Results of Proficiency Test
Benzene
February 2019

Organised by: Institute for Interlaboratory Studies
Spijkenisse Netherlands

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CONTENTS

1 INTRODUCTION

Since 1999, the Institute for Interlaboratory Studies (iis) organizes a proficiency scheme for the analysis of Benzene every year. During the annual proficiency testing program 2018/2019, it was decided to continue the round robin for the analysis of Benzene in accordance with the latest applicable version of the specification for Benzene: ASTM D2359.
In the interlaboratory study 51 laboratories in 22 different countries registered for participation. See appendix 2 for the number of participants per country. In this report, the results of the 2019 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/IEC 17025 accredited laboratory. It was decided to send one sample of Benzene (1 liter bottle, labelled #19020). Participants were requested to report rounded and unrounded test results. The unrounded test results were preferably used for the 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 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

Approximately 120 liters of Benzene was obtained from a local chemical supplier. After homogenization, 78 amber glass bottles of 1 liter were filled and labelled #19020. The homogeneity of the subsamples was checked by determination of Density at 20˚C in accordance with ISO12185 on 8 stratified randomly selected samples.

	Density at 20°C in kg/L
sample #19020-1	0.87897
sample #19020-2	0.87898
sample #19020-3	0.87898
sample #19020-4	0.87899
sample #19020-5	0.87898
sample #19020-6	0.87898
sample #19020-7	0.87898
sample #19020-8	0.87898

Table 1: homogeneity test results of subsamples #19020

From the above test results the repeatability was calculated and compared with 0.3 times the corresponding reproducibility of the reference test method in agreement with the procedure of ISO 13528, Annex B2 in the next table.

	Density at 20°C in kg/L
r (observed)	0.00001
reference test method	ISO12185:96
0.3*R (reference test method)	0.00015

Table 2: evaluation of repeatability of subsamples #19020

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

To each of the participating laboratories one 1 liter bottle of Benzene labelled #19020 was sent on February 6, 2019. An SDS was added to the sample package.

2.5 STABILITY OF THE SAMPLES

The stability of Benzene 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 #19020: Acid Wash Color, Acidity, Appearance, Bromine Index, Total Chlorides, Organic Chlorides, Color Pt/Co, Density at 20°C, Distillation (IBP, 50% recovered and DP), Total Nitrogen, Purity, Methylcyclohexane, Toluene, Nonaromatics, 1,4-Dioxane, Solidification Point, Sulfur, Thiophene and Water.

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 appropriate 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 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 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.

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 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 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, EN or ISO 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 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 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

In this interlaboratory study, some problems were encountered with dispatch of the samples. Participants in Brazil, China and India received the samples late due to problems at customs. Four participants reported the test results after the final reporting date and one laboratory did not report any test results. Not all laboratories were able to perform all analyses requested. Finally, in total 50 participants reported 532 numerical test results. Observed were 17 outlying results, which is 3.2% of the total of numerical test 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 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. The abbreviations, used in these tables, are listed in appendix 3.

Unfortunately, a suitable reference test method, providing the precision data, is not available for all determinations. For the tests, that have no available precision data, the calculated reproducibility was compared against the reproducibility estimated from the Horwitz equation.

Acid Wash Color: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in good agreement with the requirements of ASTM D848:14.

Acidity: This determination was not problematic. The majority of laboratories report “no free acid” (NFA) or “Pass” in accordance with ASTM D847:15.

Appearance: No analytical problems were observed. All labs agreed about the appearance of the sample, which was bright, clear and free of suspended matter (Pass).

Bromine Index: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of ASTM D5776:14a.

Chlorides, Total: This determination was not problematic. No statistical outliers were observed, but one test result was excluded. The calculated reproducibility after rejection of the suspect data is in full agreement with the requirements of ASTM D5194:18.

Chlorides, Organic: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in good agreement with the requirements of ASTM D5808:18.

Color Pt/Co: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in full agreement with the requirements of ASTM D5386:16 and ASTM D1209:05(2011).

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

Distillation: This determination was problematic for a number of laboratories. In total nine statistical outliers were observed and four test results were excluded. However, all calculated reproducibilities after rejection of the suspect data are in agreement with the requirements of ASTM D850-A:18.

From the reported results of the 50% recovered, it appears that four participants possibly did not correct the results for barometric pressure and thermometer inaccuracy as described in ASTM D850 (paragraph 11).

Total Nitrogen: 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 D7184:15.

GC General: ASTM D4492 was withdrawn in 2018 and replaced by ASTM D7504:18. Test method ASTM D7504 was used to evaluate the GC parameters.

Purity: This determination was not problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is in good agreement with the requirements of ASTM D7504:18.

Methylcyclohexane: This determination may be problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is not agreement with the estimated reproducibility calculated using the Horwitz equation.

Nonaromatics: This determination was not problematic. One statistical outlier was observed. However, the calculated reproducibility after rejection of the statistical outlier is in agreement with the requirements of ASTM D7504:18.

Toluene: All reporting participants agreed that the sample was not positive for Toluene (<10 mg/kg).

1,4-Dioxane: All reporting participants agreed that the sample was not positive for 1,4-Dioxane (<10 mg/kg).

Solidification Point: This determination was not problematic. Two statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers is in full agreement with the requirements of ASTM D852:16.

Sulfur: This determination was not problematic. One statistical outlier was observed. However, the calculated reproducibility after rejection of the statistical outlier is in agreement with the requirements of ASTM D5453:16e1.

Thiophene: All reporting participants agreed that the sample was not positive for Thiophene (<1 mg/kg).

Water: 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 E1064:16.

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. The number of significant test results, the average result, the calculated reproducibility (2.8 * standard deviation) and the target reproducibility derived from literature reference test methods (in casu ASTM, EN or ISO test methods) are presented in the next table.

Parameter	unit	n	average	2.8 * sd	R (lit)
Acid Wash Color		34	0.7 (1-)	0.5	2.0
Acidity	mg NaOH/100mL	35	No free acid	n.a.	n.a.
Appearance		45	Pass (C&B)	n.a.	n.a.
Bromine Index	mg Br/100g	30	1.4	2.3	4.6
Chlorides, Total	mg/kg	12	0.9	0.9	0.9
Chlorides, Organic	mg/kg	16	1.0	0.4	1.3
Color Pt/Co		36	7.6	5.1	5.8
Density at 20°C	kg/L	46	0.8790	0.0002	0.0005
Distillation, IBP	°C	28	79.8	0.2	0.6
Distillation, 50% rec.	°C	29	80.1	0.1	0.2
Distillation, DP	°C	29	80.2	0.2	0.5
Total Nitrogen	mg/kg	21	0.25	0.27	0.23
Purity	%M/M	45	99.991	0.005	0.025
Methylcyclohexane	mg/kg	27	9.0	3.7	2.9
Nonaromatics	mg/kg	44	73.9	29.0	60.0
Toluene	mg/kg	46	<10	n.a.	n.a.
1,4-Dioxane	mg/kg	24	<10	n.a.	n.a.
Solidification Point	°C	22	5.49	0.04	0.05
Sulfur	mg/kg	25	0.29	0.25	0.23
Thiophene	mg/kg	10	<1	n.a.	n.a.
Water	mg/kg	35	151	30	26

Table 3: reproducibilities of tests on sample #19020

Without further statistical calculations, it can be concluded that for most of the tests there is a good compliance of the group of participating laboratories 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 FEBRUARY 2019 WITH PREVIOUS PTS

	February 2019	March 2018	March 2017	March 2016	February 2015
Number of reporting labs	50	51	67	59	51
Number of test results	532	545	743	793	729
Number of statistical outliers	17	24	32	19	15
Percentage outliers	3.2%	4.4%	4.3%	2.4%	2.1%

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 against the requirements of the respective reference test methods. The conclusions are given in the following tables:

	February 2019	March 2018	March 2017	March 2016	February 2015
Acid Wash Color	++	++	++	++	++
Bromine Index	++	++	++	++	+
Chlorides, Total	+/-	-	+/-	+	+
Chlorides, Organic	++	++	+	++	++
Color Pt/Co	+	++	++	++	++
Density at 20°C	++	++	++	++	++
Distillation	++	++	++	++	++
Total Nitrogen	-	+	+/-	--	-
Purity	++	-	+/-	-	+/-
Methylcyclohexane	-	--	+/-	+/-	n.e.
Nonaromatics	++	-	-	+/-	-
Toluene	n.e.	++	++	++	+
1,4-Dioxane	n.e.	n.e.	n.e.	n.e.	n.e.
Solidification Point	+	+/-	+	+/-	+/-
Sulfur	+/-	+/-	n.e.	n.e.	n.e.
Thiophene	n.e.	n.e.	n.e.	n.e.	n.e.
Water	-	n.e.	n.e.	n.e.	n.e.

Table 5: comparison determinations against the 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

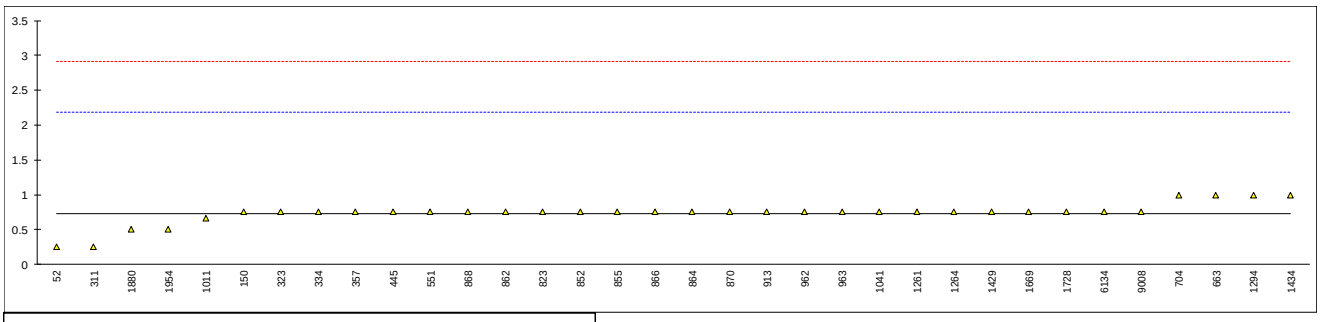
APPENDIX 1

Determination of Acid Wash Color (acid layer) on sample #19020;

lab	method	value	mark	z(targ)	remarks
52	D848	0+		-0.66	
150	D848	1-		0.02	
311	D848	0+		-0.66	
317		-----		-----	
323	D848	-1		0.02	
334	D848	1-		0.02	
347		-----		-----	
357	D848	1-		0.02	
444		-----		-----	
445	D848	1-		0.02	
551	D848	1-		0.02	
555		-----		-----	
663	D848	No. 1		0.37	
704	D848	1		0.37	
823	D848	1-		0.02	
852	D848	No.1-		0.02	
855	D848	NO1-		0.02	
862	D848	NO.1-		0.02	
864	D848	No.1-		0.02	
866	D848	NO.1-		0.02	
868	D848	No.1-		0.02	
870	D848	No.1-		0.02	
912		-----		-----	
913	D848	1-		0.02	
962	D848	1-		0.02	
963	D848	1-		0.02	
1011	D848	0.67		-0.09	
1040		-----		-----	
1041	D848	1-		0.02	
1069		-----		-----	
1081		-----		-----	
1117		-----		-----	
1151		-----		-----	
1261	D848	1-		0.02	
1264	D848	1-		0.02	
1294	D848	1		0.37	
1320		-----		-----	
1429	D848	1-		0.02	
1434	D848	1		0.37	
1467		-----		-----	
1530		-----		-----	
1669	D848	-1		0.02	
1728	D848	1-		0.02	
1812		-----		-----	
1823		-----		-----	
1880	D848	<1		-0.32	
1954	D848	<1		-0.32	
6134	D848	-1		0.02	
6198		-----		-----	
6203		-----		-----	
9008	D848	1-		0.02	

normality	not OK
n	34
outliers	0
mean (n)	0.73 (1-)
st.dev. (n)	0.163
R(calc.)	0.46
st.dev.(D848:14)	0.728
R(D848:14)	2.04

*) 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).


3.5
3
2.5
2
1.5
1
0.5
0
52
311
1880
1954
1011
150
323
334
357
445
551
868
862
823
852
855
866
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1728
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9008
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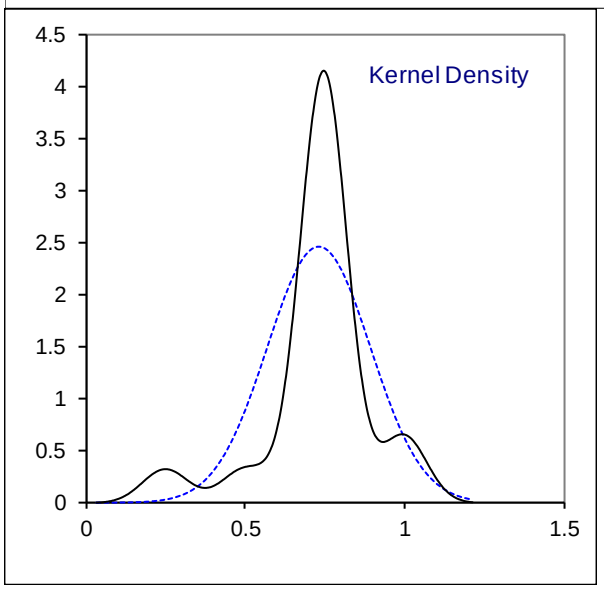
Kernel Density
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4
3.5
3
2.5
2
1.5
1
0.5
0
0
0.5
1
1.5

Determination of Acidity on sample #19020; results in mg NaOH/100mL

lab	method	value	mark	z(targ)	remarks
52	D847	Pass		-----	
150	D847	No Free Acid		-----	
311	D847	pass		-----	
317		-----		-----	
323	D847	no free acid		-----	
334	D847	Pass		-----	
347	D847	Pass		-----	
357	D847	No free acid		-----	
444		-----		-----	
445	D847	No free acid		-----	
551		-----		-----	
555		-----		-----	
663	D847	Pass		-----	
704	D847	Pass		-----	
823	D847	no free acid		-----	
852	D847	No Free Acid		-----	
855	D847	No Free Acid		-----	
862	D847	No free acid		-----	
864	D847	No Free Acid		-----	
866	D847	No Free Acid		-----	
868	D847	PASS		-----	
870	D847	No Free Acid		-----	
912	D847	No free Acid		-----	
913	D847	No free acid		-----	
962	D847	No free acid		-----	
963	D847	No Free Acid		-----	
1011	D847	Pass		-----	
1040		-----		-----	
1041		-----		-----	
1069		-----		-----	
1081	D847	pass		-----	
1117	D847	0.12		-----	
1151		-----		-----	
1261	D847	NFA		-----	
1264	D847	No Free Acid		-----	
1294	D847	0		-----	
1320		-----		-----	
1429		-----		-----	
1434	D847	negative		-----	
1467		-----		-----	
1530		-----		-----	
1669		-----		-----	
1728	D847	ABSENT		-----	
1812		-----		-----	
1823	D847	Pass		-----	
1880	D847	NFA		-----	
1954	D847	ND		-----	
6134	D847	NFA		-----	
6198		-----		-----	
6203		-----		-----	
9008	D847	NFA		-----	
	n	35			
	Mean (n)	No free acid (Pass)			

Abbreviation
NFA = No free acid

Determination of Appearance on sample #19020;

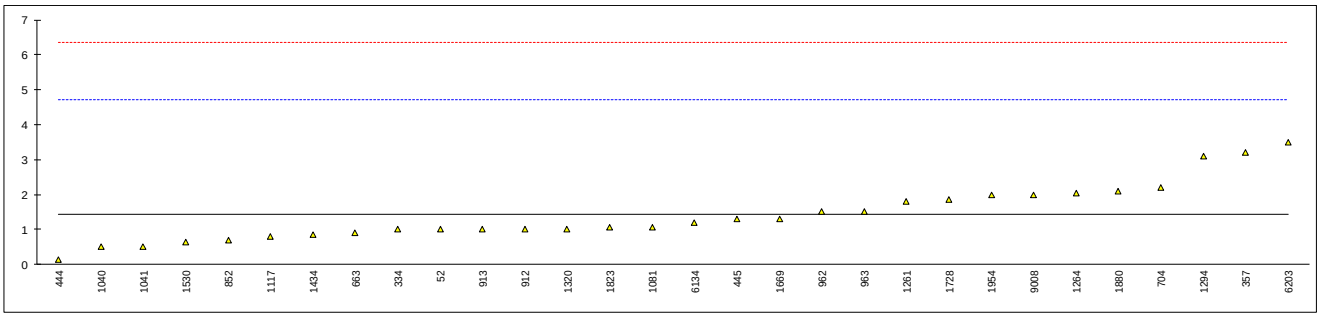
lab	method	value	mark	z(targ)	remarks
52	E2680	Pass		-----	
150	E2680	C & B		-----	
311	E2680	pass		-----	
317	D4176	pass		-----	
323	E2680	pass		-----	
334	EN15769	clear&bright ffsm		-----	
347	E2680	Pass		-----	
357	D4176	Pass		-----	
444	E2680	Pass		-----	
445	D4176	CFFSM		-----	
551	Visual	PASS		-----	
555		-----		-----	
663	Visual	Bright & Clear		-----	
704	E2680	Pass		-----	
823	E2680	Pass		-----	
852	Visual	Pass		-----	
855	E2680	PASS		-----	
862	E2680	Pass		-----	
864	D4176	Pass		-----	
866	E2680	Pass		-----	
868	E2680	PASS		-----	
870	E2680	Pass		-----	
912	E2680	Pass		-----	
913	E2680	Pass		-----	
962	D4176	Clear & Bright		-----	
963	E2680	Pass		-----	
1011	Visual	Bright and Clear		-----	
1040	Visual	Clear and bright		-----	
1041	Visual	CFSM		-----	
1069		-----		-----	
1081	In house	B/C		-----	
1117	D4176	Pass		-----	
1151		-----		-----	
1261	Visual	Clear and Bright		-----	
1264	Visual	Clear & Bright		-----	
1294	Visual	Clear		-----	
1320		-----		-----	
1429	E2680	Clear and Bright		-----	
1434	Visual	Clear Liq		-----	
1467	Visual	Clear		-----	
1530	Visual	c & b		-----	
1669	Visual	Claro y Brillante		-----	
1728	Visual	CLEAR		-----	
1812		-----		-----	
1823	D4176	Pass		-----	
1880	Visual	Pass		-----	
1954	Visual	Clear colorless liquid		-----	
6134	Visual	PASS		-----	
6198	D4176	Pass		-----	
6203		-----		-----	
9008	Visual	Clear Liquid		-----	
	n	45			
	Mean (n)	Pass (Clear & Bright)			

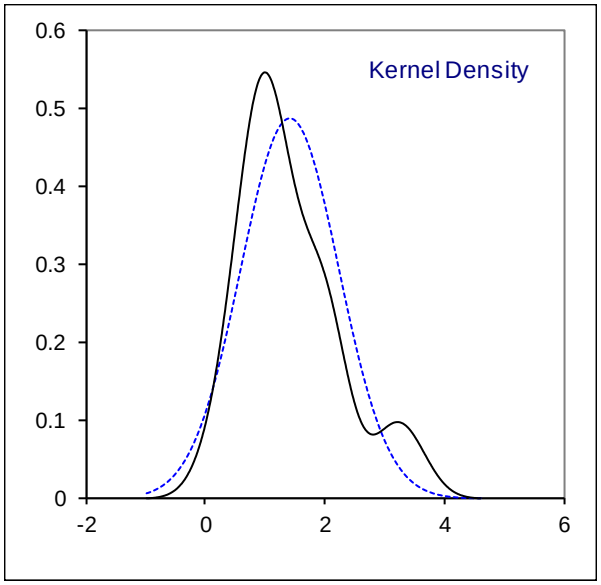
Abbreviation
C&B = Clear and Bright
CFSM/CFFSM = Clear and Free from suspended matter

Determination of Bromine Index on sample #19020; results in mg Br/100g

lab	method	value	mark	z(targ)	remarks
52	D1492	1.0		-0.26	
150		-----		-----	
311	D5776	<0.5		-----	
317	D5776	<0.5		-----	
323	D5776	<0.5		-----	
334	D5776	1.0		-0.26	
347		-----		-----	
357	D5776	3.2		1.08	
444	D5776	0.146		-0.78	
445	D1492	1.3		-0.08	
551		-----		-----	
555		-----		-----	
663	D5776	0.90		-0.32	
704	D5776	2.2		0.47	
823		-----		-----	
852	D5776	0.7		-0.44	
855	D5776	<0.5		-----	
862	D5776	<1		-----	
864	D5776	<0.5		-----	
866	D5776	<1		-----	
868	D5776	<10		-----	
870	D5776	<0.5		-----	
912	D1492	1		-0.26	
913	D5776	1.0		-0.26	
962	D1492	1.5		0.05	
963	D1492	1.50		0.05	
1011	D5776	< 1		-----	
1040	D5776	0.5		-0.56	
1041	DIN51774	0.5		-0.56	
1069		-----		-----	
1081	D1492	1.07558		-0.21	
1117	D1492	0.8		-0.38	
1151		-----		-----	
1261	D1492	1.8		0.23	
1264	D1492	2.05		0.38	
1294	D1492	3.10		1.02	
1320	D2710	1		-0.26	
1429	D2710	<1	C	-----	First reported 2.3
1434	D5776	0.85		-0.35	
1467		-----		-----	
1530	DIN51774	0.63		-0.48	
1669	D5776	1.3	C	-0.08	First reported 9.0
1728	D5776	1.85		0.26	
1812		-----		-----	
1823	D1492	1.07		-0.22	
1880	D1492	2.1		0.41	
1954	D2710	2.00		0.35	
6134	D5776	1.20		-0.14	
6198		-----		-----	
6203	D5776	3.5		1.26	
9008	D1492	2.0		0.35	

normality	suspect
n	30
outliers	0
mean (n)	1.426
st.dev. (n)	0.8187
R(calc.)	2.292
st.dev.(D5776:14a)	1.6429
R(D5776:14a)	4.6

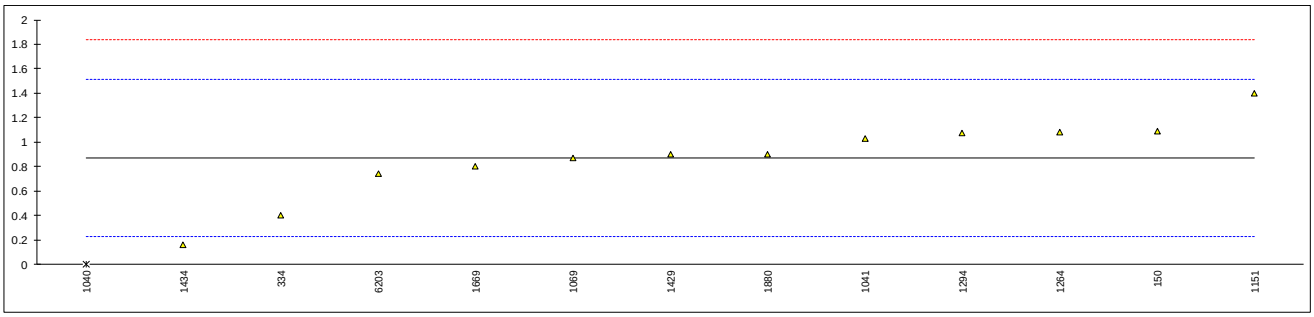

7
6
5
4
3
2
1
0
444
1040
1041
1530
852
1117
1434
663
334
52
913
912
1320
1823
1081
6134
445
1669
962
963
1261
1728
1954
9008
1264
1880
704
1294
357
6203

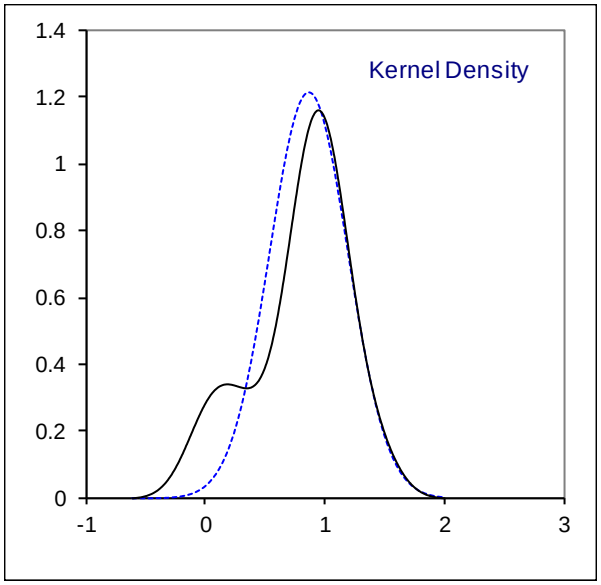

Kernel Density
0.6
0.5
0.4
0.3
0.2
0.1
0
-2
0
2
4
6

Determination of Chlorides, Total on sample #19020; results in mg/kg

lab	method	value	mark	z(targ)	remarks
52	D5194	<1		-----	
150	D7359	1.09		0.68	
311		-----		-----	
317		-----		-----	
323		-----		-----	
334	UOP588	0.4		-1.46	
347		-----		-----	
357		-----		-----	
444		-----		-----	
445		-----		-----	
551		-----		-----	
555		-----		-----	
663		-----		-----	
704	UOP588	< 1		-----	
823		-----		-----	
852		-----		-----	
855		-----		-----	
862		-----		-----	
864		-----		-----	
866		-----		-----	
868		-----		-----	
870		-----		-----	
912		-----		-----	
913		-----		-----	
962		-----		-----	
963		-----		-----	
1011		-----		-----	
1040	EN14077	0	ex	-2.71	Test result excluded as zero is not a real result
1041	D7536	1.03		0.50	
1069		0.87		0.00	
1081		-----		-----	
1117		-----		-----	
1151	D7359	1.4		1.65	
1261		-----		-----	
1264	D5194	1.08		0.65	
1294		1.072		0.63	
1320		-----		-----	
1429	D7359	0.9		0.09	
1434	D7536	0.16		-2.21	
1467		-----		-----	
1530		-----		-----	
1669	UOP779	0.8		-0.22	
1728		-----		-----	
1812		-----		-----	
1823		-----		-----	
1880	D7359	0.90		0.09	
1954		-----		-----	
6134		-----		-----	
6198		-----		-----	
6203	D5808	0.74		-0.40	
9008		-----		-----	

normality	suspect
n	12
outliers	0 (+1 excl)
mean (n)	0.870
st.dev. (n)	0.3287
R(calc.)	0.920
st.dev.(D5194:18)	0.3214
R(D5194:18)	0.9

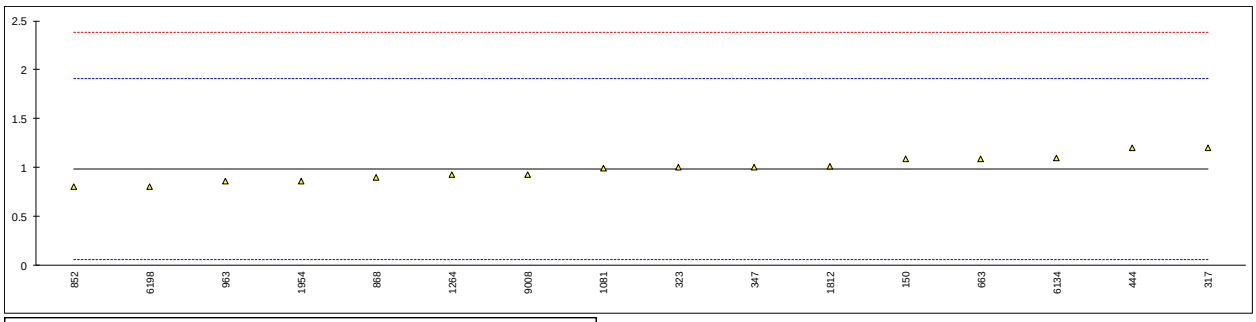

2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1040
1434
334
6203
1669
1069
1429
1880
1041
1294
1264
150
1151

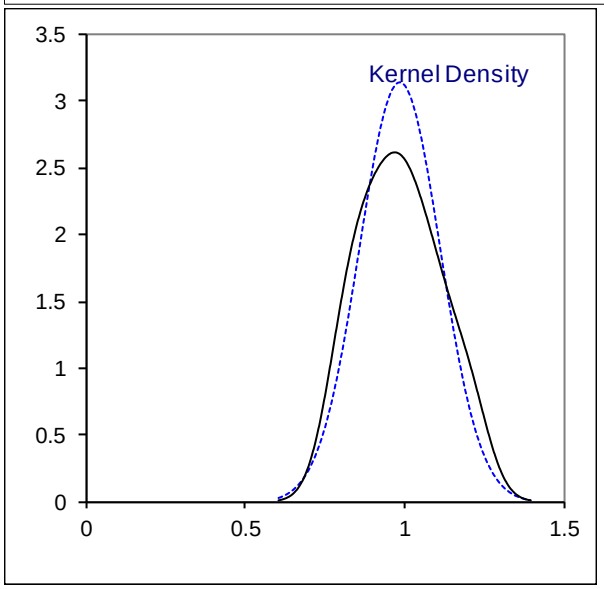

Kernel Density
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-1
0
1
2
3

Determination of Chlorides, Organic on sample #19020; results in mg/kg

lab	method	value	mark	z(targ)	remarks
52		-----		-----	
150	D7359	1.09		0.23	
311	D5808	<1		-----	
317	UOP779	1.2		0.46	
323	D5808	1		0.03	
334		-----		-----	
347	D4929B	1.0		0.03	
357		-----		-----	
444	IP510	1.2		0.46	
445	IP510	<2		-----	
551	D5808	<1		-----	
555		-----		-----	
663	D5808	1.09		0.23	
704	UOP588	<1		-----	
823	D5808	<0.2		-----	
852	D5808	0.8		-0.40	
855	D5808	<1		-----	
862	D5808	<1		-----	
864	D5808	<1		-----	
866		-----		-----	
868	D5808	0.9		-0.18	
870	D5808	<1		-----	
912	D5808	<1		-----	
913		-----		-----	
962		-----		-----	
963	D5808	0.86		-0.27	
1011		-----		-----	
1040		-----		-----	
1041		-----		-----	
1069		-----		-----	
1081	D5808	0.99		0.01	
1117		-----		-----	
1151		-----		-----	
1261		-----		-----	
1264	D5808	0.93		-0.12	
1294		-----		-----	
1320		-----		-----	
1429		-----		-----	
1434		-----		-----	
1467		-----		-----	
1530		-----		-----	
1669		-----		-----	
1728		-----		-----	
1812		1.01		0.05	
1823		-----		-----	
1880		-----		-----	
1954	D5808	0.86		-0.27	
6134	D5808	1.10		0.25	
6198	D5808	0.8		-0.40	
6203		-----		-----	
9008	D5808	0.93		-0.12	

normality	OK
n	16
outliers	0
mean (n)	0.985
st.dev. (n)	0.1270
R(calc.)	0.356
st.dev.(D5808:18)	0.4643
R(D5808:18)	1.3

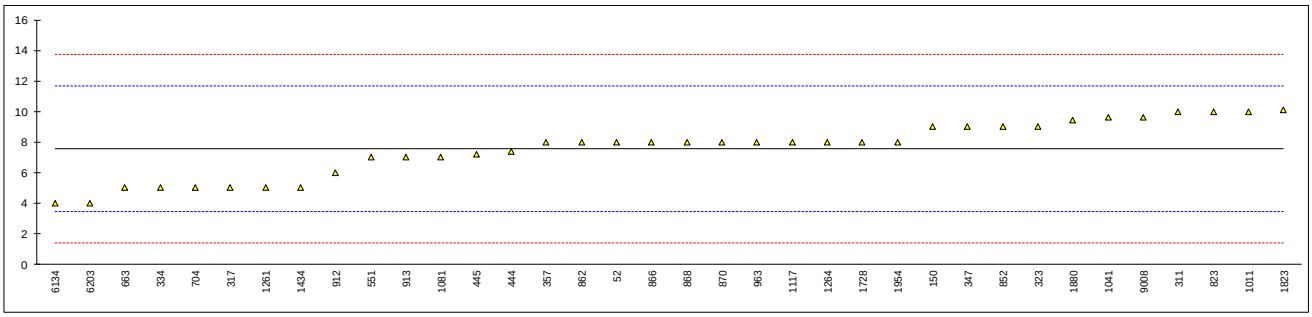

2.5
2
1.5
1
0.5
0
852
6198
963
1954
868
1264
9008
1081
323
347
1812
150
663
6134
444
317

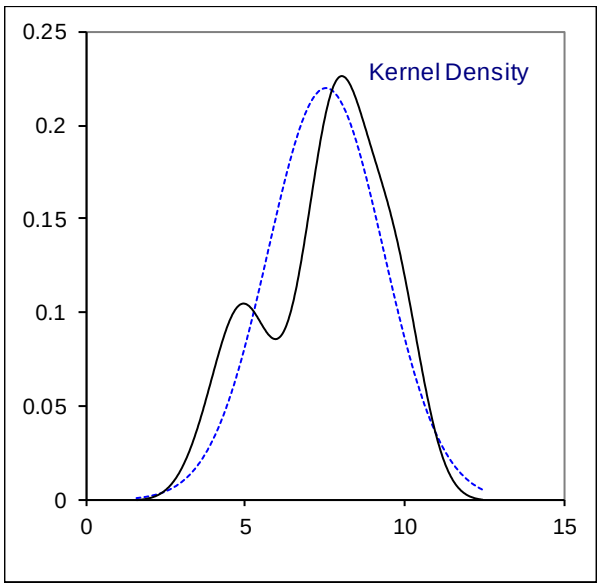

Kernel Density
3.5
3
2.5
2
1.5
1
0.5
0
0
0.5
1
1.5

Determination of Color Pt/Co on sample #19020;

lab	method	value	mark	z(targ)	remarks
52	D5386	8		0.21	
150	D5386	9		0.70	
311	D1209	10		1.18	
317	D1209	5		-1.24	
323	D5386	9		0.70	
334	D1209	5		-1.24	
347	D5386	9.0		0.70	
357	D5386	8		0.21	
444	D5386	7.4		-0.08	
445	D1209	7.2		-0.18	
551	D5386	7		-0.27	
555		-----		-----	
663	D1209	5		-1.24	
704	D1209	5		-1.24	
823	D5386	10		1.18	
852	D5386	9		0.70	
855	D1209	<10		-----	
862	D1209	8		0.21	
864	D1209	<10		-----	
866	D1209	8		0.21	
868	D5386	8		0.21	
870	D1209	8		0.21	
912	D5386	6		-0.76	
913	D5386	7		-0.27	
962		-----		-----	
963	D5386	8		0.21	
1011	D1209	10		1.18	
1040	ISO6271	<5		-----	
1041	ISO6271	9.6		0.99	
1069		-----		-----	
1081	D5386	7		-0.27	
1117	D1209	8		0.21	
1151		-----		-----	
1261	D1209	5		-1.24	
1264	D1209	8		0.21	
1294	D1209	<20		-----	
1320		-----		-----	
1429	D1209	Less than 5		-----	
1434	D1209	5		-1.24	
1467		-----		-----	
1530	D1209	< 3		-----	
1669		-----		-----	
1728	D1209	8		0.21	
1812		-----		-----	
1823	D5386	10.1		1.23	
1880	D5386	9.43		0.91	
1954	D1209	8		0.21	
6134	D1209	4.0		-1.73	
6198		-----		-----	
6203	D1209	4.0		-1.73	
9008	D5386	9.6		0.99	

	normality	OK
	n	36
	outliers	0
	mean (n)	7.56
	st.dev. (n)	1.811
	R(calc.)	5.07
	st.dev.(D5386:16)	2.061
	R(D5386:16)	5.77
Compare		
	R(D1209:05)	7

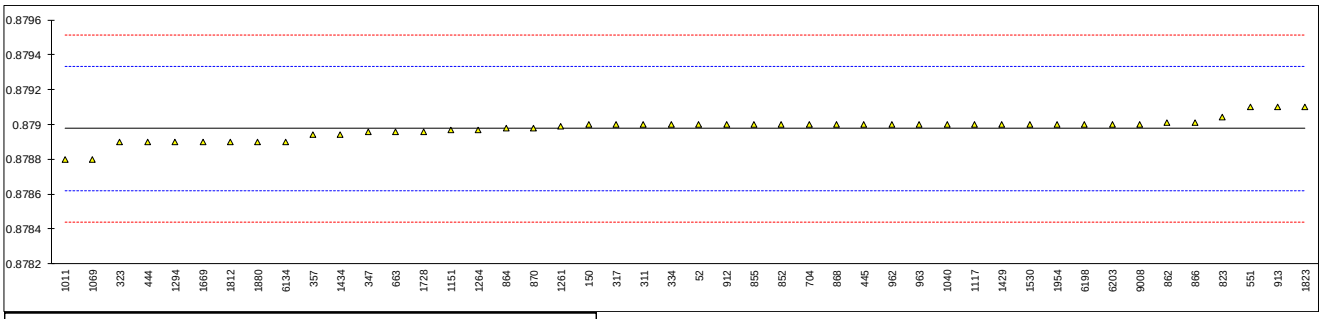

16
14
12
10
8
6
4
2
0
6134
6203
663
334
704
317
1261
1434
912
551
913
1081
445
444
357
862
52
866
868
870
963
1117
1264
1728
1954
150
347
852
323
1880
1041
9008
311
823
1011
1823

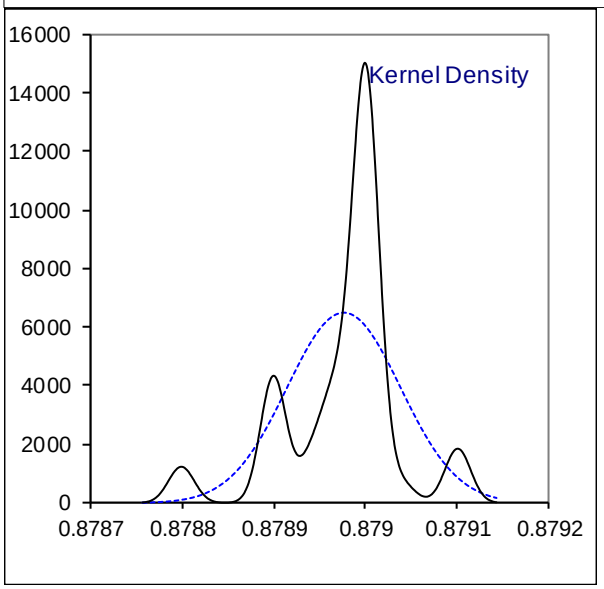

Kernel Density
0.25
0.2
0.15
0.1
0.05
0
0
5
10
15

Determination of Density at 20°C on sample #19020; results in kg/L

lab	method	value	mark	z(targ)	remarks
52	D4052	0.8790	C	0.13	First reported 0.8668
150	D4052	0.8790		0.13	
311	D4052	0.8790		0.13	
317	ISO12185	0.8790		0.13	
323	D4052	0.8789		-0.43	
334	ISO12185	0.8790		0.13	
347	D4052	0.87896		-0.09	
357	D4052	0.87894		-0.20	
444	D4052	0.8789		-0.43	
445	D4052	0.8790		0.13	
551	D4052	0.8791		0.69	
555		-----		-----	
663	D4052	0.87896		-0.09	
704	ISO12185	0.87900		0.13	
823	D4052	0.87904		0.36	
852	GB/T2013	0.8790		0.13	
855	D4052	0.8790		0.13	
862	D4052	0.87901		0.19	
864	D4052	0.87898		0.02	
866	D4052	0.87901		0.19	
868	D4052	0.87900		0.13	
870	D4052	0.87898		0.02	
912	D4052	0.87900		0.13	
913	D4052	0.8791		0.69	
962	D4052	0.8790		0.13	
963	ISO12185	0.8790		0.13	
1011	D4052	0.8788		-0.99	
1040	ISO12185	0.8790		0.13	
1041		-----		-----	
1069		0.8788		-0.99	
1081		-----		-----	
1117	D4052	0.8790		0.13	
1151	D4052	0.87897		-0.04	
1261	D4052	0.87899		0.08	
1264	D4052	0.87897		-0.04	
1294	D4052	0.8789		-0.43	
1320		-----		-----	
1429	D4052	0.8790		0.13	
1434	D4052	0.87894		-0.20	
1467		-----		-----	
1530	ISO12185	0.8790		0.13	
1669	D4052	0.8789		-0.43	
1728	ISO12185	0.87896		-0.09	
1812	ISO12185	0.8789	C	-0.43	First reported as Color Pt/Co
1823	D4052	0.8791	C	0.69	First reported 0.8971
1880	D4052	0.8789		-0.43	
1954	D4052	0.8790		0.13	
6134	D4052	0.8789		-0.43	
6198	D4052	0.8790		0.13	
6203	ISO12185	0.879		0.13	
9008	D4052	0.8790		0.13	

normality	OK
n	46
outliers	0
mean (n)	0.87898
st.dev. (n)	0.000062
R(calc.)	0.00017
st.dev.(ISO12185:96)	0.000179
R(ISO12185:96)	0.0005


0.8796
0.8794
0.8792
0.879
0.8788
0.8786
0.8784
0.8782
1011 1069 323 444 1294 1669 1812 1880 6134 357 1434 347 663 1728 1151 1264 864 870 1261 150 317 311 334 52 912 855 852 704 868 445 962 963 1040 1117 1429 1530 1954 6198 6203 9008 862 866 823 551 913 1823

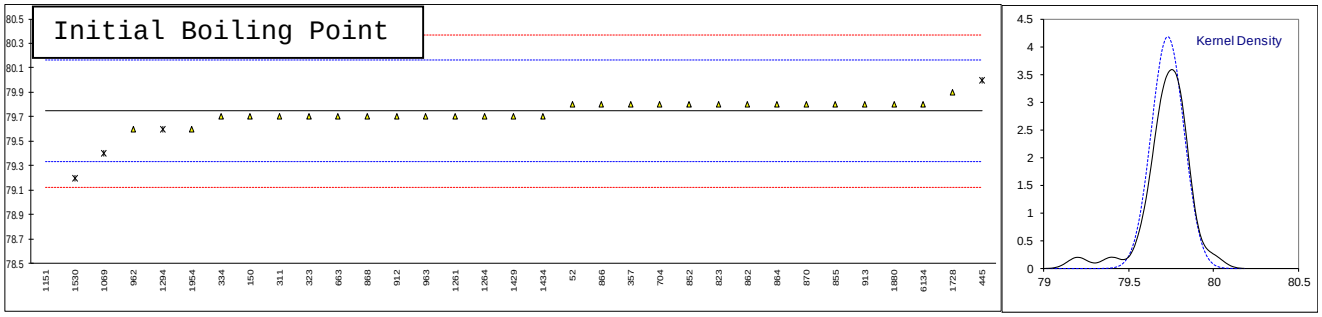

Kernel Density
16000
14000
12000
10000
8000
6000
4000
2000
0
0.8787 0.8788 0.8789 0.879 0.8791 0.8792

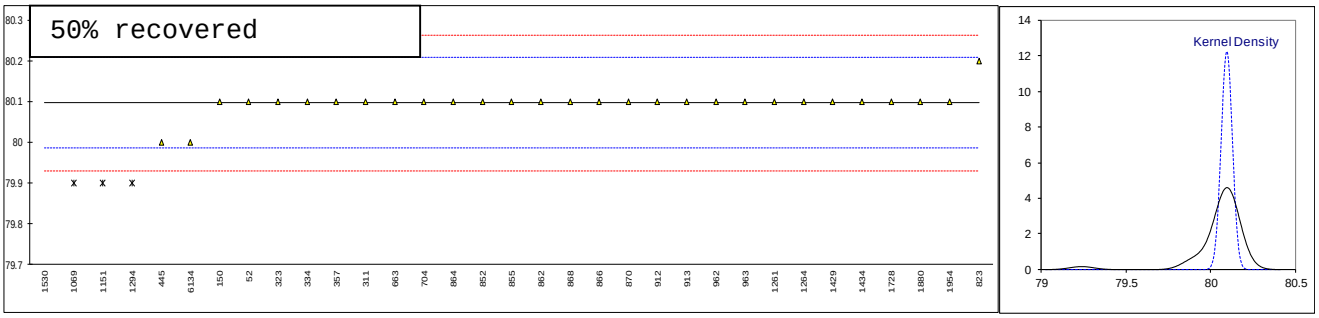
Determination of Distillation on sample #19020; results in °C

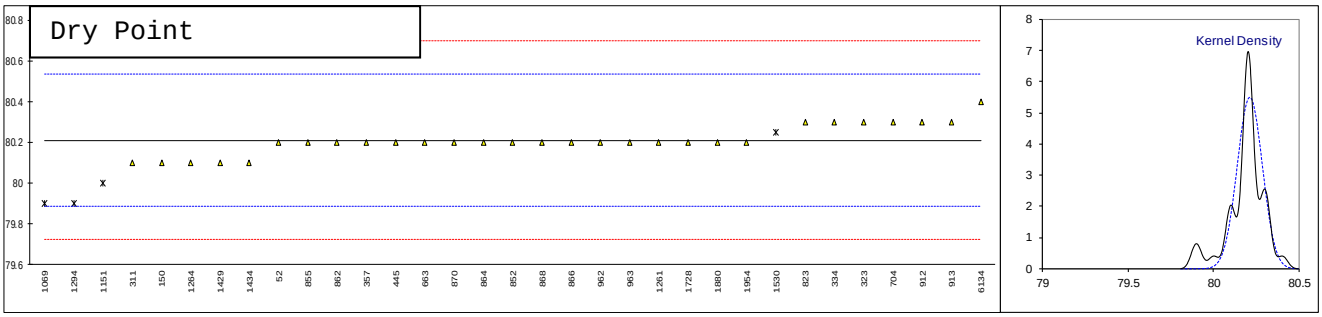
lab	method	IBP	mark	z(targ)	50%	mark	z(targ)	DP	mark	z(targ)	range	mark
52	D850-automated	79.8		0.26	80.1		0.06	80.2		-0.06	0.4	
150	D850-automated	79.7		-0.22	80.1		0.06	80.1		-0.68	0.4	
311	D850-automated	79.7		-0.22	80.1		0.06	80.1		-0.68	0.4	
317		-----		-----	-----		-----	-----		-----	-----	
323	D850-automated	79.7		-0.22	80.1		0.06	80.3		0.55	0.6	
334	D850-automated	79.7	C	-0.22	80.1	C	0.06	80.3	C	0.55	< 110	
347		-----		-----	-----		-----	-----		-----	-----	
357	D850-automated	79.8		0.26	80.1		0.06	80.2		-0.06	0.4	
444		-----		-----	-----		-----	-----		-----	-----	
445	D850-manual	80.0	R(0.01)	1.22	80.0		-1.73	80.2		-0.06	0.2	
551		-----		-----	-----		-----	-----		-----	-----	
555		-----		-----	-----		-----	-----		-----	-----	
663	D850-automated	79.7		-0.22	80.1		0.06	80.2		-0.06	0.5	
704	D850-manual	79.8		0.26	80.1		0.06	80.3		0.55	0.5	
823	D850-automated	79.8		0.26	80.2		1.86	80.3		0.55	0.5	
852	D850-manual	79.8		0.26	80.1		0.06	80.2		-0.06	0.4	
855	D850-manual	79.8		0.26	80.1		0.06	80.2		-0.06	0.4	
862	D850-manual	79.8		0.26	80.1		0.06	80.2		-0.06	0.4	
864	D850-automated	79.8		0.26	80.1		0.06	80.2		-0.06	0.4	
866	D850-manual	79.8		0.26	80.1		0.06	80.2		-0.06	0.4	
868	D850-manual	79.7		-0.22	80.1		0.06	80.2		-0.06	0.5	
870	D850-manual	79.8		0.26	80.1		0.06	80.2		-0.06	0.4	
912	D1078	79.7		-0.22	80.1		0.06	80.3		0.55	0.6	
913	D850-manual	79.8		0.26	80.1		0.06	80.3		0.55	0.5	
962	D850-automated	79.6		-0.71	80.1		0.06	80.2		-0.06	0.6	
963	D850-automated	79.7		-0.22	80.1		0.06	80.2		-0.06	0.5	
1011		-----		-----	-----		-----	-----		-----	-----	
1040		-----		-----	-----		-----	-----		-----	-----	
1041		-----		-----	-----		-----	-----		-----	-----	
1069	D850-automated	79.4	ex	-1.67	79.9	R(0.05)	-3.53	79.9	R(0.05)	-1.91	0.6	
1081		-----		-----	-----		-----	-----		-----	-----	
1117		-----		-----	-----		-----	-----		-----	-----	
1151	D1078	75.45	R(0.01)	-20.71	79.9	R(0.05)	-3.53	80.0	ex	-1.29	0.1	
1261	D850-automated	79.7		-0.22	80.1		0.06	80.2		-0.06	-----	
1264	D850-automated	79.7		-0.22	80.1		0.06	80.1		-0.68	0.4	
1294	D850-automated	79.6	ex	-0.71	79.9	R(0.05)	-3.53	79.9	R(0.05)	-1.91	0.40	
1320		-----		-----	-----		-----	-----		-----	-----	
1429	D850-automated	79.7		-0.22	80.1		0.06	80.1		-0.68	0.4	
1434	D850-automated	79.7		-0.22	80.1		0.06	80.1		-0.68	0.4	
1467		-----		-----	-----		-----	-----		-----	-----	
1530	D850-manual	79.20	R(0.01)	-2.63	79.24	R(0.01)	-15.37	80.25	ex	0.24	1.1	
1669		-----		-----	-----		-----	-----		-----	-----	
1728	D850-manual	79.9		0.74	80.1		0.06	80.2		-0.06	0.3	
1812		-----		-----	-----		-----	-----		-----	-----	
1823		-----		-----	-----		-----	-----		-----	-----	
1880	D850-automated	79.8		0.26	80.1		0.06	80.2		-0.06	0.4	
1954	D850-automated	79.6		-0.71	80.1		0.06	80.2		-0.06	0.6	
6134	D850-manual	79.8		0.26	80.0		-1.73	80.4		1.16	0.6	
6198		-----		-----	-----		-----	-----		-----	-----	
6203		-----		-----	-----		-----	-----		-----	-----	
9008		-----		-----	-----		-----	-----		-----	-----	
	normality	OK			not OK			OK				
	n	28			29			29				
	outliers	3 (+2excl)			4			2 (+2excl)				
	mean (n)	79.75			80.10			80.21				
	st.dev. (n)	0.069			0.033			0.072				
	R(calc.)	0.19			0.09			0.20				
	st.dev.(D850-A:18)	0.208			0.056			0.163				
	R(D850-A:18) *)	0.58			0.16			0.46				
Compare												
	R(D850-M:18)	0.41			0.65			0.65				

Lab 334: first reported 79.1, 79.7 and 79.7 respectively

ex = test result excluded as the other reported test results are statistical outliers.
*) precision data of Toluene is used


Initial Boiling Point
Kernel Density


50% recovered
Kernel Density

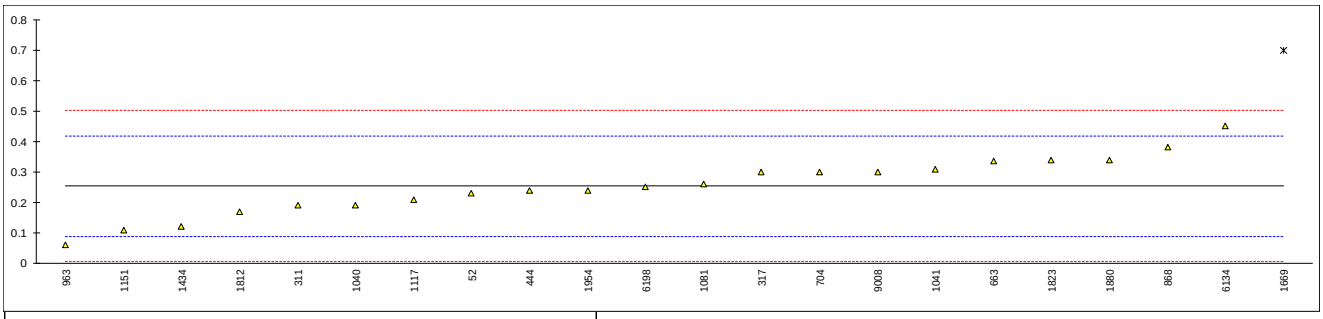

Dry Point
Kernel Density

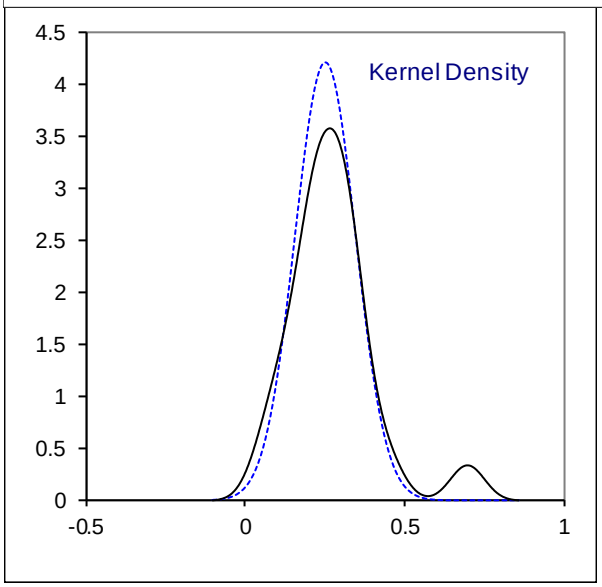
Determination of Total Nitrogen on sample #19020; results in mg/kg

lab	method	value	mark	z(targ)	remarks
52	D7184	0.23		-0.29	
150		-----		-----	
311	D7184	0.19		-0.77	
317	D4629	0.3		0.56	
323	D6069	<1.0		-----	
334	D4629	<0.3		-----	
347	D4629	<1		-----	
357		-----		-----	
444	D4629	0.24		-0.17	
445	D4629	<1		-----	
551		-----		-----	
555		-----		-----	
663	D4629	0.337		1.01	
704	D4629	0.3		0.56	
823		-----		-----	
852		-----		-----	
855		-----		-----	
862		-----		-----	
864	D4629	<1		-----	
866		-----		-----	
868	D4629	0.38		1.53	
870		-----		-----	
912		-----		-----	
913		-----		-----	
962		-----		-----	
963	D7184	0.06		-2.34	
1011		-----		-----	
1040	D7184	0.19		-0.77	
1041	D6069	0.31		0.68	
1069		-----		-----	
1081	D6069	0.26		0.08	
1117	D7184	0.21		-0.53	
1151	D4629	0.11		-1.74	
1261		-----		-----	
1264	D7184	<0.1[ND]		-----	
1294	D6069	<0.10		-----	
1320		-----		-----	
1429		-----		-----	
1434	D7184	0.12		-1.62	
1467		-----		-----	
1530	D6069	< 0,5		-----	
1669	D4629	0.7	R(0.01)	5.40	
1728		-----		-----	
1812	D6069	0.17		-1.01	
1823	D6069	0.34		1.05	
1880	D6069	0.34		1.05	
1954	D4629	0.24		-0.17	
6134	D7184	0.45		2.38	
6198	D4629	0.25		-0.04	
6203	D4629	<0.3		-----	
9008	D6069	0.3		0.56	

	normality	OK	
	n	21	
	outliers	1	
	mean (n)	0.254	
	st.dev. (n)	0.0949	
	R(calc.)	0.266	
	st.dev.(D7184:15)	0.0826	
	R(D7184:15) *)	0.231	Application range D7184:15: 0.1 – 1.2 mg/kg

Precision data of all aromatics are used to create a linear fit over range of 0.1 – 1.2 mg/kg


0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
963
1151
1434
1812
311
1040
1117
52
444
1954
6198
1081
317
704
9008
1041
663
1823
1880
868
6134
1669

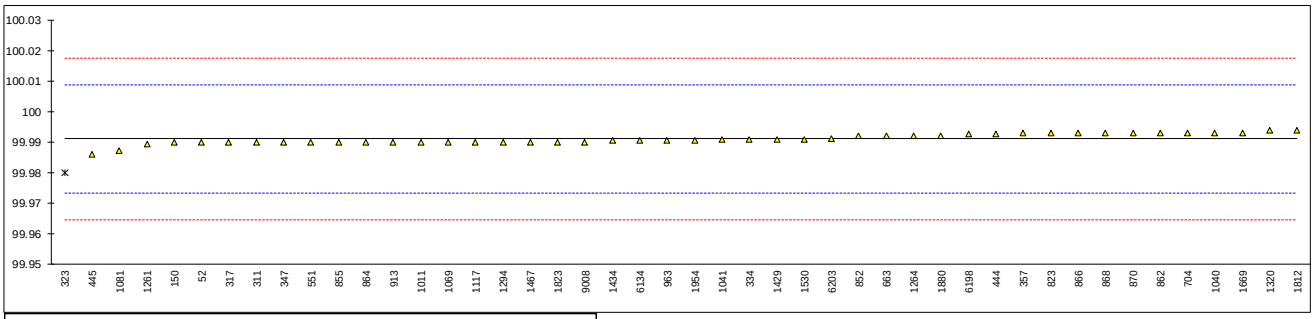

Kernel Density
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
0
0.5
1

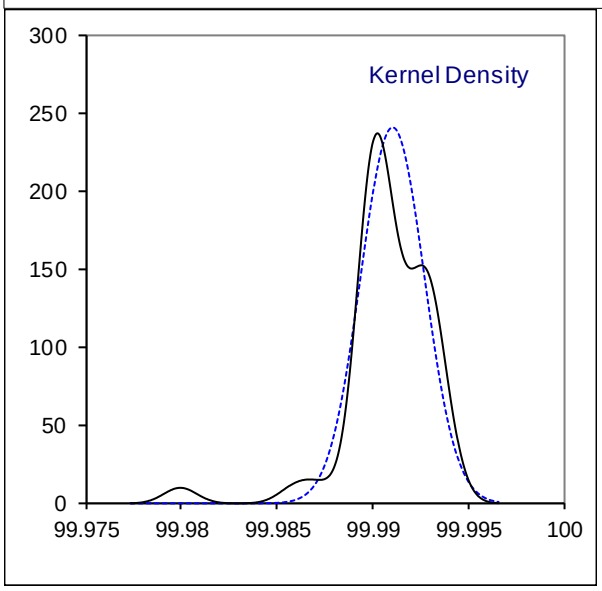
Determination of Purity by GC on sample #19020; results in %M/M

lab	method	value	mark	z(targ)	remarks
52	D7504	99.99		-0.12	
150	D4492	99.99		-0.12	
311	D4492	99.99		-0.12	
317	D4492	99.99		-0.12	
323	D4492	99.98	R(0.01)	-1.25	
334	D4492	99.991		-0.01	
347	D4492	99.99		-0.12	
357	D4492	99.993		0.22	
444	D4492	99.9927	C	0.18	First reported 99.9989
445	D4492	99.986		-0.57	
551	D4492	99.99		-0.12	
555		-----		-----	
663	D4492	99.992		0.10	
704	D7504	99.993		0.22	
823	D7360	99.9930		0.22	
852	D4492	99.992		0.10	
855	D7504	99.99		-0.12	
862	D4492	99.993		0.22	
864	D4492	99.99		-0.12	
866	D4492	99.993		0.22	
868	D4492	99.993		0.22	
870	D4492	99.993		0.22	
912		-----		-----	
913	D7360	99.99		-0.12	
962		-----		-----	
963	D4492	99.9906	C	-0.05	First reported 99.967
1011	D7360	99.99		-0.12	
1040	D7504	99.9930		0.22	
1041	In house	99.9909		-0.02	
1069		99.99		-0.12	
1081	D4492	99.98729		-0.43	
1117	D4492	99.99		-0.12	
1151		-----		-----	
1261	D4492	99.9894		-0.19	
1264	D7504	99.992		0.10	
1294	D4492	99.99		-0.12	
1320	D4492	99.99378		0.31	
1429	D7504	99.991	C	-0.01	First reported 99.997
1434	D4492	99.99044		-0.07	
1467	In house	99.99		-0.12	
1530	D4492	99.991		-0.01	
1669	D5713	99.9931		0.23	
1728		-----		-----	
1812		99.994		0.33	
1823	D7504	99.99		-0.12	
1880	D4492	99.992		0.10	
1954	D7504	99.9907		-0.04	
6134	D4492	99.9905		-0.06	
6198	D7504	99.9926		0.17	
6203	D7504	99.9912		0.01	
9008	D4492	99.99		-0.12	

	normality	OK
	n	45
	outliers	1
	mean (n)	99.99107
	st.dev. (n)	0.001655
	R(calc.)	0.00463
	st.dev.(D7504:18)	0.008836
	R(D7504:18)	0.02474
Compare		
	R(D4492:10)	0.00071

ASTM D4492 is withdrawn in 2018 and replaced by ASTM D7504

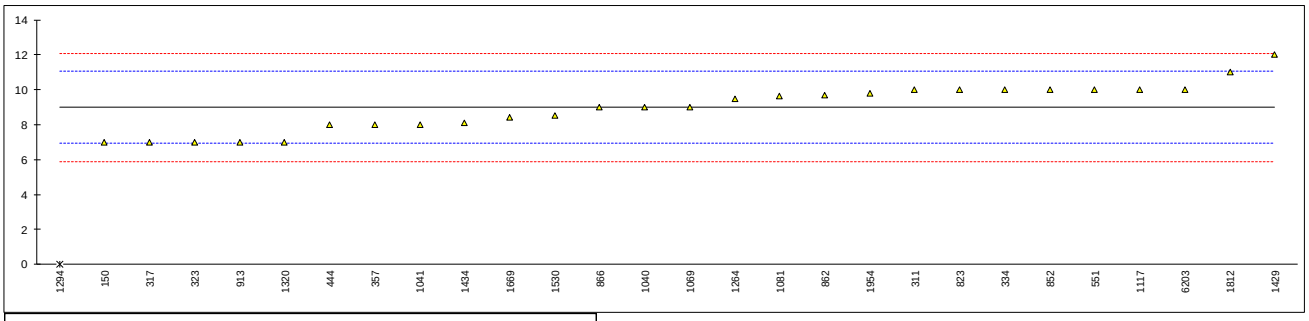

100.03
100.02
100.01
100
99.99
99.98
99.97
99.96
99.95
323 445 1081 1261 150 52 317 311 347 551 855 864 913 1011 1069 1117 1294 1467 1823 9008 1434 6134 963 1954 1041 334 1429 1530 6203 852 663 1264 1880 6198 444 357 823 866 868 870 862 704 1040 1669 1320 1812

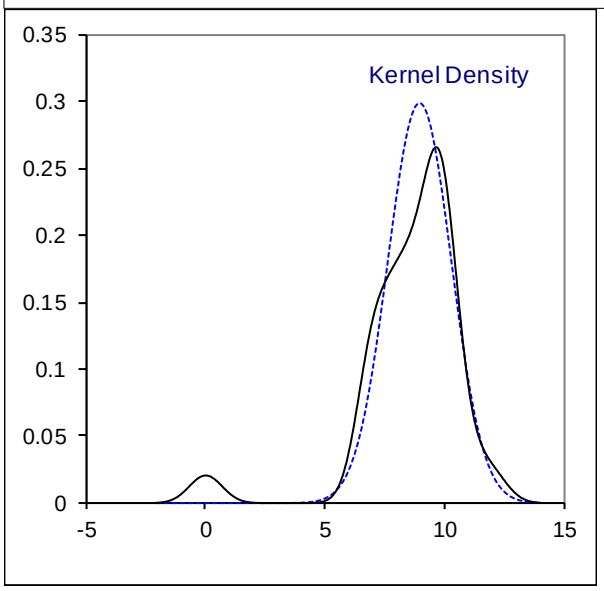

Kernel Density
300
250
200
150
100
50
0
99.975 99.98 99.985 99.99 99.995 100

Determination of Methylcyclohexane on sample #19020 in mg/kg

lab	method	value	mark	z(targ)	remarks
52		-----		-----	
150	D5713	7		-1.92	
311	D5713	10		0.98	
317	D5713	7		-1.92	
323	D4492	7		-1.92	
334	D4492	10	C	0.98	First reported 0.001 mg/kg
347		-----		-----	
357	D4492	8		-0.95	
444	D4492	8		-0.95	
445	D4492	<50		-----	
551	D4492	10		0.98	
555		-----		-----	
663		-----		-----	
704	INH-0041	< 10		-----	
823	D5713	10		0.98	
852	D4492	10		0.98	
855	D7504	<10		-----	
862	D4492	9.7		0.69	
864	D4492	<10		-----	
866	D4492	9		0.01	
868	D4492	<10		-----	
870	D4492	<10		-----	
912		-----		-----	
913	D7360	7		-1.92	
962		-----		-----	
963		-----		-----	
1011	D5134	< 14		-----	
1040	D4492	9	C	0.01	First reported 0.0009 mg/kg
1041	In house	8		-0.95	
1069		9		0.01	
1081	In house	9.61763		0.61	
1117	D4492	10		0.98	
1151		-----		-----	
1261		-----		-----	
1264	D7504	9.5		0.50	
1294	D4492	0	R(0.01)	-8.70	
1320	D4492	7		-1.92	
1429	D7504	12		2.92	
1434	D4492	8.1	C	-0.86	First reported 0.00081 mg/kg
1467		-----		-----	
1530	D4492	8.5		-0.47	
1669	D5713	8.4022		-0.56	
1728		-----		-----	
1812		11		1.95	
1823		-----		-----	
1880		-----		-----	
1954	D7504	9.8		0.79	
6134		-----		-----	
6198		-----		-----	
6203	D7504	10		0.98	
9008		-----		-----	

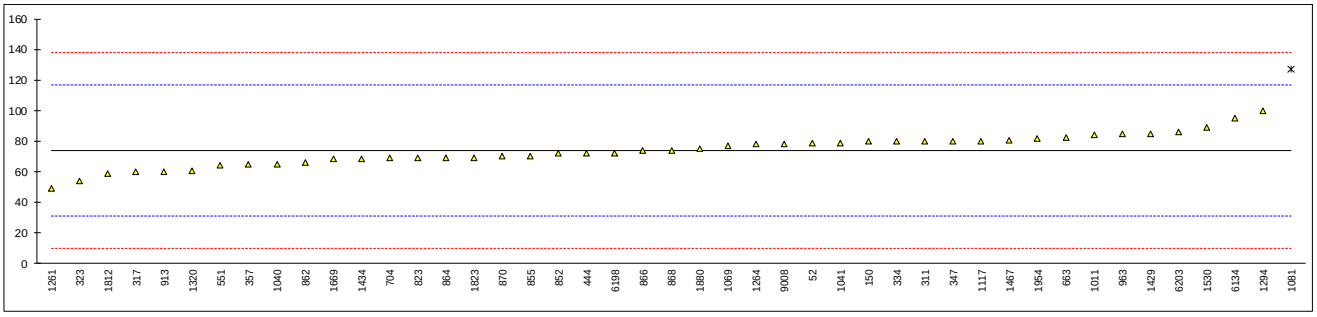
normality	OK
n	27
outliers	1
mean (n)	8.99
st.dev. (n)	1.333
R(calc.)	3.73
st.dev.(Horwitz)	1.033
R(Horwitz)	2.89

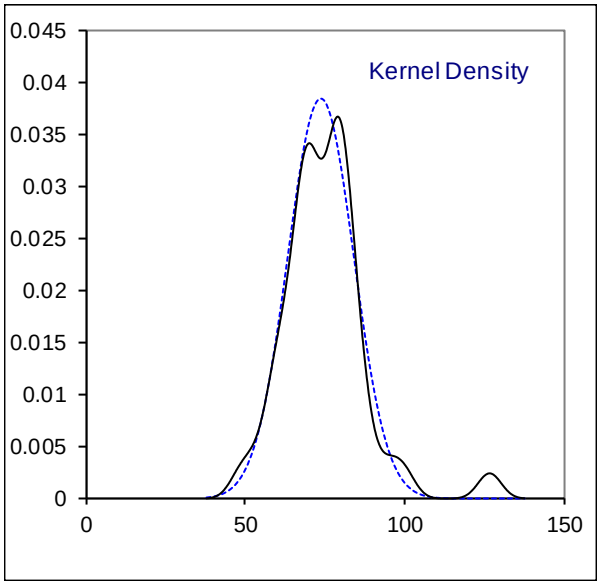

14
12
10
8
6
4
2
0
1294
150
317
323
913
1320
444
357
1041
1434
1669
1530
866
1040
1069
1264
1081
862
1954
311
823
334
852
551
1117
6203
1812
1429


Kernel Density
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-5
0
5
10
15

Determination of Nonaromatics on sample #19020; results in mg/kg

lab	method	value	mark	z(targ)	remarks
52	D7504	79		0.24	
150	D4492	80		0.28	
311	D4492	80		0.28	
317	D4492	60		-0.65	
323	D4492	54		-0.93	
334	D4492	80	C	0.28	First reported 0.008 mg/kg
347	D4492	80		0.28	
357	D4492	65		-0.42	
444	D4492	72	C	-0.09	First reported 10
445	D4492	<50		-----	
551	D4492	64		-0.46	
555		-----		-----	
663	D4492	82.35		0.39	
704	D7504	68.9		-0.24	
823	D7360	69		-0.23	
852	D4492	72		-0.09	
855	D7704	70		-0.18	
862	D4492	66		-0.37	
864	D4492	69		-0.23	
866	D4492	74		0.00	
868	D4492	74		0.00	
870	D4492	70		-0.18	
912		-----		-----	
913	D7360	60		-0.65	
962		-----		-----	
963	D4492	85		0.52	
1011	D7360	84		0.47	
1040	D4492	65	C	-0.42	First reported 0.00645 mg/kg
1041	In house	79		0.24	
1069		76.9		0.14	
1081	D4492	127.0231	R(0.01)	2.48	
1117	D4492	80		0.28	
1151		-----		-----	
1261	D4492	49		-1.16	
1264	D7504	78		0.19	
1294	D4492	100	C	1.22	First reported 0.01 mg/kg
1320	D4492	60.5		-0.63	
1429	D7504	85	C	0.52	First reported 21
1434	D4492	68.7	C	-0.24	First reported 0.00687 mg/kg
1467	In house	80.36		0.30	
1530	D4492	88.8		0.69	
1669	D5713	68.32		-0.26	
1728		-----		-----	
1812		59		-0.70	
1823	D7504	69		-0.23	
1880	D4492	75		0.05	
1954	D7504	81.6		0.36	
6134	D4492	95.0		0.98	
6198	D7504	72		-0.09	
6203	D7504	86		0.56	
9008	D4492	78		0.19	
	normality	OK			
	n	44			
	outliers	1			
	mean (n)	73.94			
	st.dev. (n)	10.362			
	R(calc.)	29.01			
	st.dev.(D7504:18)	21.425			
	R(D7504:18)	59.99			
Compare					
	R(D4492:10)	31.92			ASTM D4492 is withdrawn in 2018 and replaced by ASTM D7504


160
140
120
100
80
60
40
20
0
1261 323 1812 317 913 1320 551 357 1040 862 1669 1434 704 823 864 1823 870 855 852 444 6198 866 868 1880 1069 1264 9008 52 1041 150 334 311 347 1117 1467 1954 663 1011 963 1429 6203 1530 6134 1294 1081


Kernel Density
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0
50
100
150

Determination of Toluene on sample #19020; results in mg/kg

lab	method	value	mark	z(targ)	remarks
52	D7504	<2		-----	
150	D4492	3		-----	
311	D4492	<10		-----	
317	D4492	<10		-----	
323	D4492	<2		-----	
334	D4492	<10	C	-----	First reported <0.001 mg/kg
347	D4492	<10		-----	
357	D4492	< 10		-----	
444	D4492	1		-----	
445	D4492	<10		-----	
551	D4492	<10		-----	
555		-----		-----	
663	D4492	0		-----	
704	D7504	< 2		-----	
823	D7360	1		-----	
852	D4492	<10		-----	
855	D7704	<10		-----	
862	D4492	<10		-----	
864	D4492	<10		-----	
866	D4492	4		-----	
868	D4492	<10		-----	
870	D4492	<10		-----	
912		-----		-----	
913	D7360	<5		-----	
962		-----		-----	
963	D4492	<10		-----	
1011	D7360	< 6		-----	
1040	D4492	1	C	-----	First reported 0.0001 mg/kg
1041	In house	4		-----	
1069		1.3		-----	
1081	D4492	0		-----	
1117	D4492	< 10		-----	
1151	In house	1.70		-----	
1261	D4492	1		-----	
1264	D7504	<2[ND]		-----	
1294	D4492	0		-----	
1320	D4492	<10		-----	
1429	D7504	<5		-----	
1434	D4492	0		-----	
1467	In house	1.1		-----	
1530	D4492	< 10		-----	
1669	D5713	<2		-----	
1728		-----		-----	
1812		n.n.		-----	
1823	D7504	<2		-----	
1880	D4492	<10		-----	
1954	D7504	<5		-----	
6134	D4492	3.0		-----	
6198	D7504	2		-----	
6203	D7504	<2		-----	
9008	D4492	<10		-----	
	n	46			
	mean (n)	<10			

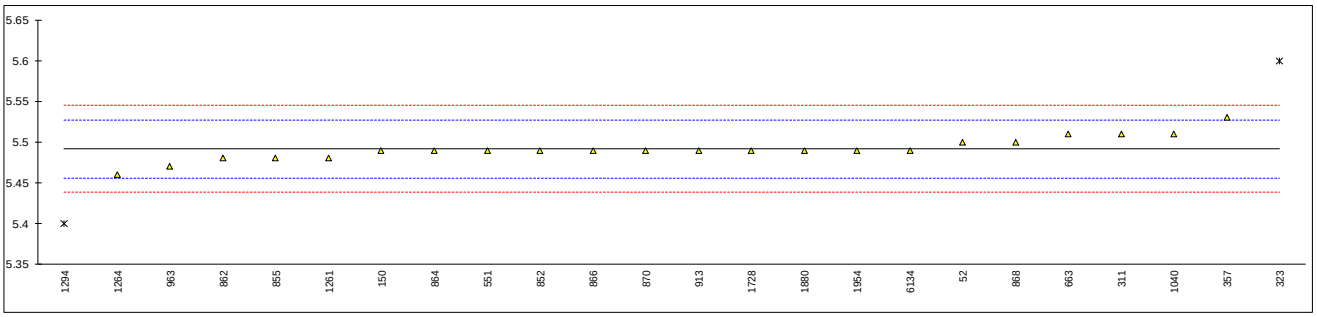
Determination of 1,4-Dioxane on sample #19020; results in mg/kg

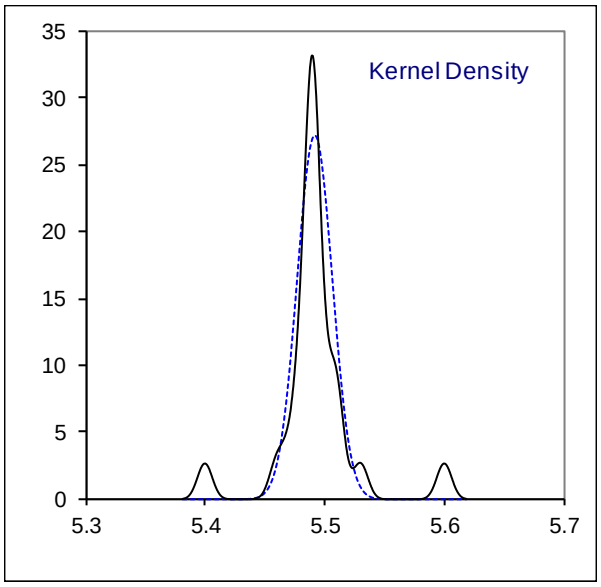
lab	method	value	mark	z(targ)	remarks
52	D7504	<2		-----	
150		-----		-----	
311		-----		-----	
317		-----		-----	
323		-----		-----	
334		-----		-----	
347		-----		-----	
357	D4492	< 5		-----	
444		-----		-----	
445	D4492	<5		-----	
551	D4492	<5		-----	
555		-----		-----	
663	D4492	0		-----	
704	D7504	< 2		-----	
823	D7360	<2.7		-----	
852	D4492	<10		-----	
855	D7704	<10		-----	
862	D4492	<5		-----	
864	D4492	<10		-----	
866	D4492	<1		-----	
868	D4492	<10		-----	
870		-----		-----	
912		-----		-----	
913	D7360	<5		-----	
962		-----		-----	
963		-----		-----	
1011	D7360	< 10		-----	
1040		-----		-----	
1041		-----		-----	
1069		-----		-----	
1081		-----		-----	
1117		-----		-----	
1151		-----		-----	
1261		-----		-----	
1264	D7504	<2[ND]		-----	
1294	D4492	0		-----	
1320	D4492	<5		-----	
1429		-----		-----	
1434	D4492	0.0000		-----	
1467		-----		-----	
1530		-----		-----	
1669	D4492	<5		-----	
1728		-----		-----	
1812		-----		-----	
1823	D7504	<2		-----	
1880		-----		-----	
1954	D7504	ND		-----	
6134		-----		-----	
6198	D7504	0		-----	
6203	D7504	<2		-----	
9008		-----		-----	
	n	24			
	mean (n)	<10			

Determination of Solidification Point (anhydrous basis) on sample #19020; results in °C

lab	method	value	mark	z(targ)	remarks
52	D852	5.50		0.46	
150	D852	5.49		-0.10	
311	D852	5.51		1.02	
317		-----		-----	
323	D852	5.60	R(0.01)	6.06	
334		-----		-----	
347		-----		-----	
357	D852	5.53		2.14	
444		-----		-----	
445		-----		-----	
551	D852	5.49		-0.10	
555		-----		-----	
663	D852	5.51		1.02	
704		-----		-----	
823		-----		-----	
852	D852	5.49		-0.10	
855	D852	5.48		-0.66	
862	D852	5.48		-0.66	
864	D852	5.49		-0.10	
866	D852	5.49		-0.10	
868	D852	5.50		0.46	
870	D852	5.49		-0.10	
912		-----		-----	
913	D852	5.49		-0.10	
962		-----		-----	
963	D852	5.47		-1.22	
1011		-----		-----	
1040	DIN51798	5.51		1.02	
1041		-----		-----	
1069		-----		-----	
1081		-----		-----	
1117		-----		-----	
1151		-----		-----	
1261	D852	5.48		-0.66	
1264	D852	5.46		-1.78	
1294	D852	5.40	R(0.01)	-5.14	
1320		-----		-----	
1429		-----		-----	
1434		-----		-----	
1467		-----		-----	
1530		-----		-----	
1669		-----		-----	
1728	D852	5.49		-0.10	
1812		-----		-----	
1823		-----		-----	
1880	D852	5.49		-0.10	
1954	D852	5.49		-0.10	
6134	D852	5.49		-0.10	
6198		-----		-----	
6203		-----		-----	
9008		-----		-----	

normality	suspect
n	22
outliers	2
mean (n)	5.492
st.dev. (n)	0.0147
R(calc.)	0.041
st.dev.(D852:16)	0.0179
R(D852:16)	0.05

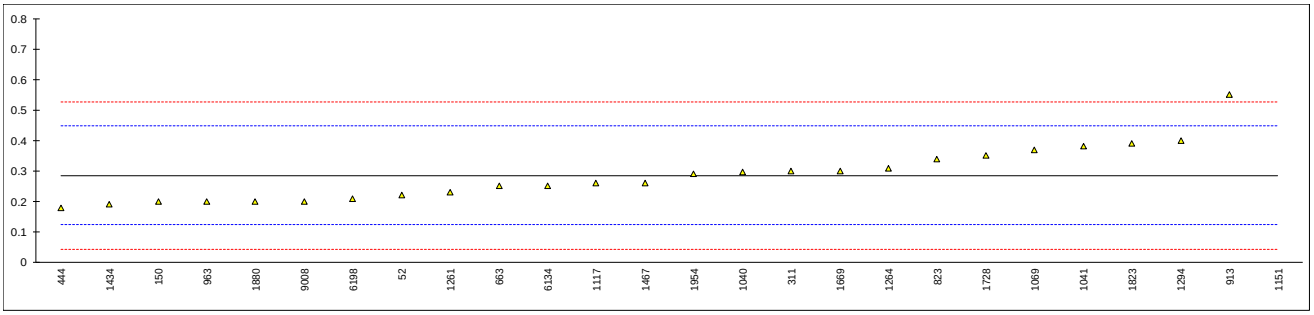

5.65
5.6
5.55
5.5
5.45
5.4
5.35
1294
1264
963
862
855
1261
150
864
551
852
866
870
913
1728
1880
1954
6134
52
868
663
311
1040
357
323

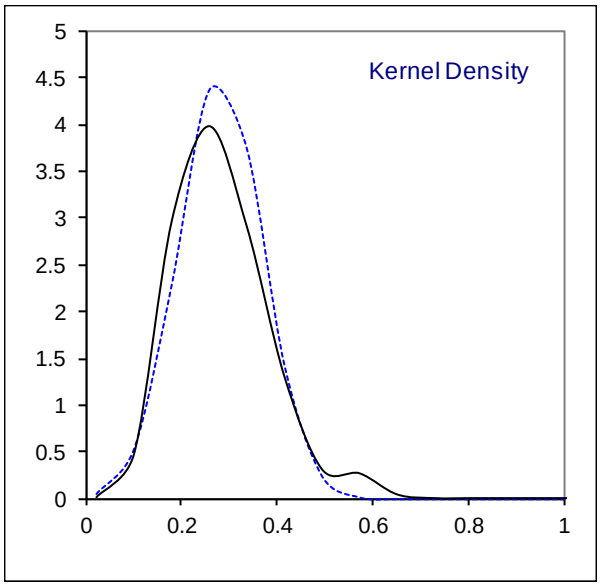

Kernel Density
35
30
25
20
15
10
5
0
5.3
5.4
5.5
5.6
5.7

Determination of Sulfur on sample #19020; results in mg/kg

lab	method	value	mark	z(targ)	remarks
52	D7183	0.22		-0.81	
150	D5453	0.20		-1.05	
311	D7183	0.30		0.19	
317	D5453	<1.0		-----	
323	D5453	<1.0		-----	
334	D5453	<0.5		-----	
347	D5453	<1		-----	
357	D7183	< 0,5		-----	
444	D5453	0.18		-1.30	
445	D5453	<1		-----	
551		-----		-----	
555		-----		-----	
663	D5453	0.25		-0.43	
704	D5453	<1		-----	
823	D7183	0.34		0.68	
852	SH/T0253	<1		-----	
855	D5453	<1		-----	
862		-----		-----	
864	D5453	<0.5		-----	
866		-----		-----	
868	D5453	<1		-----	
870	D3120	<1		-----	
912	D5453	<1		-----	
913	D7183	0.55		3.28	
962		-----		-----	
963	D5453	0.2		-1.05	
1011		-----		-----	
1040	ISO20846	0.2963		0.14	
1041	D5453	0.38		1.18	
1069		0.37		1.05	
1081		-----		-----	
1117	D5453	0.26		-0.31	
1151	D2622	19.92	R(0.01)	243.10	
1261	D5453	0.23		-0.68	
1264	D5453	0.31		0.31	
1294		0.4		1.42	
1320		-----		-----	
1429	D5453	Less than 1		-----	
1434	D7183	0.19		-1.18	
1467	In house	0.26		-0.31	
1530	D5453	< 0,5		-----	
1669	D5453	0.3		0.19	
1728	D5453	0.35		0.80	
1812		-----		-----	
1823	D5453	0.39		1.30	
1880	D5453	0.20		-1.05	
1954	D5453	0.29		0.06	
6134	D7183	0.25		-0.43	
6198	D5453	0.21		-0.93	
6203	D5453	<1		-----	
9008	D5453	0.2		-1.05	

	normality	not OK	
	n	25	
	outliers	1	
	mean (n)	0.285	
	st.dev. (n)	0.0877	
	R(calc.)	0.246	
	st.dev.(D5453:16e1)	0.0808	
	R(D5453:16e1)	0.226	Application range ASTM D5453 = 1 - 8000 mg/kg


0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
444
1434
150
963
1880
9008
6198
52
1261
663
6134
1117
1467
1954
1040
311
1669
1264
823
1728
1069
1041
1823
1294
913
1151


Kernel Density
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1

Determination of Thiophene on sample #19020; results in mg/kg

lab	method	value	mark	z(targ)	remarks
52	D4735	<0.80		-----	
150	D4735	0.5		-----	
311		-----		-----	
317		-----		-----	
323	INH-306	0.5		-----	
334		-----		-----	
347		-----		-----	
357		-----		-----	
444		-----		-----	
445		-----		-----	
551		-----		-----	
555		-----		-----	
663		-----		-----	
704		-----		-----	
823	D4735	<0.8		-----	
852		-----		-----	
855		-----		-----	
862		-----		-----	
864		-----		-----	
866		-----		-----	
868		-----		-----	
870		-----		-----	
912		-----		-----	
913	D1685	<0.4		-----	
962		-----		-----	
963		-----		-----	
1011		-----		-----	
1040		-----		-----	
1041		-----		-----	
1069		0.13		-----	
1081		-----		-----	
1117		-----		-----	
1151		-----		-----	
1261		-----		-----	
1264		-----		-----	
1294		<1.0		-----	
1320		-----		-----	
1429		-----		-----	
1434		-----		-----	
1467		-----		-----	
1530		-----		-----	
1669		-----		-----	
1728		-----		-----	
1812		0.55		-----	
1823		-----		-----	
1880	D4735	0.48		-----	
1954		-----		-----	
6134	D7011	0.18		-----	
6198		-----		-----	
6203		-----		-----	
9008		-----		-----	
	n	10			
	mean (n)	<1			

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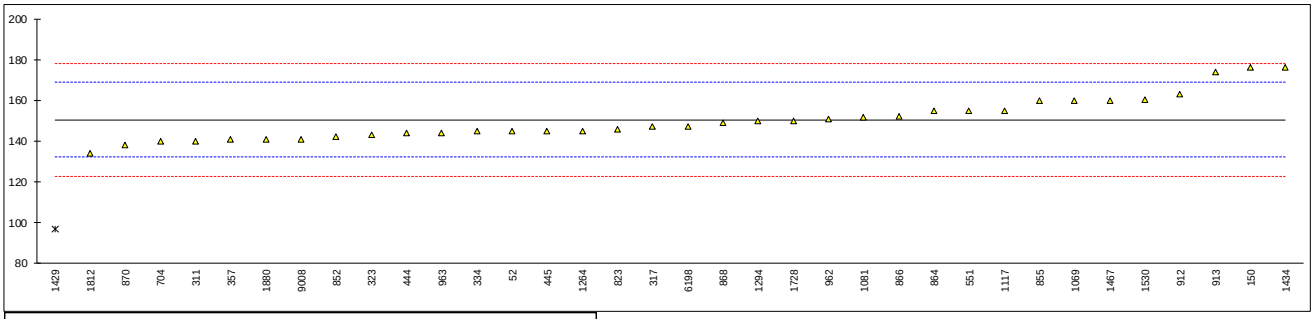
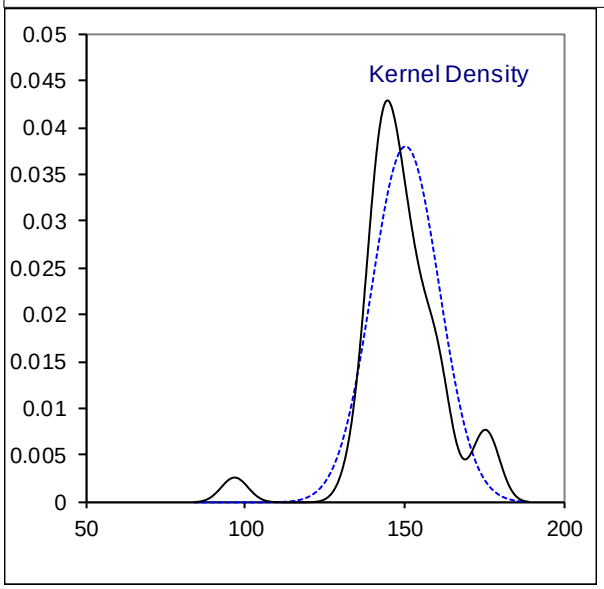
Determination of Water on sample #19020; results in mg/kg

lab	method	value	mark	z(targ)	remarks
52	D6304	145		-0.60	
150	E1064	176		2.78	
311	E1064	140		-1.14	
317	E1064	147		-0.38	
323	E1064	143		-0.81	
334	E1064	145	C	-0.60	First reported 216
347		-----		-----	
357	E1064	141		-1.03	
444	E1064	144		-0.70	
445	E1064	145.0		-0.60	
551	E1064	155		0.49	
555		-----		-----	
663		-----		-----	
704	E1064	140		-1.14	
823	E1064	146		-0.49	
852	SH/T0246	142		-0.92	
855	E1064	160		1.04	
862		-----		-----	
864	E1064	155		0.49	
866	E1064	152		0.17	
868	E1064	149		-0.16	
870	E1064	138		-1.36	
912	E203	163		1.36	
913	E1064	174		2.56	
962	E1064	151		0.06	
963	E1064	144		-0.70	
1011		-----		-----	
1040		-----		-----	
1041		-----		-----	
1069		160		1.04	
1081	D6304	151.640		0.13	
1117	D4672	155		0.49	
1151		-----		-----	
1261		-----		-----	
1264	E1064	145		-0.60	
1294		150.0		-0.05	
1320		-----		-----	
1429	IP438	97	R(0.01)	-5.82	
1434	D6304	176.4		2.82	
1467	E1064	160		1.04	
1530	E1064	160.4		1.08	
1669		-----		-----	
1728	E1064	150		-0.05	
1812		134		-1.79	
1823		-----		-----	
1880	D6304	141		-1.03	
1954		-----		-----	
6134		-----		-----	
6198	E1064	147		-0.38	
6203		-----		-----	
9008	E1064	141		-1.03	

normality	suspect
n	35
outliers	1
mean (n)	150.5
st.dev. (n)	10.52
R(calc.)	29.5
st.dev.(E1064:16)	9.19
R(E1064:16)	25.7


200
180
160
140
120
100
80
1429
1812
870
704
311
357
1880
9008
852
323
444
963
334
52
445
1264
823
317
6198
868
1294
1728
962
1081
866
864
551
1117
855
1069
1467
1530
912
913
150
1434


Kernel Density
0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
50
100
150
200

APPENDIX 2

Number of participants

1 lab in	BELGIUM
2 labs in	BRAZIL
1 lab in	CANADA
9 labs in	CHINA, People's Republic
2 labs in	FINLAND
1 lab in	FRANCE
4 labs in	GERMANY
4 labs in	INDIA
1 lab in	ISRAEL
2 labs in	KUWAIT
4 labs in	NETHERLANDS
1 lab in	PORTUGAL
2 labs in	ROMANIA
6 labs in	SAUDI ARABIA
1 lab in	SLOVAKIA
1 lab in	SOUTH KOREA
2 labs in	SPAIN
1 lab in	THAILAND
1 lab in	UKRAINE
1 lab in	UNITED ARAB EMIRATES
3 labs in	UNITED KINGDOM
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
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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3 ASTM E1301:03
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7 M. Thompson and R. Wood, J. AOAC Int, 76, 926, (1993)
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12 J.N. Miller, Analyst, 118, 455, (1993)
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