Results of Proficiency Test
Cyclohexane
February 2021

Organized by: Institute for Interlaboratory Studies
Spijkenisse, the Netherlands

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CONTENTS

1 INTRODUCTION

Since 2018 the Institute for Interlaboratory Studies (iis) organizes a proficiency scheme for the analysis of Cyclohexane every year. During the annual proficiency testing program 2020/2021 it was decided to continue the round robin for the analysis of Cyclohexane.

In this interlaboratory study 11 laboratories in 9 different countries registered for participation. See appendix 2 for the number of participants per country. In this report the results of the Cyclohexane 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 bottle of 1L Cyclohexane, labelled #21012.
The participants were requested to report rounded and unrounded test results. The unrounded test results were preferably used for the statistical evaluation.

2.1 QUALITY SYSTEM

The Institute for Interlaboratory Studies in Spijkenisse, the Netherlands, has implemented a quality system based on ISO/IEC17043:2010. 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 a 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 25 liters of Cyclohexane was obtained from a local supplier. The batch was spiked with n-Hexane. After homogenization 25 amber glass bottles of 1L were filled and labelled #21012.
The homogeneity of the subsamples was checked by determination of Density at 20˚C in accordance with ASTM D4052 on 8 stratified randomly selected subsamples.

	Density at 20°C in kg/L
sample #21012-1	0.77849
sample #21012-2	0.77847
sample #21012-3	0.77847
sample #21012-4	0.77849
sample #21012-5	0.77849
sample #21012-6	0.77848
sample #21012-7	0.77848
sample #21012-8	0.77849

Table 1: homogeneity test results of subsamples #21012

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 20°C in kg/L
r (observed)	0.00002
reference test method	ISO12185:96
0.3 x R (reference test method)	0.00015

Table 2: evaluation of the repeatability of subsamples #21012

The calculated repeatability was 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 bottle of 1 L Cyclohexane labelled #21012 was sent on January 27, 2021. An SDS was added to the sample package.

2.5 STABILITY OF THE SAMPLES

The stability of Cyclohexane 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 on sample #21012: Acid Wash Color, Appearance, Color Pt/Co, Density at 20°C, Distillation (IBP, 50% recovered, DP and range), Freezing Point, Purity, Benzene, n-Hexane, Methylcyclohexane, Methylcyclopentane, Refractive Index at 20°C and Sulfur.

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 reanalysis). Additional or corrected test results are used for data analysis and the 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 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, e.g. ASTM reproducibilities, the z-scores were calculated using a target standard deviation. This results in an evaluation independent of the variation of 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.
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

Some problems were encountered with the dispatch of the samples due to COVID-19 pandemic. Therefore, the reporting time on the data entry portal was extended with another week. All participants were able to report test results before the extended final reporting date. Not all participants were able to report all tests requested.
In total 11 participants reported 111 numerical test results. Observed were 2 outlying test results, which is 1.8%. In proficiency tests 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 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 reported test results. The abbreviations, used in these tables, are explained in appendix 3.

Unfortunately, a suitable reference test method, providing the precision data, is not available for all determinations. For these tests the calculated reproducibility was compared against the estimated reproducibility calculated with the Horwitz equation.

In the iis PT reports ASTM test methods are referred to with a number and if appropriate an indication of sub test method (e.g. D7266:13e1). If applicable, a designation in parentheses is added to designate the year of reapproval e.g. D7266:13e1(2018). In the test result tables of appendix 1 only the method number (sub) and year of adoption or revision (e.g. D7266:13e1) will be used.

Acid Wash Color: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of ASTM D848:18.

Appearance: This determination was not problematic. All participants agreed on the appearance which was bright and clear (Pass).

Color Pt/Co: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of ASTM D5386:16 or ASTM D1209:05(2019).

Density at 20°C: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of ISO12185:96.

Distillation: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility for mid-boiling point is not in agreement with the requirements of ASTM D850:21 for automated, but in agreement with the requirements of ASTM D850:21 for manual mode. The calculated reproducibilities for IBP and DP are in agreement with the respective requirements for automated and manual mode.

Freezing Point: Only three participants reported a test result. Therefore, no z-scores were calculated.

Purity: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of ASTM D7266:13e1(2018).

Benzene: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in good agreement with the requirements of ASTM D7266:13e1(2018).

n-Hexane: 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 D7266:13e1(2018).

Methylcyclohexane: 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 D7266:13e1(2018).

Methylcyclopentane: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of D7266:13e1(2018).

Refractive Index: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of ASTM D1218:12(2016).

Sulfur: This determination may not be problematic. All reporting participants agreed on a concentration lower than 1 mg/kg. Therefore, no z-scores were calculated.

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 literature reference test methods (in casu ASTM test methods) are presented in the next table.

Parameter	unit	n	average	2.8 * sd	R(lit)
Acid Wash Color		7	0.7	0.5	2.0
Appearance		11	Pass (B&C)	n.a.	n.a.
Color Pt/Co		11	2.3	2.3	5.0
Density at 20°C	kg/L	10	0.7786	0.0003	0.0005
Distillation, IBP	°C	8	80.4	0.3	0.6
Distillation, 50% recovered	°C	8	80.7	0.3	0.2
Distillation, Dry Point	°C	8	80.9	0.3	0.5
Freezing Point	°C	3	n.e.	n.e.	n.e.
Purity	%M/M	9	99.940	0.019	0.035
Benzene	mg/kg	9	14	4	13
n-Hexane	mg/kg	8	149	11	7
Methylcyclohexane	mg/kg	8	77	9	28
Methylcyclopentane	mg/kg	9	11	3	5
Refractive Index at 20°C		8	1.4263	0.0003	0.0005
Sulfur	mg/kg	11	<1	n.e.	n.e.

Table 3: reproducibilities of tests on sample #21012

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

4.3 COMPARISON OF THE PROFICIENCY TEST OF FEBRUARY 2021 WITH PREVIOUS PTS

	February 2021	February 2020	February 2019	March 2018
Number of reporting laboratories	11	9	10	10
Number of test results	111	88	104	120
Number of statistical outliers	2	5	2	10
Percentage of statistical outliers	1.8%	5.7%	1.9%	8.3%

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 test was compared against the requirements of the reference test methods. The conclusions are given the following table.

Parameter	February 2021	February 2020	February 2019	March 2018
Acid Wash Color	++	n.e.	++	++
Color Pt/Co	++	++	+	+
Density at 20°C	+	+	++	++
Distillation	+	+	++	++
Freezing Point	n.e.	n.e.	n.e.	n.e.
Purity	+	+	++	+
Benzene	++	++	++	++
n-Hexane	-	n.e.	-	-
Methylcyclohexane	++	+	++	+
Methylcyclopentane	+	++	++	--
Refractive Index at 20°C	+	++	-	+
Sulfur	n.e.	n.e.	n.e.	n.e.

Table 5: comparison determinations against the reference test methods

In the table above 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

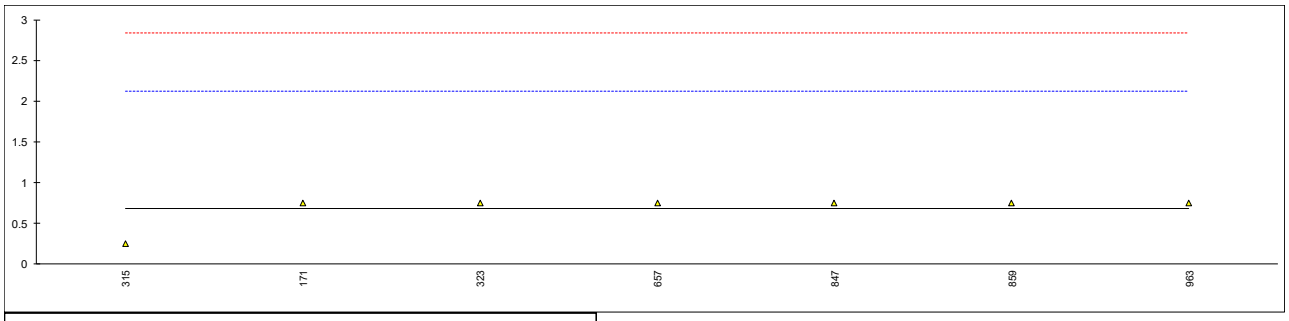
APPENDIX 1

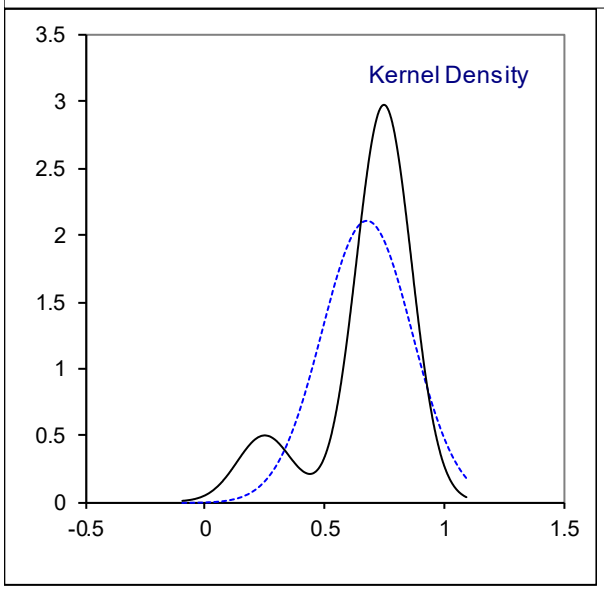
Determination of Acid Wash Color on sample #21012

lab	method	Original reported	iis conversion *)	mark	z(targ)	remarks
171	D848	-1	0.75		0.10	
315	D848	0+	0.25		-0.59	
323	D848	-1	0.75		0.10	
657	D848	1-	0.75		0.10	
847	D848	N0.1-	0.75		0.10	
859	D848	1-	0.75		0.10	
963	D848	1-	0.75		0.10	
1081		-----	-----		-----	
1669		-----	-----		-----	
1954		-----	-----		-----	
6315		-----	-----		-----	

normality	unknown
n	7
outliers	0
mean (n)	0.679
st.dev. (n)	0.1890
R(calc.)	0.529
st.dev.(D848:18)	0.7305
R(D848:18)	2.045

*) In the calculation of the mean, standard deviation, reproducibility and in the graphs, a reported value of 'y-', '-y' or '<y' is changed into y-0.25 (for example 1- into 0.75) and 'y+' is changed into y+0.25 (for example 0+ into 0.25).





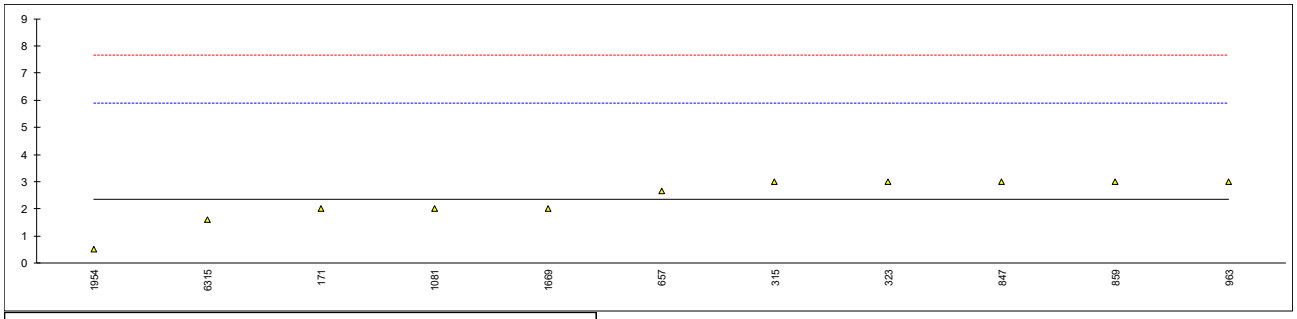
Determination of Appearance on sample #21012

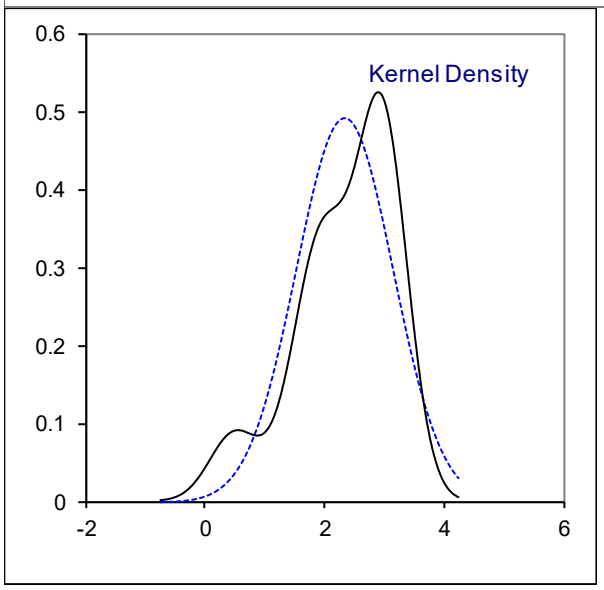
lab	method	value	mark	z(targ)	remarks
171	E2680	Pass		-----	
315	E2680	pass		-----	
323	E2680	clear & bright		-----	
657	E2680	Pass		-----	
847	Visual	clear&bright		-----	
859	Visual	Pass		-----	
963	Visual	Clear		-----	
1081	In house	C/B		-----	
1669	Visual	Claro y Brillante		-----	
1954	Visual	clear and colourless		-----	
6315	Visual	Clear, bright		-----	
	n	11			
	mean (n)	Pass			

Determination of Color Pt/Co on sample #21012

lab	method	value	mark	z(targ)	remarks
171	D5386	2		-0.19	
315	D5386	3		0.37	
323	D5386	3		0.37	
657	D5386	2.67		0.18	
847	D1209	3		0.37	
859	D5386	3		0.37	
963	D5386	3		0.37	
1081	D5386	2		-0.19	
1669	D1209	2		-0.19	
1954	D1209	0.5		-1.04	
6315	ISO6271	1.6		-0.42	

	normality	suspect
	n	11
	outliers	0
	mean (n)	2.34
	st.dev. (n)	0.810
	R(calc.)	2.27
	st.dev.(D5386:16)	1.772
	R(D5386:16)	4.96
Compare		
	R(D1209:05)	7

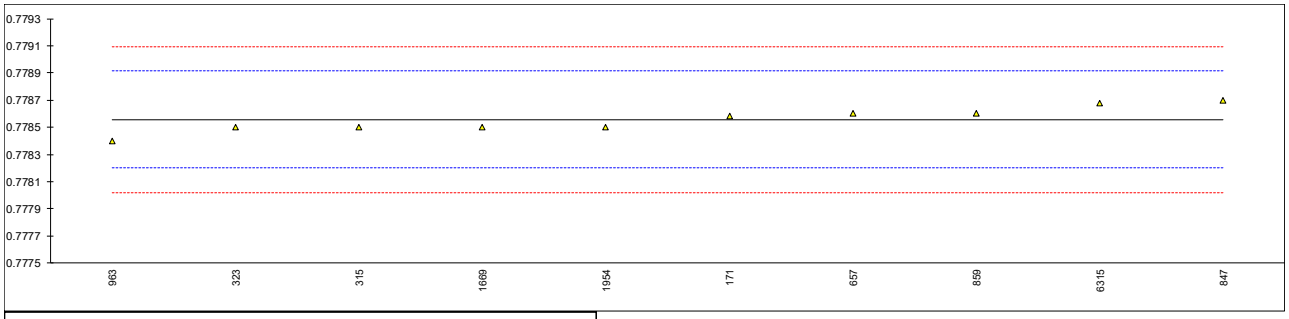


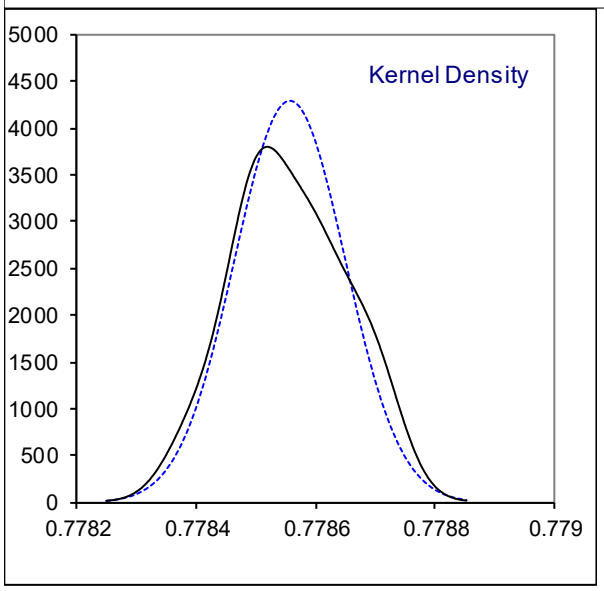


Determination of Density at 20°C on sample #21012; results in kg/L

lab	method	value	mark	z(targ)	remarks
171	D4052	0.77858		0.13	
315	D4052	0.7785		-0.31	
323	D4052	0.7785		-0.31	
657	D4052	0.7786		0.25	
847	D4052	0.7787		0.81	
859	D4052	0.7786		0.25	
963	D4052	0.7784		-0.87	
1081		-----		-----	
1669	D4052	0.7785		-0.31	
1954	D4052	0.7785		-0.31	
6315	ISO12185	0.77868		0.69	

normality	OK
n	10
outliers	0
mean (n)	0.77856
st.dev. (n)	0.000093
R(calc.)	0.00026
st.dev.(ISO12185:96)	0.000179
R(ISO12185:96)	0.0005

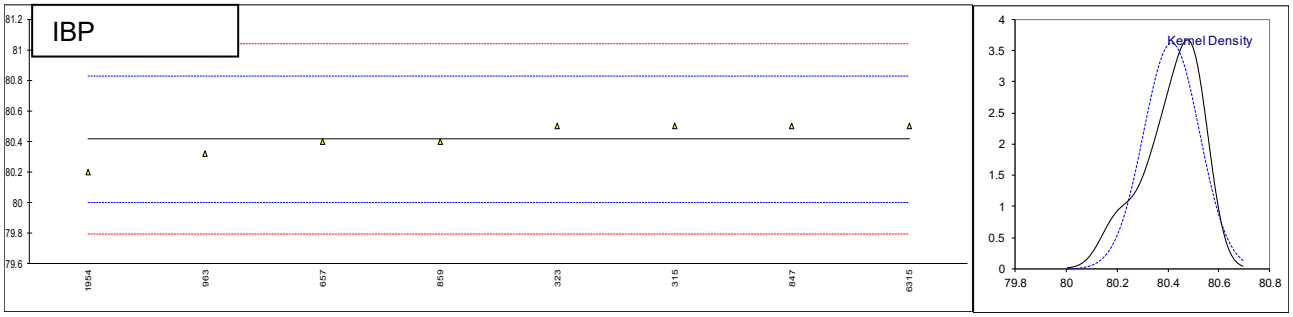


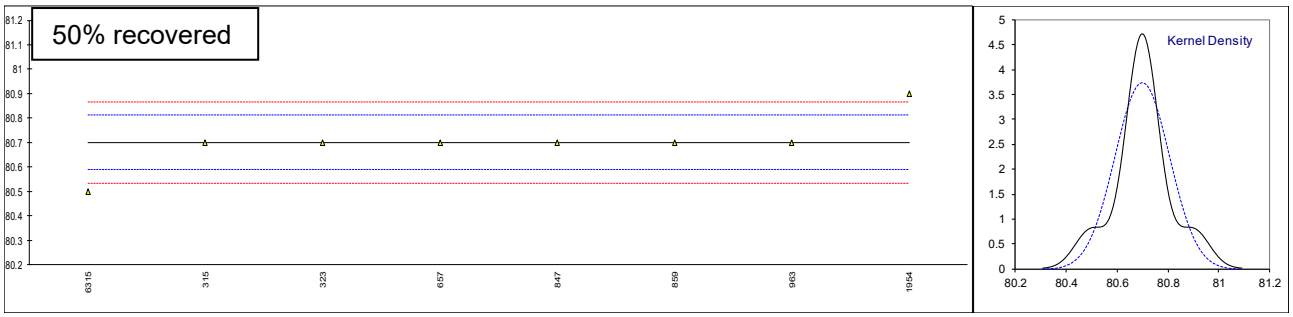


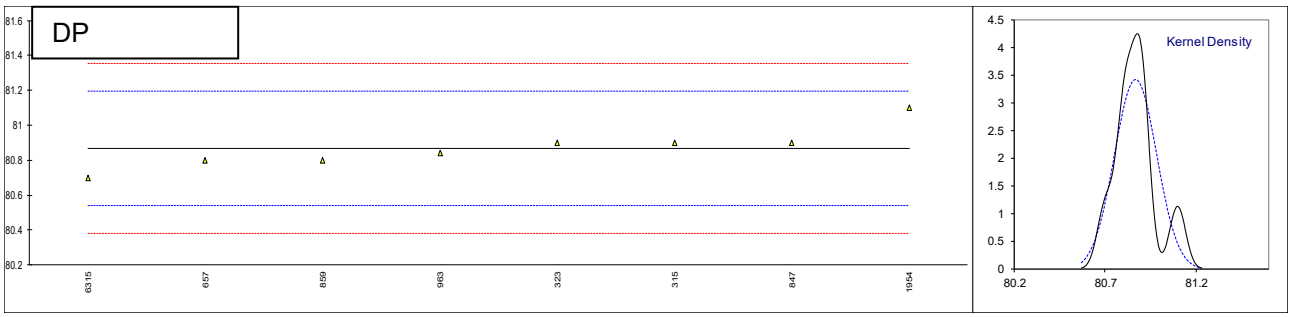
Determination of Distillation on sample #21012; results in °C

Lab	method	IBP	mark	z(targ)	50%	mark	z(targ)	DP	mark	z(targ)	range	mark
171		-----		-----	-----		-----	-----		-----	-----	
315	D1078-automated	80.5		0.41	80.7		0.00	80.9		0.20	0.4	
323	D850-automated	80.5		0.41	80.7		0.00	80.9		0.20	0.4	
657	D850-manual	80.4		-0.07	80.7		0.00	80.8		-0.41	0.4	
847	D850-manual	80.5		0.41	80.7		0.00	80.9		0.20	0.4	
859	D850-manual	80.4		-0.07	80.7		0.00	80.8		-0.41	0.4	
963	D850-automated	80.32		-0.46	80.70		0.00	80.84		-0.17	0.5	
1081		-----		-----	-----		-----	-----		-----	-----	
1669		-----		-----	-----		-----	-----		-----	-----	
1954	D1078	80.2		-1.04	80.9		3.59	81.1		1.43	0.9	C
6315	D850-automated	80.5		0.41	80.5		-3.59	80.7		-1.03	0.2	
	normality	unknown			unknown			unknown				
	n	8			8			8				
	outliers	0			0			0				
	mean (n)	80.415			80.700			80.868				
	st.dev. (n)	0.1099			0.1069			0.1166				
	R(calc.)	0.308			0.299			0.326				
	st.dev.(D850:21-A)	0.2075			0.0557			0.1629				
	R(D850:21-A)	0.581			0.156			0.456				
Compare												
	R(D850:21-M)	0.412			0.656			0.656				

Lab 1954: first reported 79.8







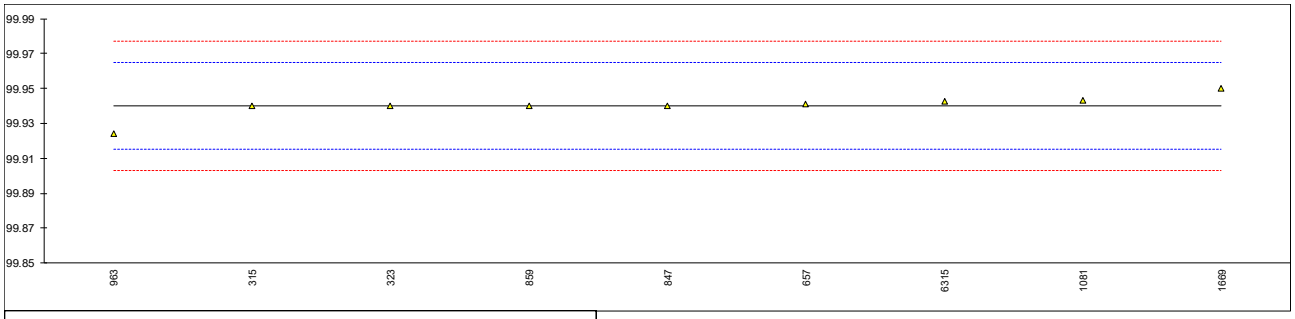
Determination of Freezing Point on sample #21012; results in °C

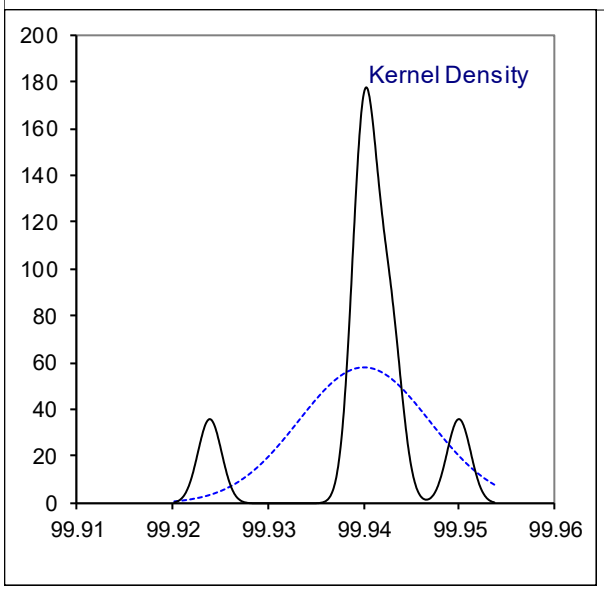
lab	method	value	mark	z(targ)	remarks
171	D5972	9.1		-----	
315	D1493	6.45		-----	
323		-----		-----	
657		-----		-----	
847	D1016	6.4		-----	
859		-----		-----	
963		-----		-----	
1081		-----		-----	
1669		-----		-----	
1954		-----		-----	
6315		-----		-----	
	n	3			

Determination of Purity of Cyclohexane on sample #21012; results in %M/M

lab	method	value	mark	z(targ)	remarks
171		-----		-----	
315	D3054	99.94		-0.01	
323	D7266	99.94		-0.01	
657	D7266	99.9411		0.08	
847	D7266	99.94		-0.01	
859	D7266	99.94		-0.01	
963	D7266	99.924		-1.30	
1081	D3054	99.943		0.23	
1669	D7266	99.95		0.80	
1954		-----		-----	
6315	D7871	99.9427		0.21	

normality	not OK
n	9
outliers	0
mean (n)	99.9401
st.dev. (n)	0.00683
R(calc.)	0.0191
st.dev.(D7266:13e1)	0.01239
R(D7266:13e1)	0.0347

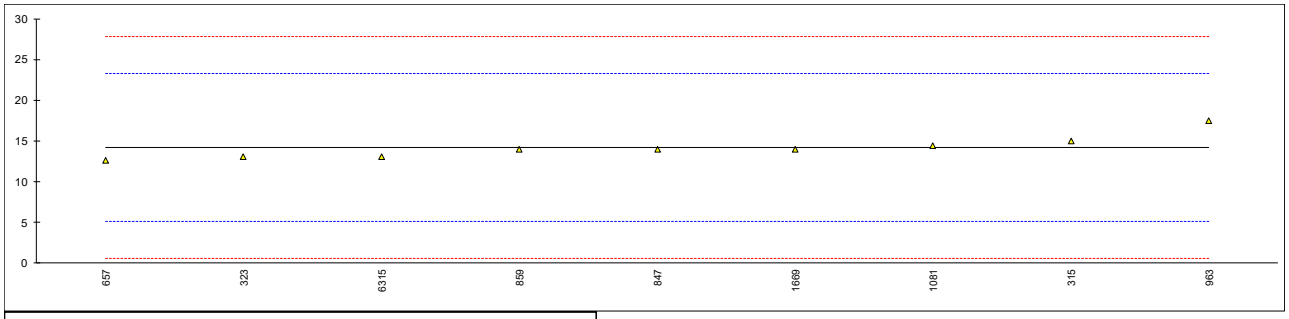


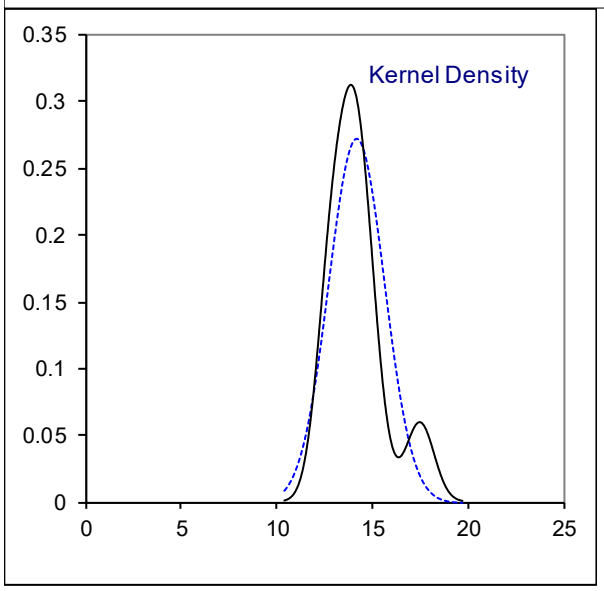


Determination of Benzene on sample #21012 in mg/kg

lab	method	value	mark	z(targ)	remarks
171		-----		-----	
315	D3054	15		0.18	
323	D7266	13		-0.26	
657	D7266	12.6		-0.35	
847	D7266	14		-0.04	
859	D7266	14		-0.04	
963	D7266	17.5		0.74	
1081	D3054	14.45		0.06	
1669	D7266	14		-0.04	
1954		-----		-----	
6315	D7871	13.0		-0.26	

normality	not OK
n	9
outliers	0
mean (n)	14.172
st.dev. (n)	1.4640
R(calc.)	4.099
st.dev.(D7266:13e1)	4.5245
R(D7266:13e1)	12.669

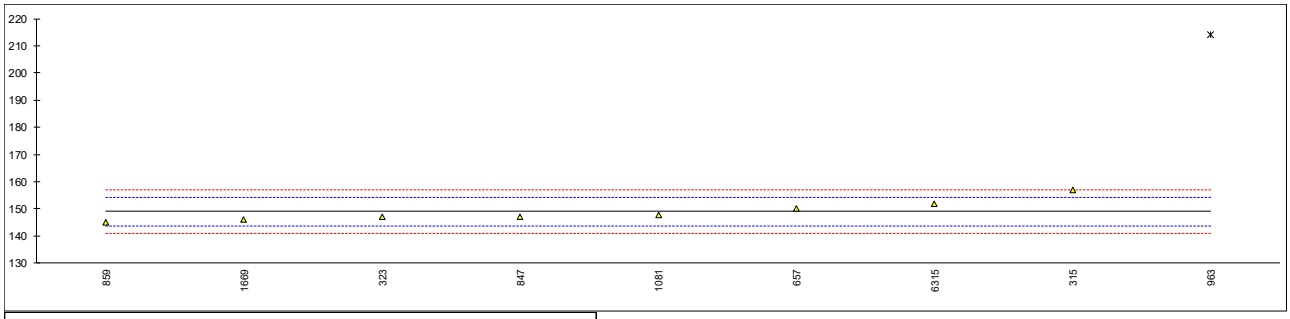


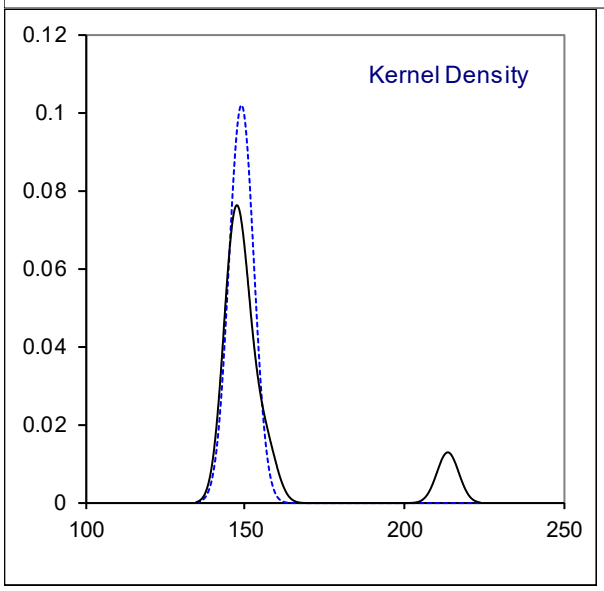


Determination of n-Hexane on sample #21012; results in mg/kg

lab	method	value	mark	z(targ)	remarks
171		-----		-----	
315	D3054	157		3.03	
323	D7266	147		-0.74	
657	D7266	150.1		0.43	
847	D7266	147		-0.74	
859	D7266	145		-1.49	
963	D7266	214	C,G(0.01)	24.52	First reported 229.1
1081	D3054	147.78		-0.44	
1669	D7266	146	C	-1.12	First reported 136
1954		-----		-----	
6315	D7871	151.8		1.07	

normality	not OK
n	8
outliers	1
mean (n)	148.96
st.dev. (n)	3.919
R(calc.)	10.97
st.dev.(D7266:13e1)	2.653
R(D7266:13e1)	7.43

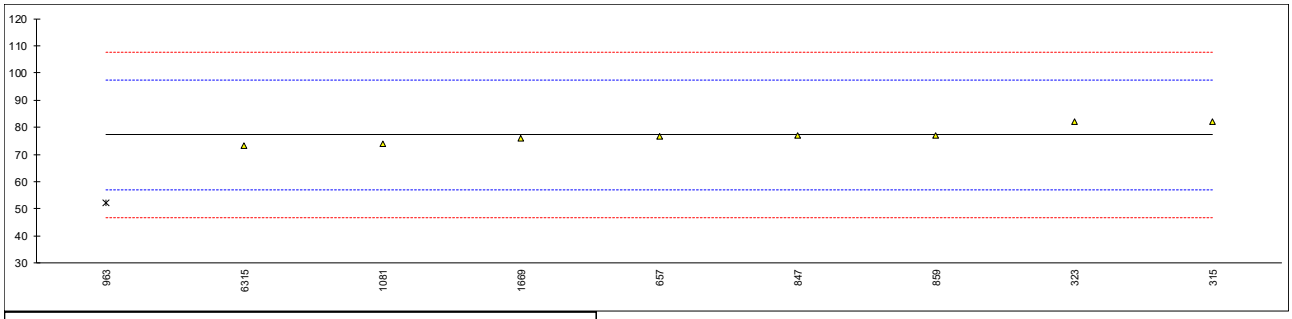


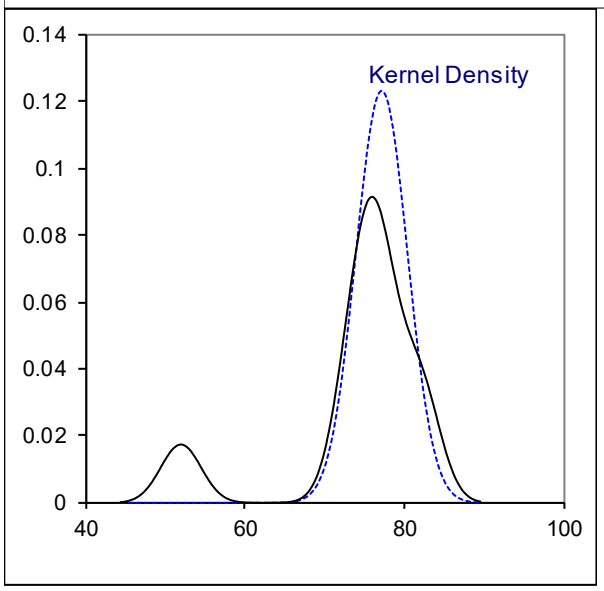


Determination of Methylcyclohexane on sample #21012; results in mg/kg

lab	method	value	mark	z(targ)	remarks
171		-----		-----	
315	D3054	82		0.47	
323	D7266	82		0.47	
657	D7266	76.5		-0.07	
847	D7266	77		-0.02	
859	D7266	77		-0.02	
963	D7266	52	C,G(0.01)	-2.49	First reported 137.7
1081	D3054	73.87		-0.33	
1669	D7266	76		-0.12	
1954		-----		-----	
6315	D7871	73.4		-0.38	

normality	OK
n	8
outliers	1
mean (n)	77.221
st.dev. (n)	3.2429
R(calc.)	9.080
st.dev.(D7266:13e1)	10.1134
R(D7266:13e1)	28.318

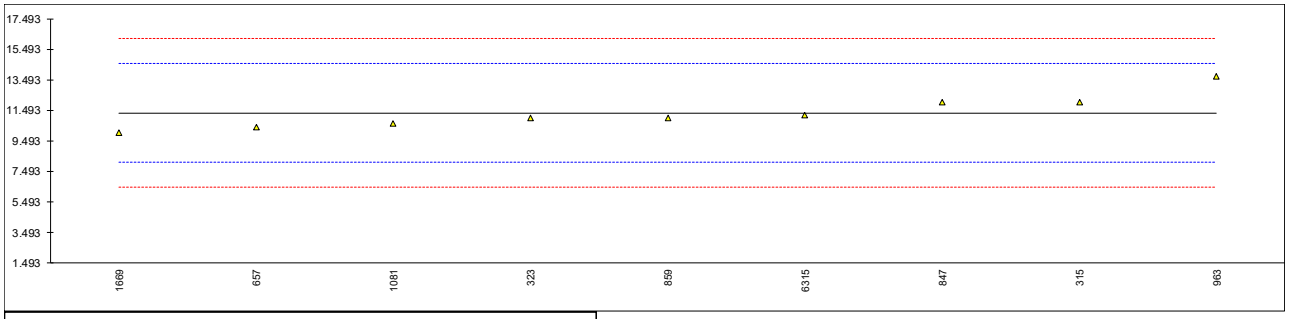


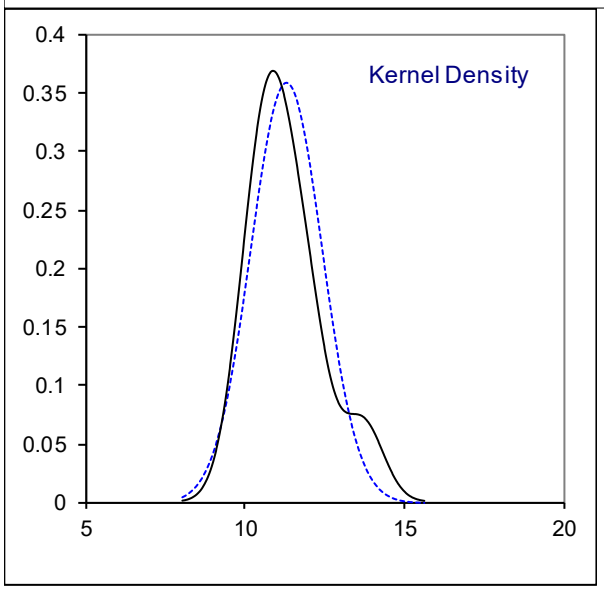


Determination of Methylcyclopentane on sample #21012; results in mg/kg

lab	method	value	mark	z(targ)	remarks
171		-----		-----	
315	D3054	12		0.42	
323	D7266	11		-0.20	
657	D7266	10.4		-0.57	
847	D7266	12		0.42	
859	D7266	11		-0.20	
963	D7266	13.7		1.46	
1081	D3054	10.61		-0.44	
1669	D7266	10		-0.81	
1954		-----		-----	
6315	D7871	11.2		-0.08	

normality	not OK
n	9
outliers	0
mean (n)	11.323
st.dev. (n)	1.1125
R(calc.)	3.115
st.dev.(D7266:13e1)	1.6271
R(D7266:13e1)	4.556

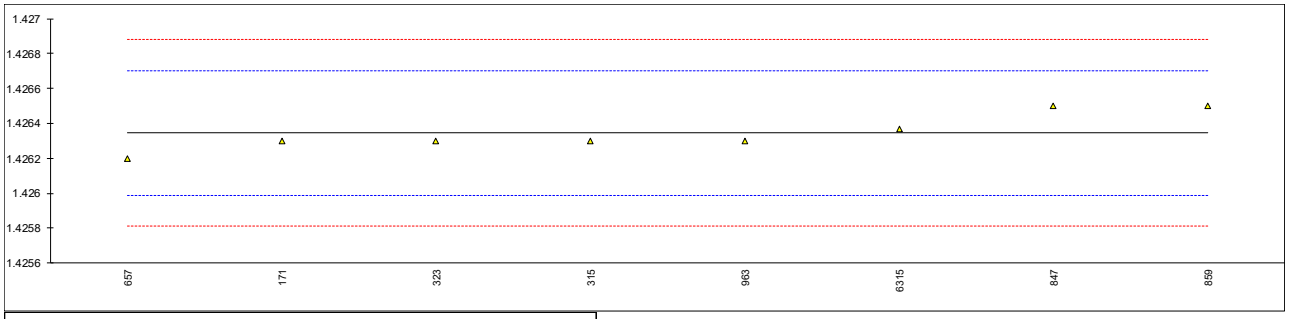


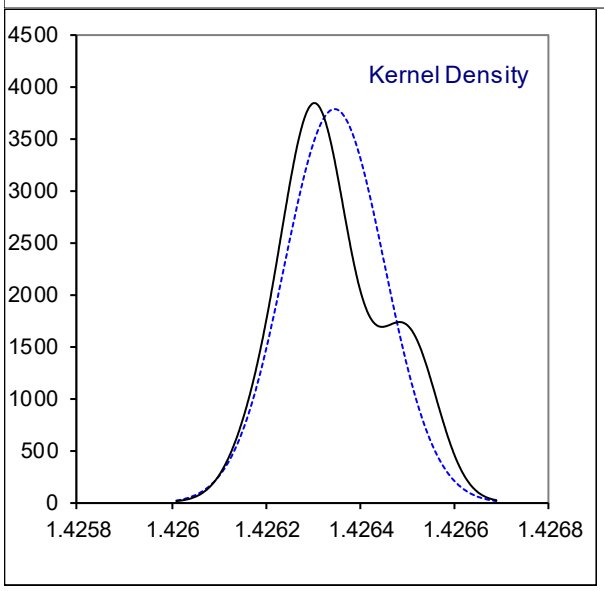


Determination of Refractive Index at 20°C on sample #21012;

lab	method	value	mark	z(targ)	remarks
171	D1218	1.4263		-0.26	
315	D1218	1.4263		-0.26	
323	D1218	1.4263		-0.26	
657	D1218	1.42620		-0.82	
847	D1218	1.4265		0.86	
859	D1218	1.4265		0.86	
963	D1218	1.4263		-0.26	
1081		-----		-----	
1669		-----		-----	
1954		-----		-----	
6315	DIN51423	1.42637		0.13	

normality	unknown
n	8
outliers	0
mean (n)	1.42635
st.dev. (n)	0.000105
R(calc.)	0.00030
st.dev.(D1218:12)	0.000179
R(D1218:12)	0.0005





Determination of Sulfur on sample #21012; results in mg/kg

lab	method	value	mark	z(targ)	remarks
171	D5453	<1		-----	
315	D7183	<0.1		-----	
323	D5453	<1		-----	
657	D5453	< 1		-----	
847	D5453	<0.5		-----	
859	ISO20846	<0.5		-----	
963	D7183	<0.5		-----	
1081	ISO20846	0.00		-----	
1669	ISO20846	<0.2		-----	
1954	D5453	0.10		-----	
6315	ISO20846	0.03		-----	
	n	11			
	mean (n)	<1			

APPENDIX 2

Number of participants per country

1 lab in	BELGIUM
2 labs in	CHINA, People's Republic
1 lab in	GERMANY
1 lab in	INDIA
2 labs in	NETHERLANDS
1 lab in	SAUDI ARABIA
1 lab in	SINGAPORE
1 lab in	SPAIN
1 lab 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	= 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
SDS	= Safety Data Sheet

Literature

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