Institute for
Interlaboratory Studies

Results of Proficiency Test
Turbine Oil (used)
May 2023

Organized 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 scheme for the analysis of used Turbine Oil every year. During the annual proficiency testing program 2022/2023 it was decided to continue the round robin for the analysis of used Turbine Oil.

In this interlaboratory study 41 laboratories in 29 countries registered for participation, see appendix 2 for the number of participants per country. In this report the results of the Turbine Oil (used) 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 analyzes for fit-for-use and homogeneity testing were subcontracted to an ISO/IEC17025 accredited laboratory.
It was decided to send one sample used Turbine Oil in a 1 L bottle labelled #23072.
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/IEC17043:2010 (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 Organisation, Statistics and Evaluation' of June 2018 (iis-protocol, version 3.5). 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

A batch of approximately 80 liters of used Turbine Oil was obtained from a third party. After homogenization 65 amber glass bottles of 1 L were filled and labelled #23072.
The homogeneity of the subsamples was checked by determination of Density at 15 °C in accordance with ISO12185 on 8 stratified randomly selected subsamples.

	Density at 15 °C in kg/L
sample #23072-1	0.86292
sample #23072-2	0.86292
sample #23072-3	0.86293
sample #23072-4	0.86293
sample #23072-5	0.86293
sample #23072-6	0.86292
sample #23072-7	0.86293
sample #23072-8	0.86293

Table 1: homogeneity test results of subsamples #23072

From the above test results the repeatability was calculated and compared with 0.3 times the reproducibility of the reference test method in agreement with the procedure of ISO13528, Annex B2 in the next table.

	Density at 15 °C in kg/L
r (observed)	0.00001
reference test method	ISO12185:96
0.3 x R (reference test method)	0.00015

Table 2: evaluation of the repeatability of subsamples #23072

The calculated repeatability is in agreement with 0.3 times the reproducibility of the reference test method. Therefore, homogeneity of the subsamples was assumed.

To each of the participating laboratories one 1 L bottle of used Turbine Oil labelled #23072 was sent on April 19, 2023. An SDS was added to the sample package.

2.5 STABILITY OF THE SAMPLES

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

2.6 ANALYZES

The participants were requested to determine: Total Acid Number, Color ASTM, Density at 15 °C, Flash Point (C.O.C. and PMcc), Insoluble Color Bodies, Kinematic Viscosity at 40 °C and 100 °C, Viscosity Index, Oxidation Stability RPVOT, Water, Water Separability at 54 °C distilled water and Level of Contamination (counts/mL and ISO4406 scale).
Some extra information was asked about the determination of Total Acid Number.

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 evaluations.

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 (when applicable) 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 individual laboratories 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 reanalyzes). Additional or corrected test results are used for data analysis and the original test results are placed under 'Remarks' in the 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 June 2018 (iis-protocol, version 3.5).
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.

The assigned value is determined by consensus based on the test results of the group of participants after rejection of the statistical outliers and/or suspect data.

According to ISO13528 all (original received or corrected) results per determination were submitted to outlier tests. In the iis procedure for proficiency tests, outliers are detected prior to calculation of the mean, standard deviation and reproducibility. For small data sets, Dixon (up to 20 test results) or Grubbs (up to 40 test results) outlier tests can be used. For larger data sets (above 20 test results) Rosner’s outlier test can be used. 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 visualize 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. This 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 (dotted line) was projected over the Kernel Density Graph (smooth line) for reference. The Gauss curve is calculated from the consensus value and the corresponding standard deviation.

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 (derived from e.g. ISO or ASTM test methods), 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 target values were used, like Horwitz or an estimated reproducibility based on former iis proficiency tests.

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 test result tables in appendix 1.

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

	|z|	< 1	good
1 <	|z|	< 2	satisfactory
2 <	|z|	< 3	questionable
3 <	|z|		unsatisfactory

4 EVALUATION

In this proficiency test some problems were encountered with the dispatch of the samples. Three participants reported test results after the final reporting date and one other participant did not report any test results. Not all participants were able to report all tests requested.
In total 40 participants reported 494 numerical test results. Observed were 11 outlying test results, which is 2.2%. In proficiency tests outlier percentages of 3% - 7.5% are quite normal.

Not all 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 reported test 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 test methods are also in the tables together with the original data in appendix 1. The abbreviations, used in these tables, are explained in appendix 3.

In the iis PT reports ASTM test methods are referred to with a number (e.g. D2270) and an added designation for the year that the test method was adopted or revised (e.g. D2270:10). When a method has been reapproved an “R” will be added and the year of approval (e.g. D2270:10R16).

Total Acid Number: This determination was problematic. No statistical outliers were observed. The calculated reproducibility is not in agreement with the requirements of ASTM D664-A:18e2 IP and BEP at 60 mL, nor with the requirements of IP and BEP at 125 mL.
When the test results for IP and BEP were evaluated separately, the calculated reproducibilities are only in agreement with IP at 60 mL, not with the requirements of BEP at 60 mL and 125 mL and IP at 125 mL.
Remarkably, three participants still used pH 11 for BEP instead of pH 10. In test method ASTM D664-A:18e2 pH 10 is mentioned.

Color ASTM: This determination was not problematic. Two statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is in agreement with ASTM D1500:12R17.

Density at 15 °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 ISO12185:96.

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 D92:18.

Flash Point PMcc: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of ASTM D93-A:20. Only four participants used procedure B.

Insoluble Color Bodies: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of ASTM D7843:21.

Kinematic Viscosity 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 D445:21e2.

Kinematic Viscosity at 100 °C: This determination was problematic. No statistical outliers were observed. The calculated reproducibility is not in agreement with the requirements of ASTM D445:21e2.

Viscosity Index: This determination was problematic. No statistical outliers were observed but one test result was excluded. The calculated reproducibility after rejection of the suspect data is not in agreement with the requirements of ASTM D2270:10R16.

Oxidation Stability RPVOT: In this PT the reported test results appear to be bimodally distributed depending on the procedure used. Therefore, the test results of ASTM D2272-A and D2272-B were evaluated separately.
This determination was very problematic when ASTM D2272-A was used. No statistical outliers were observed. The calculated reproducibility is not at all in agreement with the requirements of ASTM D2272:22.
This determination was problematic when ASTM D2272-B was used. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is not in agreement with the requirements of ASTM D2272:22.

Water: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of ASTM D6304:20 procedure B and A, but not with procedure C.

Water Separability at 54 °C, distilled water: This determination was not problematic. Two statistical outliers were observed over 3 parameters. All calculated reproducibilities are in agreement with the requirements of ASTM D1401:21.

Level of Contamination: This determination was problematic. Four statistical outliers were observed and fourteen other test results were excluded over 6 parameters. For the determination in counts/mL and for the determination in scale number is after rejection of the suspect data only the calculated reproducibility of particle size ≥ 4 µm in agreement with the requirements of ASTM D7647:10R18. The calculated reproducibilities of Particle sizes ≥ 6 µm and ≥ 14 µm are not in agreement with these requirements.

4.2 PERFORMANCE EVALUATION FOR THE GROUP OF LABORATORIES

A comparison has been made between the reproducibility as declared by the reference test method and the reproducibility as found for the group of participating laboratories. The number of significant test results, the average, the calculated reproducibility (2.8 * standard deviation) and the target reproducibility derived from reference methods are presented in the next table.

Parameter	unit	n	average	2.8 * sd	R(lit)
Total Acid Number	mg KOH/g	37	0.10	0.08	0.06
Color ASTM		27	3.3	0.5	1
Density at 15 °C	kg/L	32	0.8630	0.0003	0.0005
Flash Point C.O.C.	°C	22	234.0	17.8	18
Flash Point PMcc	°C	32	216.3	13.9	15.4
Insoluble Color Bodies		15	13.1	11.6	12.6
Kinematic Viscosity at 40 °C	mm^2/s	35	44.64	0.28	0.41
Kinematic Viscosity at 100 °C	mm^2/s	34	6.911	0.079	0.057
Viscosity Index		28	111.4	3.1	2
Oxidation Stab. RPVOT D2272-A	minutes	9	1038	627	239
Oxidation Stab. RPVOT D2272-B	minutes	6	1837	578	427
Water	mg/kg	33	28.3	23.2	92.6
Water Separability at 54 °C, distilled water					
Time ≤ 3 mL emulsion	minutes	16	23.5	14.1	20
Time 37 mL water	minutes	16	23.9	14.5	20
Time to complete break	minutes	9	28.9	7.9	20
Level of Contamination					
≥ 4 µm (c)	counts/mL	19	30017	25091	33919
≥ 6 µm (c)	counts/mL	19	7009	8673	5327
≥ 14 µm (c)	counts/mL	19	270	434	364
≥ 4 µm (c)	ISO scale	20	22	1	2
≥ 6 µm (c)	ISO scale	20	20	2	1
≥ 14 µm (c)	ISO scale	20	15	2	2

Table 3: reproducibilities of tests on sample #23072

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

4.3 COMPARISON OF THE PROFICIENCY TEST OF MAY 2023 WITH PREVIOUS PTS

	May 2023	May 2022	May 2021	May 2020	May 2019
Number of reporting laboratories	40	42	45	35	42
Number of test results	494	517	547	440	600
Number of statistical outliers	11	21	24	25	13
Percentage of statistical outliers	2.2%	4.1%	4.4%	5.7%	2.2%

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 reference test methods. The conclusions are given in the following table.

Parameter	May 2023	May 2022	May 2021	May 2020	May 2019
Total Acid Number	-	+	+/-	-	+
Color ASTM	+	+	-	+	+
Density at 15 °C	+	+	+/-	+/-	+
Flash Point C.O.C.	+/-	-	-	+/-	+/-
Flash Point PMcc	+/-	+	+	+	+
Insoluble Color Bodies	+/-	+	+	+	+/-
Kinematic Viscosity at 40 °C	+	-	+	-	-
Kinematic Viscosity at 100 °C	-	--	-	--	-
Viscosity Index	-	-	-	--	-
Oxidation Stability RPVOT	-	-	--	--	(--)
Water	++	++	-	++	++
Water Separability	+	-	++	+	+
Level of Contamination	-	-	--	--	(--)

Table 5: comparison determinations to the reference test methods

For results between brackets: no z-scores are calculated

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

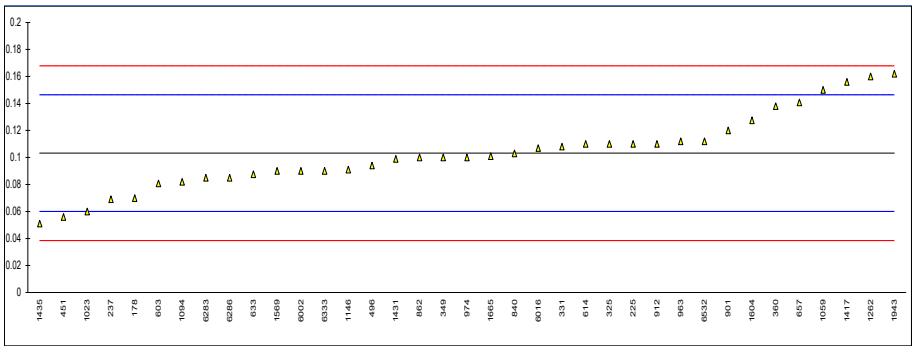
APPENDIX 1

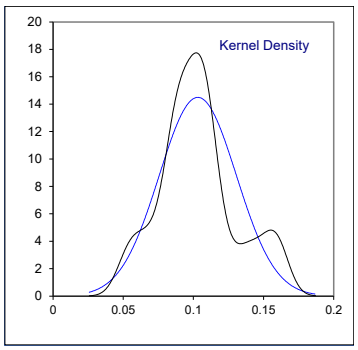
Determination of Total Acid Number on sample #23072; results in mg KOH/g

lab	method	value	mark	z(targ)	End point determination	Volume titration solvent
178	D664-A	0.07		-1.54	---	---
179		-----		-----	---	---
225	D974	0.11		0.32	---	---
237	D664-B	0.0691		-1.58	Inflection Point	125 mL
325	D664-A	0.11		0.32	Buffer End Point pH 10	125 mL
331	D664-A	0.108		0.22	---	---
349	D664-A	0.10		-0.15	Buffer End Point pH 10	60 mL
360	D974	0.138		1.61	Inflection Point	60 mL
432		-----		-----	---	---
451	D664-A	0.056		-2.19	Buffer End Point pH 10	60 mL
496	D664-A	0.094		-0.43	Buffer End Point pH 10	60 mL
603	D664-A	0.0808		-1.04	Inflection Point	125 mL
614	D664-A	0.11		0.32	---	---
633	D664-A	0.0876		-0.72	Inflection Point	125 mL
657	D664-A	0.1407		1.74	Inflection Point	60 mL
663	D664-A	<0.10		-----	Buffer End Point pH 10	60 mL
840	D664-B	0.103		-0.01	Buffer End Point pH 10	60 mL
862	D664-A	0.10		-0.15	Inflection Point	60 mL
901	D974	0.12		0.78	---	---
912	D664-A	0.11		0.32	---	---
963	D974	0.112		0.41	---	---
974	D664-A	0.10		-0.15	Inflection Point	125 mL
1023	D8045	0.06		-2.00	---	---
1059	ISO6619	0.15		2.17	Buffer End Point pH 11	60 mL
1094	D664-A	0.0819		-0.99	Buffer End Point pH 10	60 mL
1146	D664-A	0.091		-0.56	Buffer End Point pH 10	125 mL
1262	ISO6618	0.16		2.63	---	---
1417	D664-A	0.156	C	2.45	Buffer End Point pH 10	60 mL
1431	D664-A	0.099		-0.19	Inflection Point	60 mL
1435	D664-A	0.051		-2.42	Buffer End Point pH 10	100 mL
1569	D664-A	0.09	C	-0.61	Inflection Point	60 mL
1604	D664-A	0.1276		1.13	Inflection Point	60 mL
1665	D664-A	0.101		-0.10	Inflection Point	60 mL
1943	ISO6618	0.162		2.73	---	---
2124		-----		-----	---	---
6002	D664-A	0.090		-0.61	Inflection Point	60 mL
6016	D664-A	0.107		0.18	Inflection Point	60 mL
6283	D664-A	0.085		-0.84	Buffer End Point pH 11	60 mL
6286	ISO6619	0.085		-0.84	Inflection Point	60 mL
6333	D8045	0.09		-0.61	---	60 mL
6532	D664-A	0.112		0.41	Buffer End Point pH 11	60 mL

			Buffer End Point only	Inflection Point only
	normality	OK	OK	OK
	n	37	12	14
	outliers	0	0	0
	mean (n)	0.1032	0.0992	0.1011
	st.dev. (n)	0.02753	0.03146	0.02112
	R(calc.)	0.0771	0.0881	0.0591
	st.dev.(D664-A:18e2 BEP, 60 mL)	0.02158	0.02076	---
	R(D664-A:18e2 BEP, 60 mL)	0.0604	0.0581	---
	compare			
	R(D664-A:18e2 BEP, 125 mL)	0.0290	0.0278	---
	R(D664-A:18e2 IP, 60 mL)	0.0625	---	0.0615
	R(D664-A:18e2 IP, 125 mL)	0.0205	---	0.0200

Lab 1417 first reported 0.232
Lab 1569 first reported <0.01



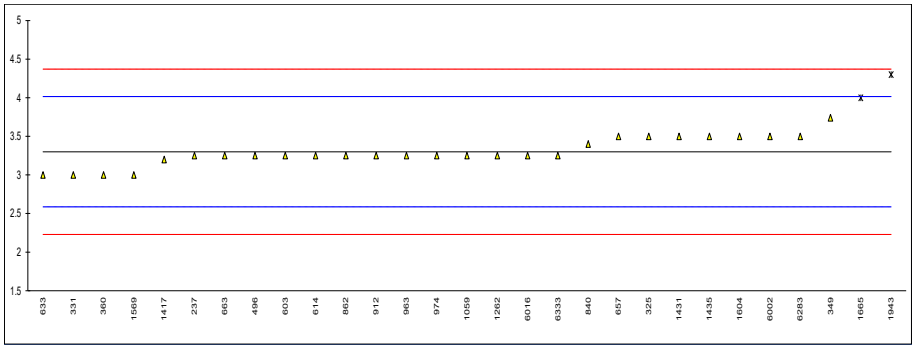


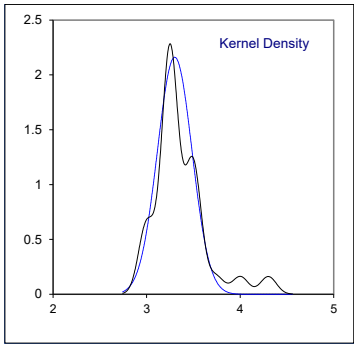
Determination of Color ASTM on sample #23072;

lab	method	reported test result	iis conversion *)	mark	z(targ)	remarks
178		-----	-----		-----	
179		-----	-----		-----	
225		-----	-----		-----	
237	D1500	L3.5	3.25		-0.14	
325	D6045	3.5	3.5		0.56	
331	D1500	3.0	3.0		-0.84	
349	D1500	3.74	3.74		1.23	
360	ISO2049	3.0	3.0		-0.84	
432		-----	-----		-----	
451		-----	-----		-----	
496	D1500	L3.5	3.25		-0.14	
603	D1500	L3.5	3.25		-0.14	
614	D1500	<3.5	3.25		-0.14	
633	D1500	3.0	3.0		-0.84	
657	D1500	3.5	3.5		0.56	
663	D1500	L3.5	3.25		-0.14	
840	D6045	3.4	3.4		0.28	
862	D1500	L3.5	3.25		-0.14	
901		-----	-----		-----	
912	D1500	<3.5	3.25		-0.14	
963	D1500	L3.5	3.25		-0.14	
974	D1500	L3.5	3.25		-0.14	
1023		-----	-----		-----	
1059	D1500	L3,5	3.25		-0.14	
1094		-----	-----		-----	
1146		-----	-----		-----	
1262	D1500	L3.5	3.25		-0.14	
1417	D6045	3.2	3.2		-0.28	
1431	D1500	3.5	3.5		0.56	
1435	D1500	3.5	3.5		0.56	
1569	D1500	3.0	3.0		-0.84	
1604	D1500	3.5	3.5		0.56	
1665	D1500	4	4	C,R(0.05)	1.96	first reported 5
1943	ISO2049	4.3	4.3	R(0.01)	2.80	
2124		-----	-----		-----	
6002	In house	3.5	3.5		0.56	
6016	D1500	<3.5	3.25		-0.14	
6283	D1500	3.5	3.5		0.56	
6286		-----	-----		-----	
6333	D1500	3.25	3.25		-0.14	
6532		-----	-----		-----	

normality	OK
n	27
outliers	2
mean (n)	3.30
st.dev. (n)	0.185
R(calc.)	0.52
st.dev.(D1500:12R17)	0.357
R(D1500:12R17)	1

*) In the calculation of the mean, standard deviation and the reproducibility in this column, a reported value of 'L y' is changed tot y-0.25 (for example L3.5 into 3.25).

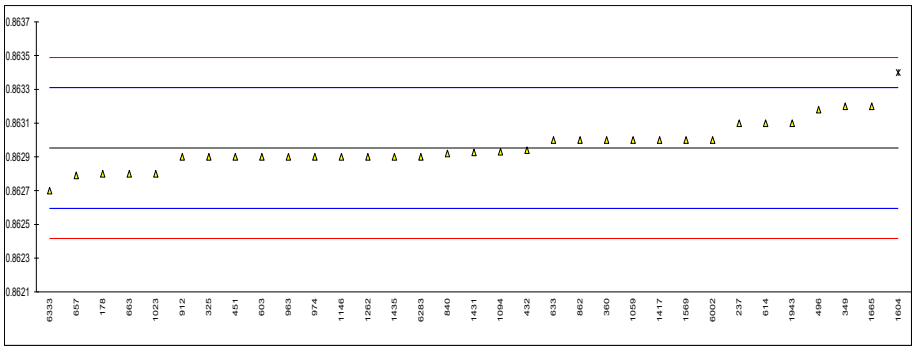


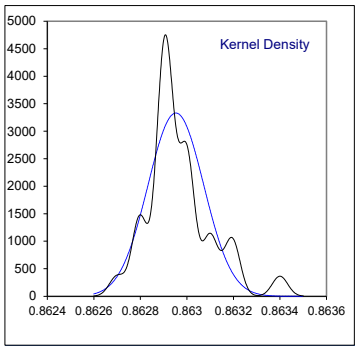


Determination of Density at 15 °C on sample #23072; results in kg/L

lab	method	value	mark	z(targ)	remarks
178		0.8628		-0.86	
179		-----		-----	
225		-----		-----	
237	D4052	0.8631		0.82	
325	D4052	0.8629		-0.30	
331		-----		-----	
349	D4052	0.8632		1.38	
360	ISO12185	0.8630		0.26	
432	D4052	0.86294		-0.07	
451	D4052	0.8629		-0.30	
496	ISO12185	0.86318		1.27	
603	D4052	0.86290		-0.30	
614	D4052	0.8631		0.82	
633	D4052	0.8630		0.26	
657	D4052	0.86279		-0.91	
663	D4052	0.8628		-0.86	
840	D4052	0.86292		-0.18	
862	D4052	0.8630		0.26	
901		-----		-----	
912	ISO12185	0.8629		-0.30	
963	D4052	0.8629		-0.30	
974	D4052	0.8629		-0.30	
1023	D4052	0.8628		-0.86	
1059	ISO12185	0.8630		0.26	
1094	D4052	0.86293		-0.13	
1146	D4052	0.8629		-0.30	
1262	D4052	0.8629		-0.30	
1417	IP365	0.8630		0.26	
1431	D4052	0.862927		-0.14	
1435	D4052	0.8629		-0.30	
1569	ISO12185	0.8630		0.26	
1604	D1298	0.8634	R(0.05)	2.50	
1665	D4052	0.8632		1.38	
1943	ISO3675	0.8631		0.82	
2124		-----		-----	
6002	ISO12185	0.8630		0.26	
6016		-----		-----	
6283	D4052	0.8629		-0.30	
6286		-----		-----	
6333	D7042	0.8627	C	-1.42	first reported 0.8634
6532		-----		-----	

normality	OK
n	32
outliers	1
mean (n)	0.86295
st.dev. (n)	0.000120
R(calc.)	0.00034
st.dev.(ISO12185:96)	0.000179
R(ISO12185:96)	0.00050

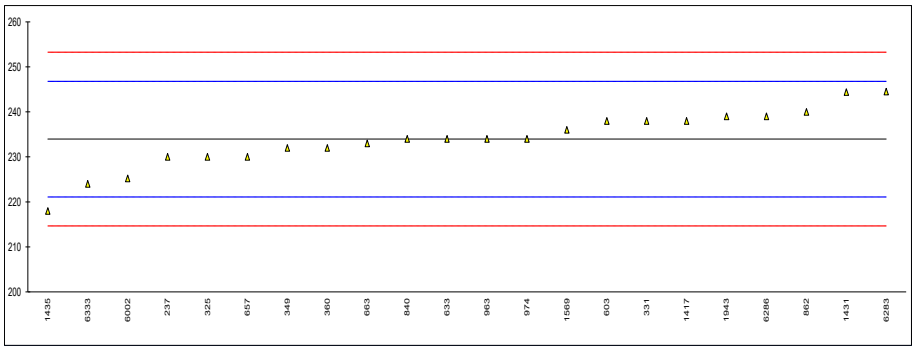


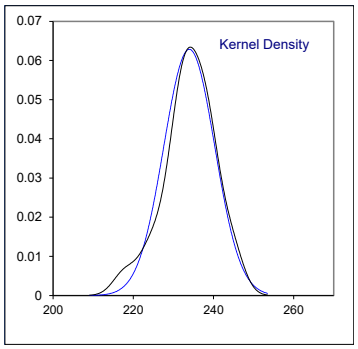


Determination of Flash Point C.O.C. on sample #23072; results in °C

lab	method	value	mark	z(targ)	remarks
178		-----		-----	
179		-----		-----	
225		-----		-----	
237	D92	230		-0.62	
325	D92	230		-0.62	
331	D92	238.0		0.63	
349	D92	232		-0.30	
360	D92	232		-0.30	
432		-----		-----	
451		-----		-----	
496		-----		-----	
603	D92	238		0.63	
614		-----		-----	
633	D92	234		0.01	
657	D92	230		-0.62	
663	D92	233		-0.15	
840	D92	234.0		0.01	
862	D92	240		0.94	
901		-----		-----	
912		-----		-----	
963	D92	234.0		0.01	
974	D92	234		0.01	
1023		-----		-----	
1059		-----		-----	
1094		-----		-----	
1146		-----		-----	
1262		-----		-----	
1417	D92	238		0.63	
1431	D92	244.4		1.62	
1435	D92	218.0		-2.48	
1569	D92	236		0.32	
1604		-----		-----	
1665		-----		-----	
1943	ISO2592	239		0.78	
2124		-----		-----	
6002	ISO2592	225.23		-1.36	
6016		-----		-----	
6283	D92	244.5		1.64	
6286	ISO2592	239		0.78	
6333	D92	224		-1.55	
6532		-----		-----	

normality	OK
n	22
outliers	0
mean (n)	233.96
st.dev. (n)	6.348
R(calc.)	17.77
st.dev.(D92:18)	6.429
R(D92:18)	18

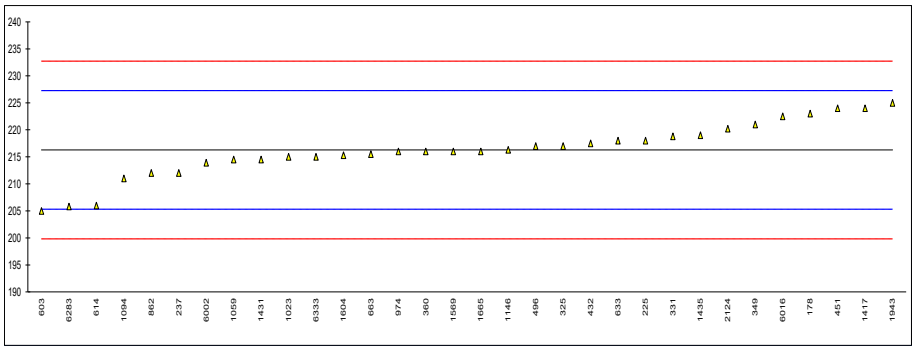


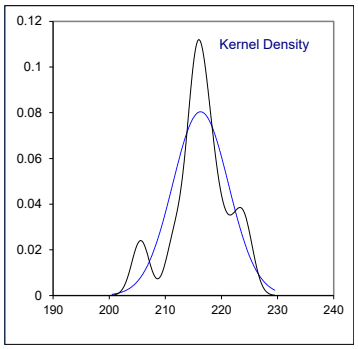


Determination of Flash Point PMcc on sample #23072; results in °C

lab	method	value	mark	z(targ)	remarks
178	D93-A	223		1.23	
179		-----		-----	
225	D93-B	218.0		0.31	
237	D93-B	212.0		-0.78	
325	D93-A	217.0		0.13	
331	D93-A	218.8		0.46	
349	D93-A	221		0.86	
360	D93-A	216.0		-0.05	
432	D93-A	217.5		0.22	
451	D93-A	224		1.41	
496	D93-A	217		0.13	
603	D93-A	205		-2.06	
614	D93-A	206		-1.87	
633	D93-B	218.0		0.31	
657		-----		-----	
663	D93-A	215.5		-0.14	
840		-----		-----	
862	D93-A	212		-0.78	
901		-----		-----	
912		-----		-----	
963		-----		-----	
974	D93-A	216		-0.05	
1023	D93-A	215		-0.23	
1059	ISO2719-A	214.5		-0.32	
1094	D93-A	211.0		-0.96	
1146	D93-A	216.3		0.00	
1262		-----		-----	
1417	D93-A	224		1.41	
1431	D93-A	214.5		-0.32	
1435	D93-A	219.0		0.50	
1569	D93-A	216		-0.05	
1604	D93-A	215.3		-0.18	
1665	D93-A	216		-0.05	
1943	ISO2719-A	225		1.59	
2124	D93-A	220.2		0.72	
6002	ISO2719-A	213.93		-0.43	
6016	D93-B	222.5		1.13	
6283	D93-A	205.8		-1.91	
6286		-----		-----	
6333	D7094	215		-0.23	
6532		-----		-----	

normality	OK
n	32
outliers	0
mean (n)	216.28
st.dev. (n)	4.962
R(calc.)	13.89
st.dev.(D93-A:20)	5.484
R(D93-A:20)	15.36

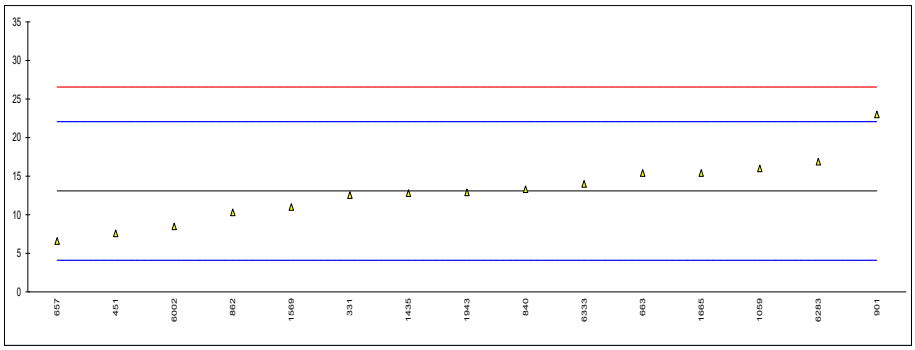


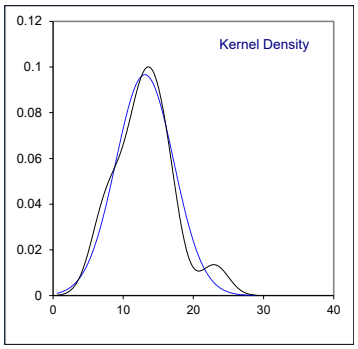


Determination of Insoluble Color Bodies, membrane patch colorimetry on sample #23072;

lab	method	value	mark	z(targ)	remarks
178		-----		-----	
179		-----		-----	
225		-----		-----	
237		-----		-----	
325		-----		-----	
331	D7843	12.55		-0.12	
349		-----		-----	
360		-----		-----	
432		-----		-----	
451	D7843	7.6		-1.22	
496		-----		-----	
603		-----		-----	
614		-----		-----	
633		-----		-----	
657	D7843	6.6		-1.44	
663	D7843	15.4		0.52	
840	D7843	13.3		0.05	
862	D7843	10.3		-0.62	
901	D7843	23.0		2.21	
912		-----		-----	
963		-----		-----	
974		-----		-----	
1023		-----		-----	
1059	D7843	16.0		0.65	
1094		-----		-----	
1146		-----		-----	
1262		-----		-----	
1417		-----		-----	
1431		-----		-----	
1435	D7843	12.8		-0.06	
1569	D7843	11		-0.46	
1604		-----		-----	
1665	D7843	15.407		0.52	
1943	D7843	12.9		-0.04	
2124		-----		-----	
6002	D7843	8.5		-1.02	
6016		-----		-----	
6283	D7843	16.9		0.85	
6286		-----		-----	
6333	D7843	14		0.20	
6532		-----		-----	

normality	suspect
n	15
outliers	0
mean (n)	13.08
st.dev. (n)	4.129
R(calc.)	11.56
st.dev.(D7843:21)	4.490
R(D7843:21)	12.57

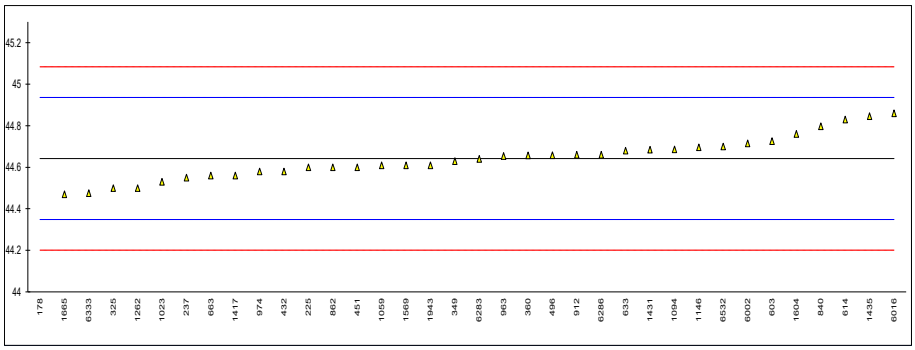


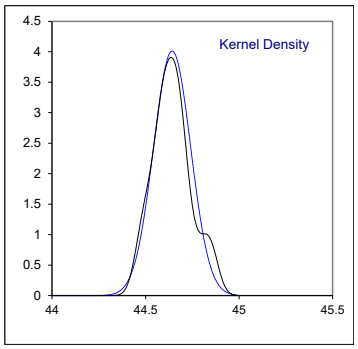


Determination of Kinematic Viscosity at 40 °C on sample #23072; results in mm^2/s

lab	method	value	mark	z(targ)	remarks
178	D445	42.70	C,R(0.01)	-13.21	first reported 45.80
179		-----		-----	
225	D445	44.60		-0.29	
237	D445	44.55		-0.63	
325	D445	44.50		-0.97	
331		-----		-----	
349	D445	44.63		-0.08	
360	ISO3104	44.657		0.10	
432	D445	44.58		-0.42	
451	D7279 corrected to D445	44.6		-0.29	
496	D445	44.658		0.11	
603	D7042	44.726		0.57	
614	D7042	44.83		1.28	
633	D445	44.68		0.26	
657		-----		-----	
663	D445	44.56		-0.56	
840	D7042	44.798		1.06	
862	D445	44.60		-0.29	
901		-----		-----	
912	D445	44.66		0.12	
963	D445	44.654		0.08	
974	D445	44.58		-0.42	
1023	D445	44.53		-0.76	
1059	ISO3104	44.61		-0.22	
1094	D445	44.686		0.30	
1146	D445	44.696		0.37	
1262	D7042	44.50		-0.97	
1417	D445	44.56		-0.56	
1431	D7042	44.685	C	0.29	first reported 44.672
1435	D7042	44.846		1.39	
1569	D445	44.61		-0.22	
1604	D445	44.76		0.80	
1665	D445	44.47		-1.17	
1943	ISO3104	44.61		-0.22	
2124		-----		-----	
6002	ISO3104	44.7152		0.50	
6016	D7042	44.860		1.48	
6283	D7042	44.640		-0.01	
6286	ISO3104	44.66		0.12	
6333	D7042	44.4755		-1.13	
6532	D445	44.7		0.39	

normality	OK
n	35
outliers	1
mean (n)	44.6422
st.dev. (n)	0.09944
R(calc.)	0.2784
st.dev.(D445:21e2)	0.14706
R(D445:21e2)	0.4118

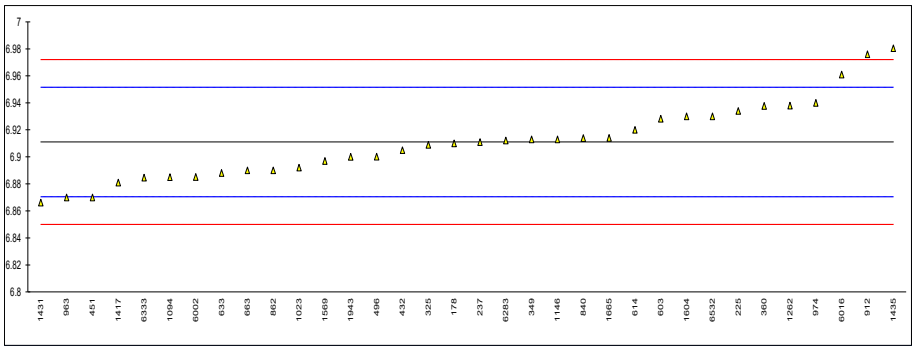


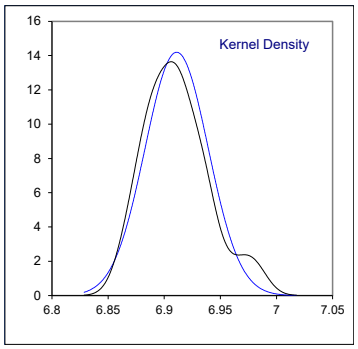


Determination of Kinematic Viscosity at 100 °C on sample #23072; results in mm²/s

lab	method	value	mark	z(targ)	remarks
178	D445	6.91		-0.05	
179		-----		-----	
225	D445	6.934		1.13	
237	D445	6.911		0.00	
325	D445	6.909		-0.10	
331		-----		-----	
349	D445	6.913		0.10	
360	ISO3104	6.9378		1.32	
432	D445	6.905		-0.30	
451	D7279 corrected to D445	6.87		-2.02	
496	D445	6.9001		-0.54	
603	D7042	6.9283		0.85	
614	D7042	6.920		0.44	
633	D445	6.888		-1.13	
657		-----		-----	
663	D445	6.890		-1.04	
840	D7042	6.9139		0.14	
862	D445	6.890		-1.04	
901		-----		-----	
912	D445	6.976		3.20	
963	D445	6.870		-2.02	
974	D445	6.940		1.43	
1023	D445	6.892		-0.94	
1059		-----		-----	
1094	D445	6.885		-1.28	
1146	D445	6.913		0.10	
1262	D7042	6.938		1.33	
1417	D445	6.881		-1.48	
1431	D7042	6.8662	C	-2.21	first reported 6.8419
1435	D7042	6.9805		3.42	
1569	D445	6.897		-0.69	
1604	D445	6.93		0.93	
1665	D445	6.914		0.15	
1943	ISO3104	6.90		-0.54	
2124		-----		-----	
6002	ISO3104	6.8851		-1.28	
6016	D7042	6.961		2.46	
6283	D7042	6.9121		0.05	
6286		-----		-----	
6333	D7042	6.8846		-1.30	
6532	D445	6.93		0.93	

normality	OK
n	34
outliers	0
mean (n)	6.9110
st.dev. (n)	0.02810
R(calc.)	0.0787
st.dev.(D445:21e2)	0.02031
R(D445:21e2)	0.0569

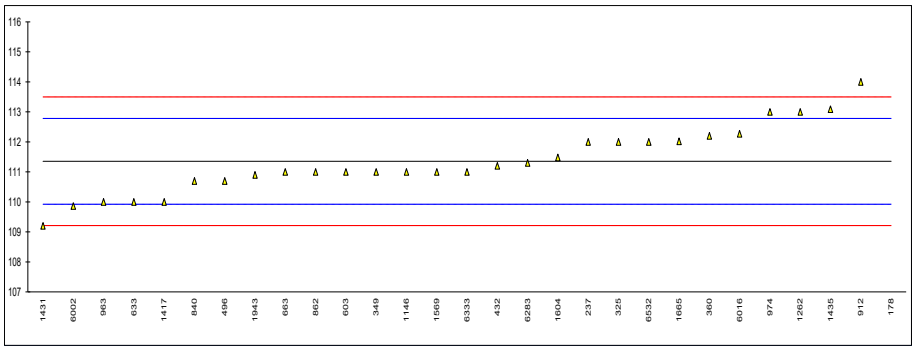


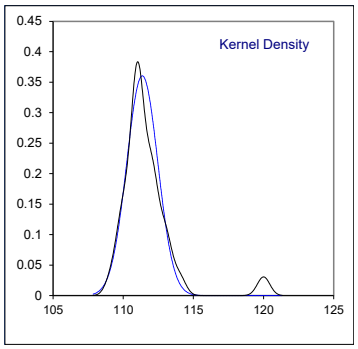


Determination of Viscosity Index on sample #23072;

lab	method	value	mark	z(targ)	remarks
178	D2270	120	ex,C,E	12.10	fr 107; excluded as statistical outlier in KV 40 °C; iis calc 119
179		-----		-----	
225		-----		-----	
237	D2270	112		0.90	
325	D2270	112		0.90	
331		-----		-----	
349	D2270	111		-0.50	
360	ISO2909	112.2		1.18	
432	D2270	111.2		-0.22	
451		-----		-----	
496	ISO2909	110.7		-0.92	
603	D2270	111	E	-0.50	calculation difference, iis calculated 112
614		-----		-----	
633	D2270	110		-1.90	
657		-----		-----	
663	D2270	111		-0.50	
840	D2270	110.7		-0.92	
862	D2270	111		-0.50	
901		-----		-----	
912	D2270	114		3.70	
963	D2270	110		-1.90	
974	D2270	113		2.30	
1023		-----		-----	
1059		-----		-----	
1094		-----		-----	
1146	D2270	111		-0.50	
1262	D2270	113		2.30	
1417	D2270	110		-1.90	
1431	D2270	109.2	C	-3.02	first reported 108.3
1435	D2270	113.09		2.43	
1569	D2270	111		-0.50	
1604	D2270	111.48		0.18	
1665	D2270	112.022		0.93	
1943	ISO2909	110.9		-0.64	
2124		-----		-----	
6002	ISO2909	109.86		-2.09	
6016	D2270	112.27		1.28	
6283	D2270	111.3		-0.08	
6286		-----		-----	
6333	D2270	111		-0.50	
6532	D2270	112		0.90	

normality	OK
n	28
outliers	0 + 1ex
mean (n)	111.35
st.dev. (n)	1.106
R(calc.)	3.10
st.dev.(D2270:10R16)	0.714
R(D2270:10R16)	2

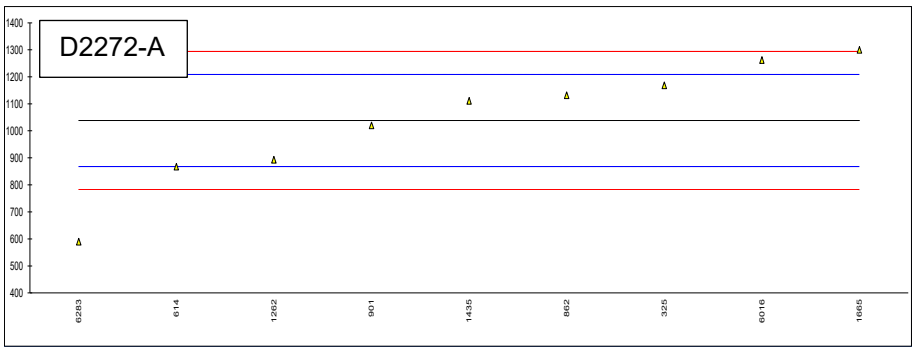


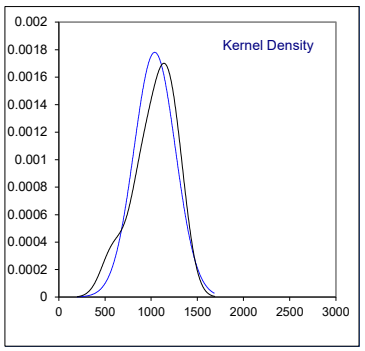


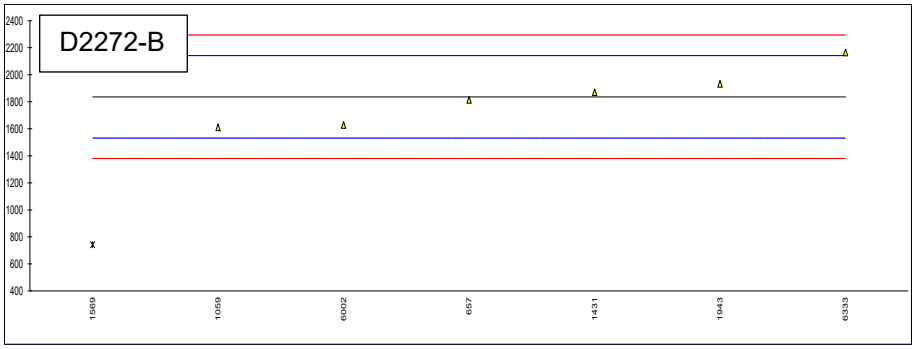
Determination of Oxidation Stability RPVOT on sample #23072; results in minutes

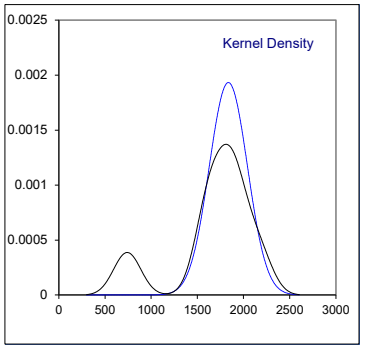
		D2272-A			D2272-B			
lab	method	value	mark	z(targ)	value	mark	z(targ)	remarks
178		-----		-----	-----		-----	
179		-----		-----	-----		-----	
225		-----		-----	-----		-----	
237		-----		-----	-----		-----	
325	D2272-A	1169		1.53	-----		-----	
331		-----		-----	-----		-----	
349		-----		-----	-----		-----	
360		-----		-----	-----		-----	
432		-----		-----	-----		-----	
451		-----		-----	-----		-----	
496		-----		-----	-----		-----	
603		-----		-----	-----		-----	
614	D2272-A	867		-2.01	-----		-----	
633		-----		-----	-----		-----	
657	D2272-B	-----		-----	1813		-0.15	
663		-----		-----	-----		-----	
840		-----		-----	-----		-----	
862	D2272-A	1132		1.10	-----		-----	
901	D2272-A	1020		-0.21	-----		-----	
912		-----		-----	-----		-----	
963		-----		-----	-----		-----	
974		-----		-----	-----		-----	
1023		-----		-----	-----		-----	
1059	D2272-B	-----		-----	1610		-1.49	
1094		-----		-----	-----		-----	
1146		-----		-----	-----		-----	
1262	D2272-A	893		-1.70	-----		-----	
1417		-----		-----	-----		-----	
1431	D2272-B	-----		-----	1871		0.23	
1435	D2272-A	1111		0.85	-----		-----	
1569	D2272-B	-----		-----	741	D(0.05)	-7.19	
1604		-----		-----	-----		-----	
1665	D2272-A	1300		3.07	-----		-----	
1943	D2272-B	-----		-----	1933		0.63	
2124		-----		-----	-----		-----	
6002	D2272-B	-----		-----	1628		-1.37	
6016	D2272-A	1262.43		2.63	-----		-----	
6283	D2272-A	590		-5.26	-----		-----	
6286		-----		-----	-----		-----	
6333	D2272-B	-----		-----	2164		2.15	
6532		-----		-----	-----		-----	

	normality	OK	unknown
	n	9	6
	outliers	0	1
	mean (n)	1038.3	1836.5
	st.dev. (n)	224.06	206.44
	R(calc.)	627.4	578.0
	st.dev.(D2272:22)	85.21	152.46
	R(D2272:22)	238.6	426.9


D2272-A
1400
1300
1200
1100
1000
900
800
700
600
500
400
6283
614
1262
901
1435
862
325
6016
1665

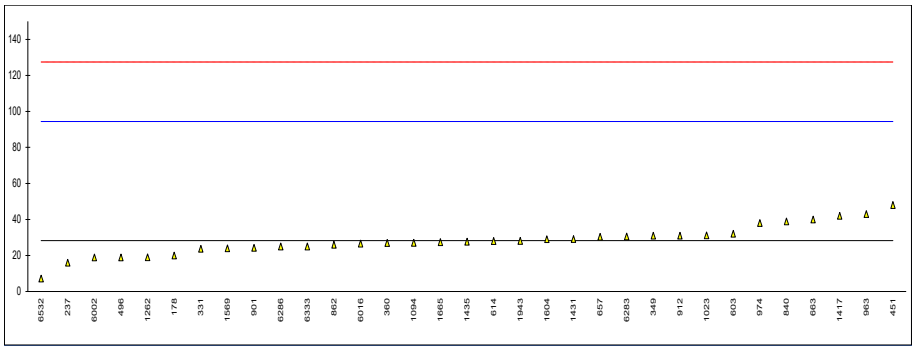

Kernel Density
0.002
0.0018
0.0016
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
0
500
1000
1500
2000
2500
3000

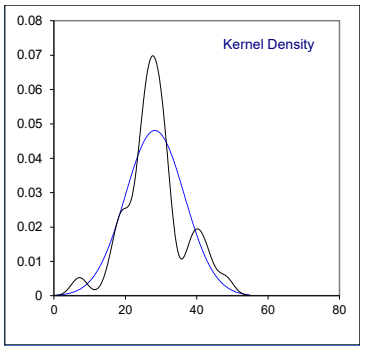

D2272-B
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
1569
1059
6002
657
1431
1943
6333


Kernel Density
0.0025
0.002
0.0015
0.001
0.0005
0
0
500
1000
1500
2000
2500
3000

Determination of Water on sample #23072; results in mg/kg

lab	method	value	mark	z(targ)	remarks
178	D6304-B:16e1	20		-0.25	
179		-----		-----	
225		-----		-----	
237	D6304-C:16e1	16		-0.37	
325	D6304-C:20	<100		-----	
331	D6304-C:20	23.75		-0.14	
349	D6304-A:20	31		0.08	
360	D6304-A:20	26.9		-0.04	
432		-----		-----	
451	D6304-B:20	48		0.60	
496	D6304-B:20	18.9		-0.28	
603	D6304-B:20	32		0.11	
614	D6304-B:20	28		-0.01	
633		-----		-----	
657	D6304-A:20	30.3		0.06	
663	D6304-B:20	40		0.35	
840	D6304-B:20	38.9		0.32	
862	D6304-A	26		-0.07	
901	D6304-A:20	24.3		-0.12	
912	D6304	31		0.08	
963	D6304-A:16e1	43		0.45	
974	D6304-A:20	38		0.29	
1023	D6304-A:16e1	31.1		0.09	
1059	D6304-B:20	<30		-----	
1094	D6304-A:20	27		-0.04	
1146	D6304-B:20	<100		-----	
1262	ISO760	19		-0.28	
1417	D6304-A:20	42		0.41	
1431	D6304-A:20	29.05		0.02	
1435	D6304-A:20	27.7		-0.02	
1569	D6304-C:16e1	24		-0.13	
1604	D6304-A:16e1	29		0.02	
1665	D6304-A:20	27.35		-0.03	
1943	EN60814	28.08		-0.01	
2124		-----		-----	
6002	ISO12937	18.88		-0.28	
6016	D6304-A:16e1	26.6		-0.05	
6283	D6304-A:16e1	30.5		0.07	
6286	ISO12937	25		-0.10	
6333	D6304-B:20	25		-0.10	
6532	ISO12937	7.173		-0.64	
	normality	OK			
	n	33			
	outliers	0			
	mean (n)	28.29			
	st.dev. (n)	8.294			
	R(calc.)	23.22			
	st.dev.(D6304-B:20)	33.058			
	R(D6304-B:20)	92.56			range 30 – 2100 mg/kg
	compare				
	R(D6304-A:20)	24.69			range 30 – 25000 mg/kg
	R(D6304-C:20)	16.15			range 20 – 360 mg/kg

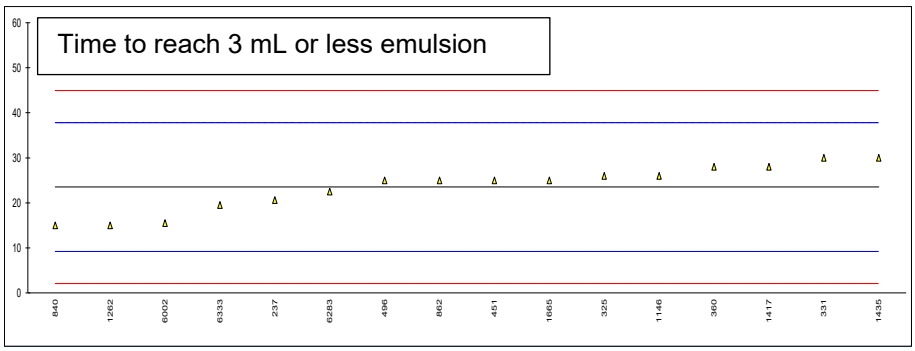


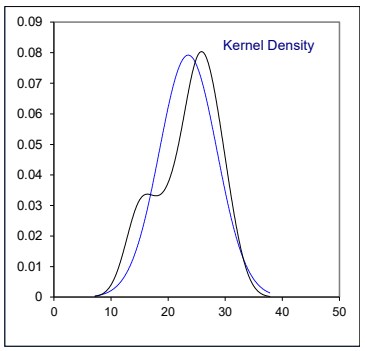


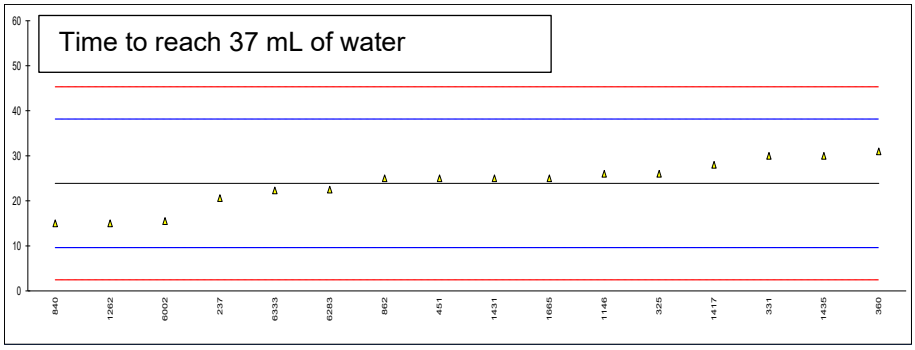
Determination of Water Separability at 54 °C, distilled water on sample #23072; results in minutes

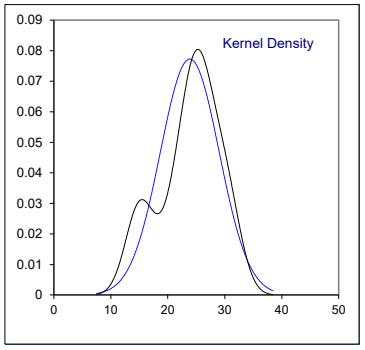
lab	method	3 mL or less emulsion		z(targ)	37 mL of water		z(targ)	complete break (40-40-0)		z(targ)	test aborted	time aborted	
178		-----		-----	-----		-----	-----		-----		-----	
179		-----		-----	-----		-----	-----		-----		-----	
225		-----		-----	-----		-----	-----		-----		-----	
237	D1401	20.6		-0.41	20.6		-0.46	28.0		-0.12	No	-----	
325	D1401	26		0.35	26		0.30	30		0.16	No	30	
331	D1401	30		0.91	30		0.86	30		0.16	No	-----	
349		-----		-----	-----		-----	-----		-----		-----	
360	D1401	28		0.63	31		1.00	34		0.72	No	-----	
432		-----		-----	-----		-----	-----		-----		-----	
451	D1401	25		0.21	25		0.16	-----		-----		-----	
496	D1401	25		0.21	-----		-----	-----		-----	No	-----	
603		-----		-----	-----		-----	-----		-----		-----	
614		-----		-----	-----		-----	-----		-----		-----	
633		-----		-----	-----		-----	-----		-----		-----	
657		-----		-----	-----		-----	-----		-----	Yes	30	
663		-----		-----	-----		-----	-----		-----		-----	
840	D1401	15	C	-1.19	15	C	-1.24	25	C	-0.54	Yes	25	C
862	D1401	25		0.21	25		0.16	-----		-----	Yes	25	
901		-----		-----	-----		-----	-----		-----		-----	
912		-----		-----	-----		-----	-----		-----		-----	
963		-----		-----	-----		-----	-----		-----		-----	
974		-----		-----	-----		-----	-----		-----		-----	
1023		-----		-----	-----		-----	-----		-----		-----	
1059		-----		-----	-----		-----	-----		-----		-----	
1094		-----		-----	-----		-----	-----		-----		-----	
1146	D1401	26		0.35	26		0.30	-----		-----	Yes	26	
1262	ISO6614	15		-1.19	15		-1.24	15	DG(0.05)	-1.94	Yes	15	
1417	D1401	28		0.63	28		0.58	28		-0.12	No	-----	
1431		-----		-----	25		0.16	-----		-----	No	30	
1435		30		0.91	30		0.86	-----		-----	No	-----	
1569		-----		-----	-----		-----	-----		-----		-----	
1604		-----		-----	-----		-----	-----		-----		-----	
1665	D1401	25		0.21	25		0.16	30		0.16	No	-----	
1943		-----		-----	-----		-----	-----		-----		-----	
2124		-----		-----	-----		-----	-----		-----		-----	
6002	ISO6614	15.5		-1.12	15.5		-1.17	16.0	DG(0.05)	-1.80	No	16.0	
6016	D1401	>30		-----	>30		-----	>30		-----	Yes	30	
6283	D1401	22.5		-0.14	22.5		-0.19	24.8		-0.57	Yes	24.8	
6286		-----		-----	-----		-----	-----		-----		-----	
6333	D1401	19.5		-0.56	22.3		-0.22	30.0		0.16	No	20	
6532		-----		-----	-----		-----	-----		-----		-----	
	normality	OK			OK			OK					
	n	16			16			9					
	outliers	0			0			2					
	mean (n)	23.51			23.87			28.87					
	st.dev. (n)	5.036			5.162			2.839					
	R(calc.)	14.10			14.45			7.95					
	st.dev.(D1401:21)	7.143			7.143			7.143					
	R(D1401:21)	20			20			20					

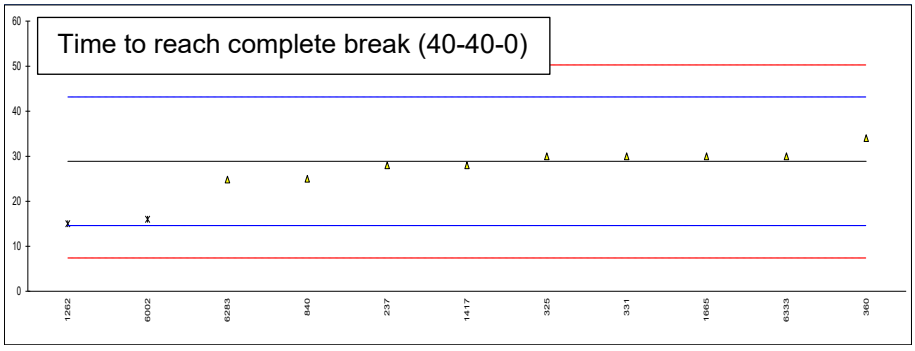
Lab 840 first reported >30, >30, >30 and 30 respectively

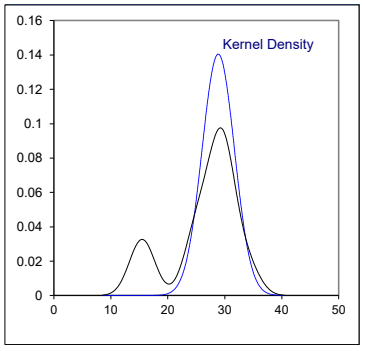

Time to reach 3 mL or less emulsion
840
1262
6002
6333
237
6283
496
862
451
1665
325
1146
360
1417
331
1435


Kernel Density


Time to reach 37 mL of water
840
1262
6002
237
6333
6283
862
451
1431
1665
1146
325
1417
331
1435
360


Kernel Density


Time to reach complete break (40-40-0)
1262
6002
6283
840
237
1417
325
331
1665
6333
360


Kernel Density

Determination of Water Separability at 54 °C, distilled water on sample #23072; results in mL

lab	method	volume oil phase	mark	volume water phase	mark	volume emulsion phase	mark
178		-----		-----		-----	
179		-----		-----		-----	
225		-----		-----		-----	
237	D1401	40.0		40.0		0	
325	D1401	40		40		0	
331	D1401	-----		-----		-----	
349		-----		-----		-----	
360	D1401	42		38		0	
432		-----		-----		-----	
451	D1401	40		37		3	
496	D1401	40		39		1	
603		-----		-----		-----	
614		-----		-----		-----	
633		-----		-----		-----	
657		41		37		2	
663		-----		-----		-----	
840	D1401	40	C	40	C	0	C
862	D1401	40		37		3	
901		-----		-----		-----	
912		-----		-----		-----	
963		-----		-----		-----	
974		-----		-----		-----	
1023		-----		-----		-----	
1059		-----		-----		-----	
1094		-----		-----		-----	
1146	D1401	40		37		3	
1262	ISO6614	40		40		0	
1417	D1401	40		40		0	
1431		43		37		0	
1435		-----		-----		-----	
1569		-----		-----		-----	
1604		-----		-----		-----	
1665	D1401	42		38		0	
1943		-----		-----		-----	
2124		-----		-----		-----	
6002	ISO6614	40		40		0	
6016	D1401	35		35		10	
6283	D1401	40		40		0	
6286		-----		-----		-----	
6333	D1401	41		36		3	
6532		-----		-----		-----	

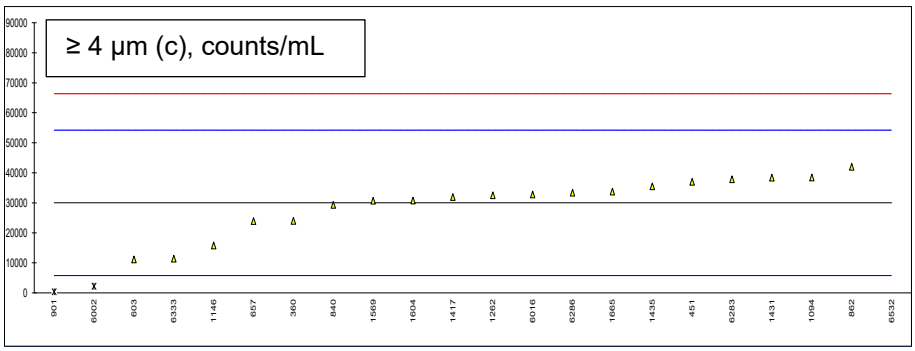
Lab 840 first reported 0, 0 and 80 respectively

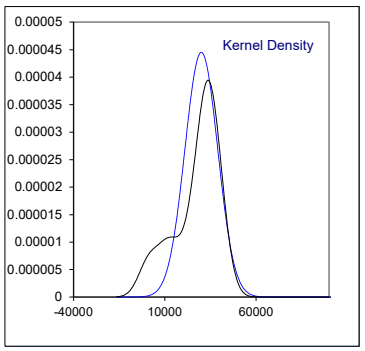
Determination of Level of Contamination on sample #23072; results in counts/mL

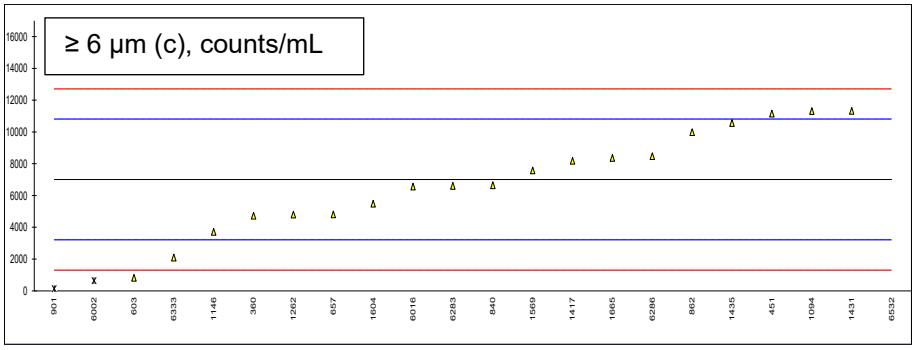
lab	method	≥ 4 µm (c)	mark	z(targ)	≥ 6 µm (c)	mark	z(targ)	≥ 14 µm (c)	mark	z(targ)
178		-----		-----	-----		-----	-----		-----
179		-----		-----	-----		-----	-----		-----
225		-----		-----	-----		-----	-----		-----
237		-----		-----	-----		-----	-----		-----
325		-----		-----	-----		-----	-----		-----
331		-----		-----	-----		-----	-----		-----
349		-----		-----	-----		-----	-----		-----
360	ISO4406	24002		-0.50	4725		-1.20	144		-0.97
432		-----		-----	-----		-----	-----		-----
451	ISO11500	37014		0.58	11159		2.18	432		1.25
496		-----		-----	-----		-----	-----		-----
603	ISO4406	11149	C	-1.56	816	C	-3.26	2	C	-2.06
614		-----		-----	-----		-----	-----		-----
633		-----		-----	-----		-----	-----		-----
657	ISO4406	23929		-0.50	4805		-1.16	98		-1.32
663		-----		-----	-----		-----	-----		-----
840	D7647	29298.6	C	-0.06	6640.5	C	-0.19	253.1	C	-0.13
862	D7647	41972		0.99	9986		1.56	198		-0.55
901	D7647	372.5	ex,C	-2.45	128.5	ex,C	-3.62	29.7	ex,C	-1.85
912		-----		-----	-----		-----	-----		-----
963		-----		-----	-----		-----	-----		-----
974		-----		-----	-----		-----	-----		-----
1023		-----		-----	-----		-----	-----		-----
1059		-----		-----	-----		-----	-----		-----
1094	D7647	38448.36		0.70	11315.54		2.26	483.60		1.64
1146	ISO11500	15775		-1.18	3708		-1.74	274		0.03
1262	ISO11500	32497	C	0.20	4797		-1.16	291		0.16
1417	In house	31928		0.16	8180		0.62	246		-0.18
1431	ISO4407	38364		0.69	11324		2.27	495		1.73
1435	ISO4407	35474.90		0.45	10557.57		1.87	575.77		2.35
1569	ISO11500	30662		0.05	7577		0.30	231		-0.30
1604	ISO4407	30711		0.06	5486		-0.80	131		-1.07
1665	D7647	33717		0.31	8360		0.71	419		1.15
1943		-----		-----	-----		-----	-----		-----
2124		-----		-----	-----		-----	-----		-----
6002	D7647	2201.4	ex,C	-2.30	634.2	ex,C	-3.35	78.3	ex,C	-1.47
6016	D7596	32782.1		0.23	6563.5		-0.23	215.5		-0.42
6283	ISO4407	37855.73		0.65	6602.53		-0.21	118.67		-1.16
6286	ISO11500	33329		0.27	8474		0.77	370		0.77
6333	D7596	11418.8	C	-1.54	2096.0	C	-2.58	150.9		-0.91
6532	ISO4407	222206	ex,C	15.86	34807	ex,C	14.61	274	ex,C	0.03

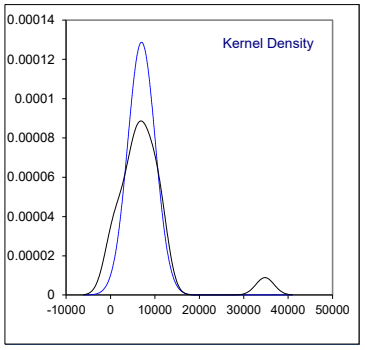
normality	OK	OK	OK
n	19	19	19
outliers	0 + 3ex	0 + 3ex	0 + 3ex
mean (n)	30017.2	7009.1	269.9
st.dev. (n)	8960.93	3097.33	155.08
R(calc.)	25090.6	8672.5	434.2
st.dev.(D7647:10R18)	12114.10	1902.47	130.14
R(D7647:10R18)	33919.5	5326.9	364.4

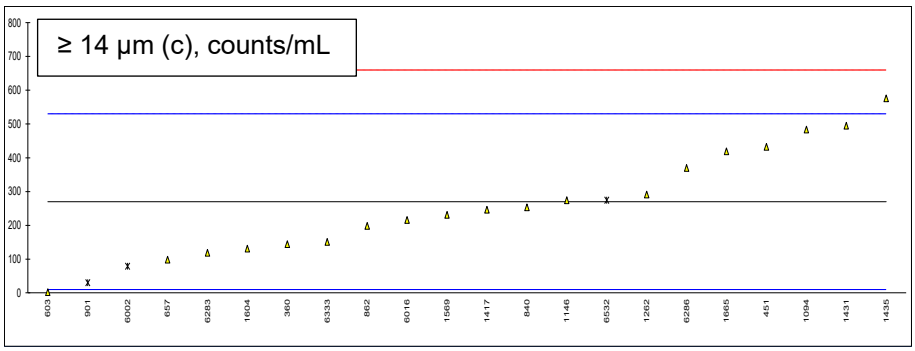
Lab 603 reported the results in counts/mL as scale number; first reported 17833, 2239 and 13 scale number respectively
Lab 840 first reported 698.5, 138.8 and 16.4 respectively
Lab 901 first reported 557, 175 and 24 respectively; test results excluded as statistical outliers and excluded test result at related measurement for ISO4406 scale number
Lab 1262 first reported 12497
Lab 6002 first reported 775.82, 201.85 and 22.38 respectively; test results excluded as statistical outliers and excluded test result at related measurement for ISO4406 scale number
Lab 6333 first reported 10778.6 and 1685.8 respectively
Lab 6532 first reported 222206, 34807 and 274 respectively; test results excluded as results in counts/mL and ISO4406 scale number did not match

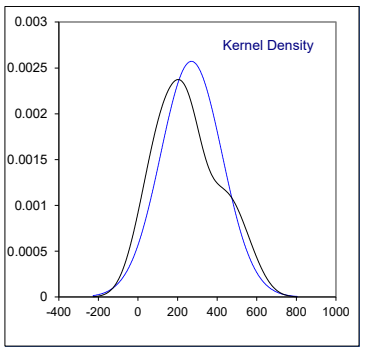

≥ 4 µm (c), counts/mL


Kernel Density


≥ 6 µm (c), counts/mL


Kernel Density

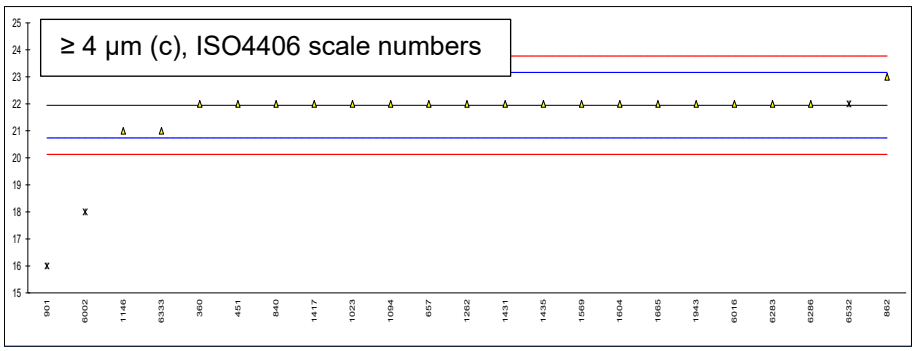

≥ 14 µm (c), counts/mL

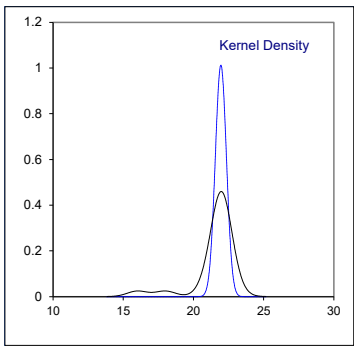

Kernel Density

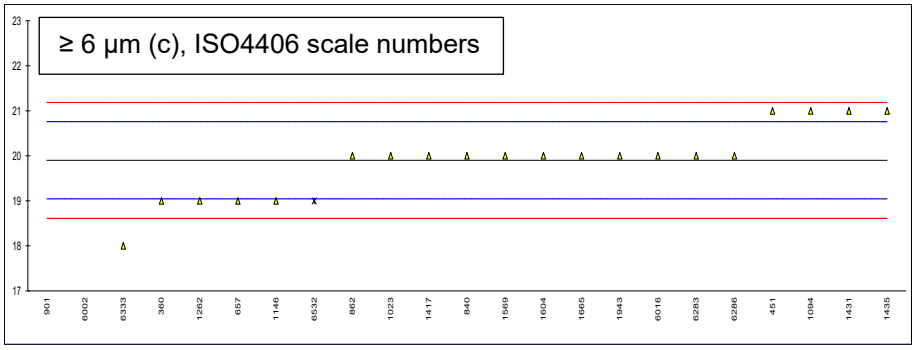
Determination of Level of Contamination on sample #23072; results in ISO4406 scale numbers

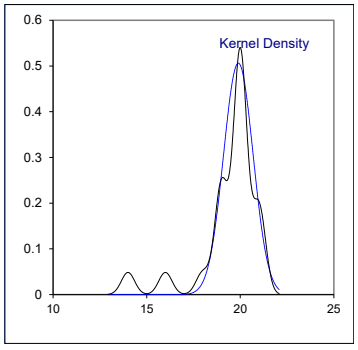
lab	method	≥ 4 µm (c)	mark	z(targ)	≥ 6 µm (c)	mark	z(targ)	≥ 14 µm (c)	mark	z(targ)
178		-----		-----	-----		-----	-----		-----
179		-----		-----	-----		-----	-----		-----
225		-----		-----	-----		-----	-----		-----
237		-----		-----	-----		-----	-----		-----
325		-----		-----	-----		-----	-----		-----
331		-----		-----	-----		-----	-----		-----
349		-----		-----	-----		-----	-----		-----
360	ISO4406	22		0.08	19		-2.10	14		-1.54
432		-----		-----	-----		-----	-----		-----
451	ISO4406	22		0.08	21		2.57	16		1.26
496		-----		-----	-----		-----	-----		-----
603		-----		-----	-----		-----	-----		-----
614		-----		-----	-----		-----	-----		-----
633		-----		-----	-----		-----	-----		-----
657	ISO4406	22		0.08	19		-2.10	14		-1.54
663		-----		-----	-----		-----	-----		-----
840	ISO4406	22	C	0.08	20	C	0.23	15	C	-0.14
862	D7647	23		1.73	20		0.23	15		-0.14
901	ISO4406	16	G(0.01)	-9.80	14	C,G(0.01)	-13.77	12	ex	-4.34
912		-----		-----	-----		-----	-----		-----
963		-----		-----	-----		-----	-----		-----
974		-----		-----	-----		-----	-----		-----
1023	ISO4406	22		0.08	20		0.23	15		-0.14
1059		-----		-----	-----		-----	-----		-----
1094	ISO4406	22		0.08	21		2.57	16		1.26
1146	ISO11500	21		-1.56	19		-2.10	15		-0.14
1262	ISO4406	22	C	0.08	19		-2.10	15		-0.14
1417	ISO4406	22		0.08	20		0.23	15		-0.14
1431	ISO4406	22		0.08	21		2.57	16		1.26
1435	ISO4406	22		0.08	21		2.57	16		1.26
1569	ISO11500	22		0.08	20		0.23	15		-0.14
1604	ISO4406	22		0.08	20		0.23	14		-1.54
1665	ISO4406	22		0.08	20		0.23	16		1.26
1943		22		0.08	20		0.23	16		1.26
2124		-----		-----	-----		-----	-----		-----
6002	D7647	18	C,G(0.01)	-6.51	16	C,G(0.01)	-9.10	13	ex,C	-2.94
6016	D7596	22		0.08	20		0.23	15		-0.14
6283		22		0.08	20		0.23	14		-1.54
6286	ISO4406	22		0.08	20		0.23	16		1.26
6333	ISO4406	21		-1.56	18		-4.43	14		-1.54
6532	ISO4406	22	ex	0.08	19	ex,C	-2.10	12	ex,C	-4.34
	normality	not OK			OK			OK		
	n	20			20			20		
	outliers	2 + 1ex			2 + 1ex			0 + 3ex		
	mean (n)	22.0			19.9			15.1		
	st.dev. (n)	0.39			0.79			0.79		
	R(calc.)	1.1			2.2			2.2		
	st.dev.(D7647:10R18)	0.61			0.43			0.71		
	R(D7647:10R18)	1.7			1.2			2.0		

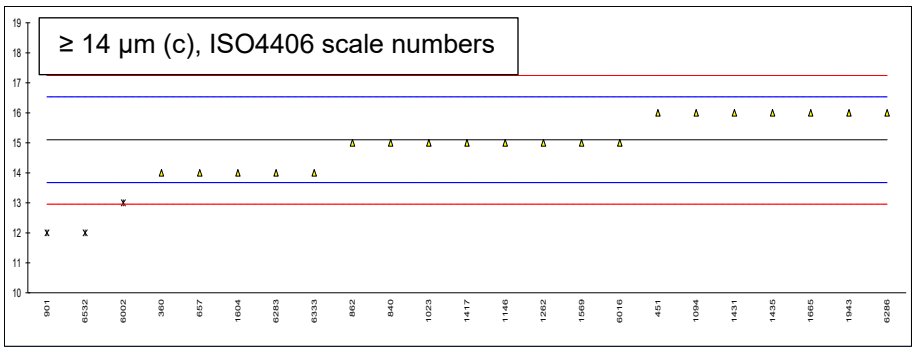
Lab 840 first reported 17, 14 and 11 respectively
Lab 901 first reported 15; test result excluded because of two statistical outliers at related parameters for ISO4406 scale numbers
Lab 1262 first reported 21
Lab 6002 first reported 17,15 and 12 respectively; test result excluded because of two statistical outliers at related parameters for ISO4406 scale numbers
Lab 6532 first reported 20 and 15 respectively; test results excluded as results in counts/mL and ISO4406 scale number did not match

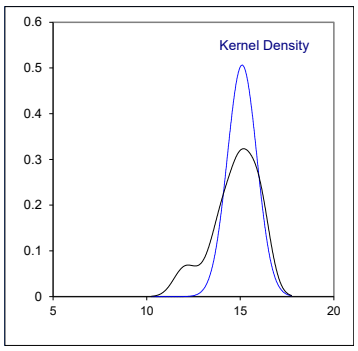

≥ 4 µm (c), ISO4406 scale numbers


Kernel Density


≥ 6 µm (c), ISO4406 scale numbers


Kernel Density


≥ 14 µm (c), ISO4406 scale numbers


Kernel Density

APPENDIX 2

Number of participants per country

2 labs in	AUSTRALIA
1 lab in	AUSTRIA
2 labs in	BELGIUM
2 labs in	BULGARIA
1 lab in	CHINA, People's Republic
1 lab in	COTE D'IVOIRE
2 labs in	FRANCE
1 lab in	GERMANY
1 lab in	GREECE
1 lab in	INDIA
2 labs in	ITALY
1 lab in	KAZAKHSTAN
1 lab in	LATVIA
1 lab in	MALAYSIA
1 lab in	NETHERLANDS
1 lab in	NIGERIA
1 lab in	NORWAY
1 lab in	PHILIPPINES
3 labs in	POLAND
1 lab in	SAUDI ARABIA
1 lab in	SINGAPORE
1 lab in	SLOVENIA
4 labs in	SPAIN
1 lab in	THAILAND
1 lab in	TURKEY
1 lab in	UNITED ARAB EMIRATES
2 labs in	UNITED KINGDOM
2 labs in	UNITED STATES OF AMERICA
1 lab in	VIETNAM

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	= calculation difference between reported test result and result calculated by iis
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
f+?	= possibly a false positive test result?
f-?	= possibly a false negative test result?
SDS	= Safety Data Sheet

Literature

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