598
R(calc.)	18.48
st.dev.(D97:17b)	3.214
R(D97:17b)	9

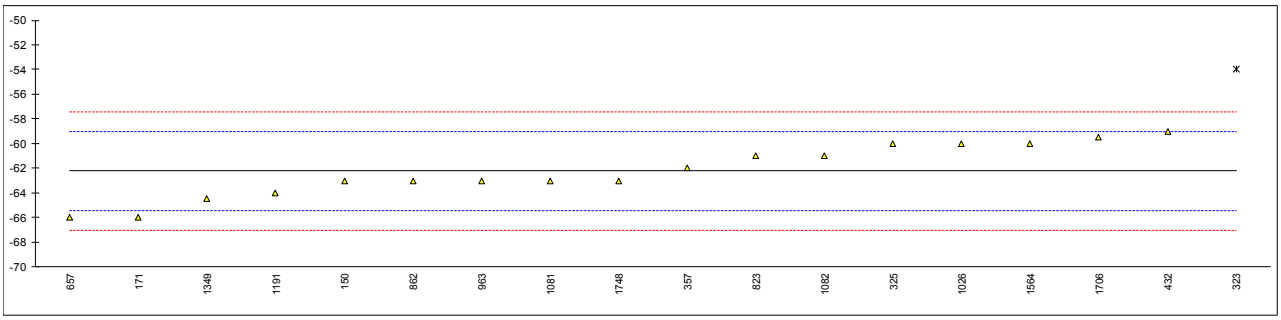

0
-10
-20
-30
-40
-50
-60
-70
343
823
6048
432
178
614
323
179
1161
6002
171
1488

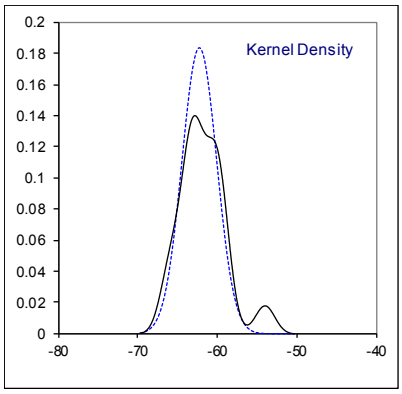

Kernel Density
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
-80
-60
-40
-20
0

Determination of Pour Point automated 1°C int. on sample #18075; results in °C

lab	method	value	mark	z(targ)	remarks
150	D5950	-63		-0.48	
171	D5950	-66		-2.34	
173		-----		-----	
178		-----		-----	
179		-----		-----	
237		-----		-----	
273		-----		-----	
323	D5950	-54	G(0.05)	5.12	
325	D5950	-60		1.39	
329	D5950	<-50		-----	
333		-----		-----	
343		-----		-----	
349		-----		-----	
357	D5950	-62		0.15	
369		-----		-----	
371		-----		-----	
396		-----		-----	
432	D5950	-59		2.01	
446		-----		-----	
485		-----		-----	
494	D5950	< -51		-----	
496		-----		-----	
551		-----		-----	
601		-----		-----	
603		-----		-----	
614		-----		-----	
657	D5950	-66		-2.34	
704		-----		-----	
823	D5950	-61		0.77	
862	D5950	-63		-0.48	
874		-----		-----	
875		-----		-----	
886		-----		-----	
912		-----		-----	
922		-----		-----	
962		-----		-----	
963	D5950	-63		-0.48	
974		-----		-----	
982		-----		-----	
1011		-----		-----	
1026	D5950	-60		1.39	
1081	In house	-63		-0.48	
1082	D5950	-61		0.77	
1161		-----		-----	
1191	D5950	-64		-1.10	
1320		-----		-----	
1349	D7346	-64.5		-1.41	
1461		-----		-----	
1488		-----		-----	
1564	D5949	-60		1.39	
1706	D5950	-59.5		1.70	
1748	D7346	-63		-0.48	
1749		-----		-----	
1877		-----		-----	
6002		-----		-----	
6016		-----		-----	
6048		-----		-----	
6113		-----		-----	

normality	OK
n	17
outliers	1
mean (n)	-62.24
st.dev. (n)	2.173
R(calc.)	6.08
st.dev.(D5950:14)	1.607
R(D5950:14)	4.5


-50
-52
-54
-56
-58
-60
-62
-64
-66
-68
-70
657
171
1349
1191
150
862
963
1081
1748
357
823
1082
325
1026
1564
1706
432
323


Kernel Density
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
-80
-70
-60
-50
-40

Determination of Rust prevention (synthetic seawater) on sample #18075

lab	method	value	mark	z(targ)	remarks
150		-----		-----	
171		-----		-----	
173		-----		-----	
178		-----		-----	
179	D665	Fail		-----	
237		-----		-----	
273		-----		-----	
323		-----		-----	
325	D665	Severe		-----	
329		-----		-----	
333		-----		-----	
343		-----		-----	
349		-----		-----	
357		-----		-----	
369		-----		-----	
371		-----		-----	
396		-----		-----	
432		-----		-----	
446		-----		-----	
485		-----		-----	
494		-----		-----	
496		-----		-----	
551		-----		-----	
601		-----		-----	
603		-----		-----	
614		-----		-----	
657		-----		-----	
704		-----		-----	
823		-----		-----	
862	D665	severe rusting		-----	
874		-----		-----	
875		-----		-----	
886		-----		-----	
912		-----		-----	
922		-----		-----	
962		-----		-----	
963		-----		-----	
974		-----		-----	
982		-----		-----	
1011		-----		-----	
1026	D665	Pass		-----	
1081		-----		-----	
1082		-----		-----	
1161		-----		-----	
1191		-----		-----	
1320	D665	FAIL		-----	
1349		-----		-----	
1461		-----		-----	
1488		-----		-----	
1564		-----		-----	
1706		-----		-----	
1748		-----		-----	
1749		-----		-----	
1877		-----		-----	
6002		-----		-----	
6016	D665	FAIL		-----	
6048		-----		-----	
6113		-----		-----	
	reported	5 fail, 1 pass			

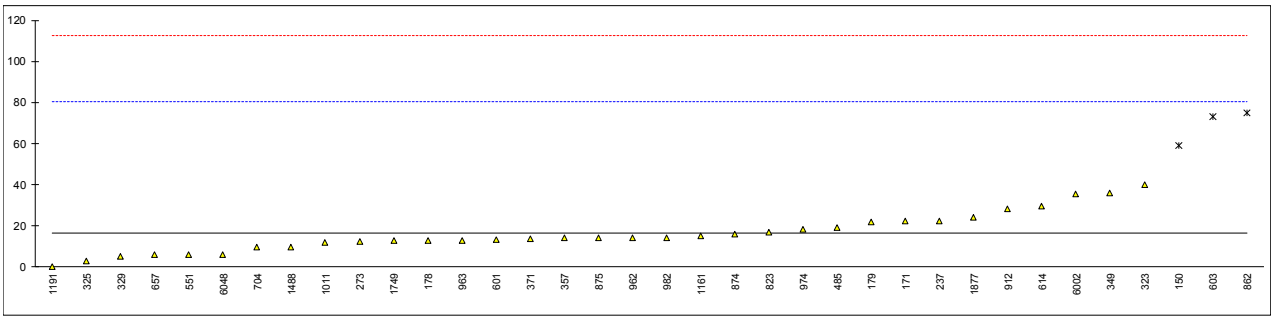
Determination of Sulphur on sample #18075; results in mg/kg

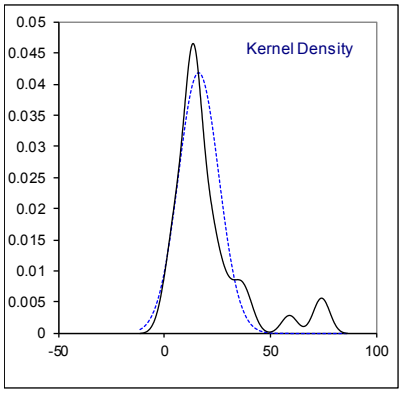
lab	method	value	mark	z(targ)	remarks
150	D2622	<3.0		-----	
171	D2622	<3.0		-----	
173		-----		-----	
178		-----		-----	
179		-----		-----	
237		-----		-----	
273	D5453	<1		-----	
323	D2622	< 3		-----	
325		-----		-----	
329		-----		-----	
333		-----		-----	
343	IP336	<300	C	-----	First reported 0.004%
349	D2622	<0,3		-----	
357		-----		-----	
369	D2622	<3		-----	
371	D5453	0.18		-----	
396		-----		-----	
432		-----		-----	
446		-----		-----	
485		-----		-----	
494	D4294	<20		-----	
496	D2622	0		-----	
551		-----		-----	
601		-----		-----	
603		-----		-----	
614		-----		-----	
657	D5453	0.7	C	-----	First reported 0.7% M/M
704	ISO20846	< 3		-----	
823	D5453	0.03		-----	
862	D2622	<3		-----	
874	D2622	<3		-----	
875	D4294	<20		-----	
886		-----		-----	
912		-----		-----	
922	D5453	<1		-----	
962		-----		-----	
963		-----		-----	
974		-----		-----	
982		-----		-----	
1011	IP336	<0.030		-----	
1026		-----		-----	
1081	ISO20846	0.01		-----	
1082		-----		-----	
1161		-----		-----	
1191		-----		-----	
1320		-----		-----	
1349	D7039	0		-----	
1461		-----		-----	
1488	D4294	4		-----	Possibly a false positive test result?
1564		-----		-----	
1706	ISO20846	-0.8		-----	
1748		-----		-----	
1749		-----		-----	
1877		-----		-----	
6002		-----		-----	
6016		-----		-----	
6048	ISO20884	0.4		-----	
6113		-----		-----	
	n	19			
	mean (n)	<3		Application range: 3 mg/kg – 4.6 %M/M of ASTM D2622:16	

Determination of Water content by KF on sample #18075; results in mg/kg

lab	method	value	mark	z(targ)	remarks
150	D6304-A	59	R(0.01)	1.33	
171	D6304-A	22.3		0.19	
173	D6304-C	<10		-----	
178	D6304-C	13		-0.10	
179	D6304-C	22		0.18	
237	D6304-A	22.53		0.20	
273	D6304-A	12.3		-0.12	
323	D6304-A	40		0.74	
325	D6304-C	3		-0.41	
329	D6304-A	5		-0.35	
333		-----		-----	
343		-----		-----	
349	D6304-A	36		0.62	
357	D6304-A	14		-0.07	
369	ISO12937	<30		-----	
371	D6304-A	13.8		-0.08	
396		-----		-----	
432		-----		-----	
446	D6304-A	<10		-----	
485	D6304-A	19		0.09	
494		-----		-----	
496		-----		-----	
551	D6304-A	6.0		-0.32	
601	D6304-A	13.4		-0.09	
603	D6304-C	73.3	R(0.01)	1.78	
614	D6304-C	29.7		0.42	
657	D6304-C	5.9		-0.32	
704	D6304-A	9.5		-0.21	
823	D6304-A	17		0.02	
862	D6304-C	75	R(0.01)	1.83	
874	D6304-A	16		-0.01	
875	D6304-A	14		-0.07	
886		-----		-----	
912	D6304-C	28		0.37	
922	D6304-A	<10		-----	
962	D6304-A	14		-0.07	
963	D6304-A	13		-0.10	
974	D6304-A	18		0.05	
982	D6304-A	14		-0.07	
1011	D6304	12		-0.13	
1026		-----		-----	
1081		-----		-----	
1082		-----		-----	
1161	D6304-A	14.903		-0.04	
1191	D6304-C	0		-0.51	
1320		-----		-----	
1349		-----		-----	
1461		-----		-----	
1488	ISO12937	9.5		-0.21	
1564		-----		-----	
1706		-----		-----	
1748		-----		-----	
1749	ISO12937	12.73		-0.11	
1877	D6304-C	24		0.24	
6002	D6304-C	35.35		0.59	
6016		-----		-----	
6048	ISO12937	6		-0.32	
6113		-----		-----	

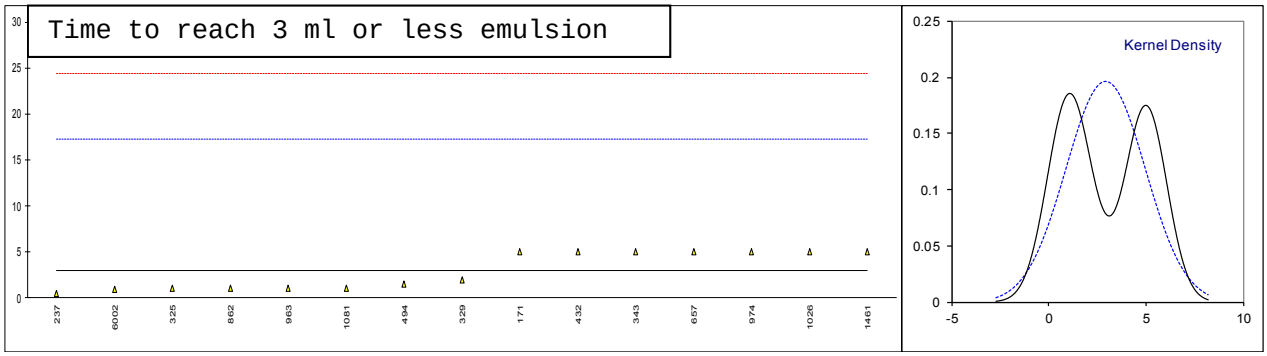
normality	OK
n	33
outliers	3
mean (n)	16.24
st.dev. (n)	9.514
R(calc.)	26.64
st.dev.(D6304:16e1)	32.126
R(D6304:16e1)	89.95

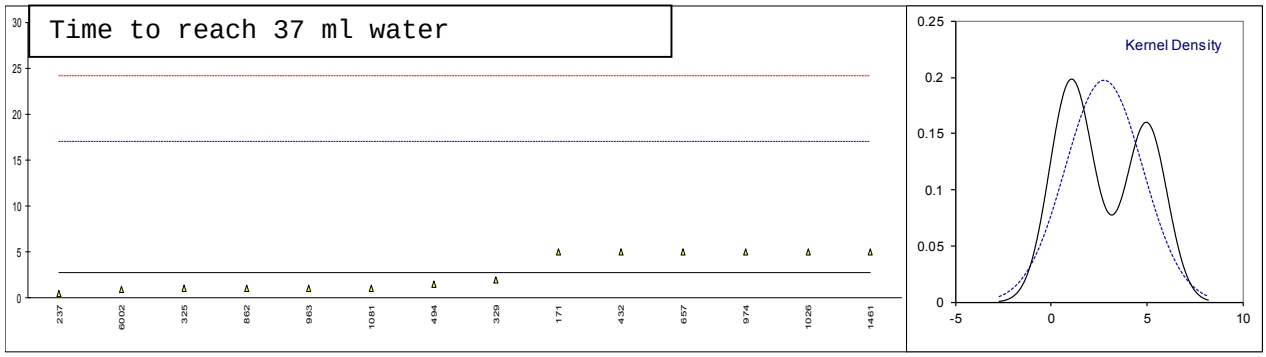

120
100
80
60
40
20
0
1191
325
329
657
551
6048
704
1488
1011
273
1749
178
963
601
371
357
875
962
982
1161
874
823
974
485
179
171
237
1877
912
614
6002
349
323
150
603
862

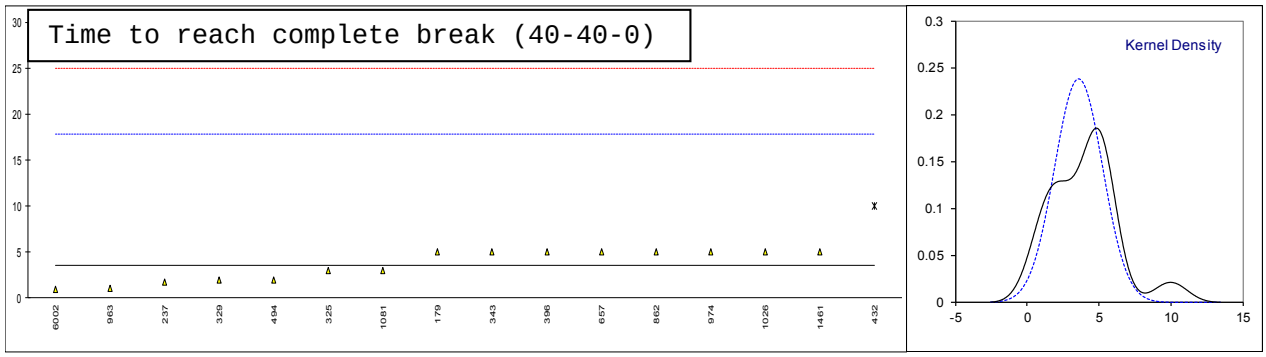

Kernel Density
0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
-50
0
50
100

Determination of Water Separability at 54°C, distilled water on sample #18075; results in minutes

lab	method	time to reach 3 ml or less emulsion	mark	z(targ)	time to reach 37 ml of water	mark	z(targ)	Time to reach complete break (40-40-0)	mark	z(targ)	Test aborted /time
150		-----		-----	-----		-----	-----		-----	
171	D1401	5		0.29	5		0.31	-----		-----	NO
173		-----		-----	-----		-----	-----		-----	
178		-----		-----	-----		-----	-----		-----	
179	D1401	-----		-----	-----		-----	5		0.20	NO
237	D1401	0.49		-0.34	0.53		-0.32	1.68		-0.26	NO
273		-----		-----	-----		-----	-----		-----	
323		-----		-----	-----		-----	-----		-----	
325	D1401	1		-0.27	1		-0.25	3		-0.08	NO
329	D1401	2		-0.13	2		-0.11	2		-0.22	NO
333		-----		-----	-----		-----	-----		-----	
343	D1401	5		0.29	-----		-----	5		0.20	5
349		-----		-----	-----		-----	-----		-----	
357		-----		-----	-----		-----	-----		-----	
369		-----		-----	-----		-----	-----		-----	
371		-----		-----	-----		-----	-----		-----	
396	D1401	-----		-----	-----		-----	5		0.20	
432	D1401	5		0.29	5		0.31	10	G5	0.90	NO
446		-----		-----	-----		-----	-----		-----	
485		-----		-----	-----		-----	-----		-----	
494	D1401	1.5		-0.20	1.5		-0.18	2.0		-0.22	NO
496		-----		-----	-----		-----	-----		-----	
551		-----		-----	-----		-----	-----		-----	
601		-----		-----	-----		-----	-----		-----	
603		-----		-----	-----		-----	-----		-----	
614		-----		-----	-----		-----	-----		-----	NO
657	D1401	5		0.29	5		0.31	5		0.20	NO
704		-----		-----	-----		-----	-----		-----	
823		-----		-----	-----		-----	-----		-----	
862	D1401	1		-0.27	1		-0.25	5		0.20	NO, 5
874		-----		-----	-----		-----	-----		-----	
875		-----		-----	-----		-----	-----		-----	
886		-----		-----	-----		-----	-----		-----	
912		-----		-----	-----		-----	-----		-----	
922		-----		-----	-----		-----	-----		-----	
962		-----		-----	-----		-----	-----		-----	
963	D1401	1		-0.27	1		-0.25	1		-0.36	NO
974	D1401	5		0.29	5		0.31	5		0.20	NO
982		-----		-----	-----		-----	-----		-----	
1011		-----		-----	-----		-----	-----		-----	
1026	D1401	5		0.29	5		0.31	5		0.20	NO
1081	D1401	1		-0.27	1		-0.25	3		-0.08	NO
1082		-----		-----	-----		-----	-----		-----	
1161		-----		-----	-----		-----	-----		-----	
1191		-----		-----	-----		-----	-----		-----	
1320		-----		-----	-----		-----	-----		-----	
1349		-----		-----	-----		-----	-----		-----	
1461		5		0.29	5		0.31	5		0.20	1
1488		-----		-----	-----		-----	-----		-----	
1564		-----		-----	-----		-----	-----		-----	
1706		-----		-----	-----		-----	-----		-----	
1748		-----		-----	-----		-----	-----		-----	
1749		-----		-----	-----		-----	-----		-----	
1877		-----		-----	-----		-----	-----		-----	
6002	ISO6614	0.9		-0.28	0.9		-0.26	0.9		-0.37	NO
6016		-----		-----	-----		-----	-----		-----	
6048		-----		-----	-----		-----	-----		-----	
6113		-----		-----	-----		-----	-----		-----	
	normality	OK			OK			OK			
	n	15			14			15			
	outliers	0			0			1			
	mean (n)	2.93			2.78			3.57			
	st.dev. (n)	2.033			2.021			1.674			
	R(calc.)	5.69			5.66			4.69			
	st.dev.(D1401:18)	7.143			7.143			7.143			
	R(D1401:18)	20			20			20			


Time to reach 3 ml or less emulsion
Kernel Density


Time to reach 37 ml water
Kernel Density


Time to reach complete break (40-40-0)
Kernel Density

Determination of Water Separability at 54°C, distilled water sample #18075; results in ml

lab	method	volume oil phase	volume water phase	volume emulsion phase
150		-----	-----	-----
171	D1401	41	39	0
173		-----	-----	-----
178		-----	-----	-----
179	D1401	40	39	1
237	D1401	40	40	0
273		-----	-----	-----
323		-----	-----	-----
325		-----	-----	-----
329		-----	-----	-----
333		-----	-----	-----
343	D1401	40	40	0
349		-----	-----	-----
357		-----	-----	-----
369		-----	-----	-----
371		-----	-----	-----
396		-----	-----	-----
432	D1401	41	39	0
446		-----	-----	-----
485		-----	-----	-----
494	D1401	40	40	0
496		-----	-----	-----
551		-----	-----	-----
601		-----	-----	-----
603		-----	-----	-----
614		-----	-----	-----
657	D1401	40	40	0
704		-----	-----	-----
823		-----	-----	-----
862	D1401	40	40	0
874		-----	-----	-----
875		-----	-----	-----
886		-----	-----	-----
912		-----	-----	-----
922		-----	-----	-----
962		-----	-----	-----
963	D1401	40	40	0
974	D1401	40.0	40.0	0
982		-----	-----	-----
1011		-----	-----	-----
1026	D1401	40	40	0
1081		-----	-----	-----
1082		-----	-----	-----
1161		-----	-----	-----
1191		-----	-----	-----
1320		-----	-----	-----
1349		-----	-----	-----
1461		40	40	0
1488		-----	-----	-----
1564		-----	-----	-----
1706		-----	-----	-----
1748		-----	-----	-----
1749		-----	-----	-----
1877		-----	-----	-----
6002		-----	-----	-----
6016		-----	-----	-----
6048		-----	-----	-----
6113		-----	-----	-----

APPENDIX 2

Number of participants per country

1 lab in	AUSTRALIA
2 labs in	AUSTRIA
4 labs in	BELGIUM
1 lab in	BRAZIL
2 labs in	BULGARIA
1 lab in	CHINA, People's Republic
3 labs in	FINLAND
1 lab in	FRANCE
3 labs in	GERMANY
1 lab in	INDIA
1 lab in	IRAN, Islamic Republic of
1 lab in	ITALY
1 lab in	JORDAN
1 lab in	KAZAKHSTAN
3 labs in	LATVIA
2 labs in	MALAYSIA
2 labs in	NETHERLANDS
1 lab in	NIGERIA
1 lab in	PAKISTAN
2 labs in	POLAND
1 lab in	PORTUGAL
2 labs in	RUSSIAN FEDERATION
2 labs in	SAUDI ARABIA
1 lab in	SINGAPORE
1 lab in	SLOVAKIA
1 lab in	SOUTH AFRICA
1 lab in	SOUTH KOREA
4 labs in	SPAIN
1 lab in	TAIWAN
1 lab in	TURKEY
1 lab in	UKRAINE
1 lab in	UNITED ARAB EMIRATES
2 labs in	UNITED KINGDOM
5 labs in	UNITED STATES OF AMERICA

APPENDIX 3

Abbreviations:

C	= final test result after checking of first reported suspect test result
D(0.01)	= outlier in Dixon's outlier test
D(0.05)	= straggler in Dixon's outlier test
G(0.01)	= outlier in Grubbs' outlier test
G(0.05)	= straggler in Grubbs' outlier test
DG(0.01)	= outlier in Double Grubbs' outlier test
DG(0.05)	= straggler in Double Grubbs' outlier test
R(0.01)	= outlier in Rosner's outlier test
R(0.05)	= straggler in Rosner's outlier test
E	= probably an error in calculations
U	= test result probably reported in a different unit
W	= test result withdrawn on request of participant
ex	= test result excluded from statistical evaluation
n.a.	= not applicable
n.e.	= not evaluated
n.d.	= not detected
fr.	= first reported test result
SDS	= Safety Data Sheet

Literature:

1 iis Interlaboratory Studies, Protocol for the Organization, Statistics and Evaluation, March 2017
2 ASTM E178:08
3 ISO 5725-86
4 ISO 5725, parts 1-6, 1994
5 ISO13528:05
6 ISO17043:2010
7 M. Thompson and R. Wood, J. AOAC Int, 76, 926, (1993)
8 W.J. Youden and E.H. Steiner, Statistical Manual of the AOAC, (1975)
9 IP 367/84
10 DIN 38402 T41/42
11 P.L. Davies, Fr. Z. Anal. Chem, 331, 513, (1988)
12 J.N. Miller, Analyst, 118, 455, (1993)
13 Analytical Methods Committee Technical briefs, No 4 January 2001.
14 P.J. Lowthian and M. Thompson, The Royal Society of Chemistry 2002, Analyst 2002, 127, 1359-1364
15 Bernard Rosner, Percentage Points for a Generalized ESD Many-Outlier Procedure, *Technometrics*, 25(2), 165-172, (1983)