Results of Proficiency Test
Mono Propylene Glycol (MPG)
October 2019

Organised by: Institute for Interlaboratory Studies
Spijkenisse, the Netherlands

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1 INTRODUCTION

Since 1995 the Institute for Interlaboratory Studies (iis) organized once every two years a proficiency test for Mono Propylene Glycol (MPG). During the annual proficiency testing program 2019/2020, it was decided to continue the round robin for the analysis on Mono Propylene Glycol based on the scope of the latest specification of ASTM E202.
In this interlaboratory study, 24 laboratories in 16 different countries registered for participation. See appendix 2 for the number of participants per country. In this report, the results of the 2019 Mono Propylene Glycol proficiency test are presented and discussed. This report is also electronically available through the iis website www.iisnl.com.

2 SET UP

The Institute for Interlaboratory Studies (iis) in Spijkenisse, the Netherlands, was the organizer of this proficiency test (PT). Sample analyses for fit-for-use and homogeneity testing were subcontracted to an ISO/IEC17025 accredited laboratory. It was decided to send one sample of 0.5L labelled #19210.
The participants were requested to report rounded and unrounded test results. The unrounded test results were preferably used for statistical evaluation.

2.1 ACCREDITATION

The Institute for Interlaboratory Studies in Spijkenisse, the Netherlands, is accredited in agreement with ISO/IEC17043:2010 (R007), since January 2000, by the Dutch Accreditation Council (Raad voor Accreditatie). This PT falls under the accredited scope. This ensures strict adherence to protocols for sample preparation and statistical evaluation and 100% confidentiality of participant's data. Feedback from the participants on the reported data is encouraged and customer's satisfaction is measured on regular basis by sending out questionnaires.

2.2 PROTOCOL

The protocol followed in the organization of this proficiency test was the one as described for proficiency testing in the report 'iis Interlaboratory Studies: Protocol for the Organisation, Statistics and Evaluation' of June 2018 (iis-protocol, version 3.5). This protocol is electronically available through the iis website www.iisnl.com, from the FAQ page.

2.3 CONFIDENTIALITY STATEMENT

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

2.4 SAMPLES

Approximately 30 liters of MPG was obtained from a local supplier. After homogenization 37 amber glass bottles of 0.5L were filled and labelled #19210. The homogeneity of the subsamples #19210 was checked by determination of Density in accordance with ASTM D4052 on 8 stratified randomly selected samples.

	Density at 20°C in kg/L
sample #19210-1	1.03612
sample #19210-2	1.03612
sample #19210-3	1.03612
sample #19210-4	1.03612
sample #19210-5	1.03612
sample #19210-6	1.03612
sample #19210-7	1.03612
sample #19210-8	1.03612

Table 1: homogeneity test results of subsamples #19210

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 ISO13528, Annex B2 in the next table.

	Density at 20°C in kg/L
r (observed)	0.00000
reference test method	ISO12185:96
0.3 * R (ref. test method)	0.00015

Table 2: evaluation of the repeatability of subsamples #19210

The calculated repeatability is 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 1 * 0.5L bottle labelled #19210 was sent on October 2, 2019.

2.5 STABILITY OF THE SAMPLES

The stability of the Mono Propylene Glycol 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 #19205: Acidity as Acetic Acid, Appearance, Inorganic Chloride, Color, Density, Distillation, Iron, Purity, Dipropylene Glycol, Specific Gravity at 20/20°C 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 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.

According to ISO5725 the original test results per determination were submitted to Dixon's and/or 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 these 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. The Kernel Density Graph is a method for producing a smooth density approximation to a set of data that avoids some problems associated with histograms. Also, a normal Gauss curve was projected over the Kernel Density Graph for reference.

3.3 Z-SCORES

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

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

The z-scores were calculated according to:

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

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

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

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

4 EVALUATION

In this proficiency test some problems some problems were encountered with the dispatch of the samples. One participant reported the test results after the final reporting date and two other participants did not report any test results. Not all laboratories were able to report all analyses requested. In total 22 participants did report 181 numerical test results. Observed were 4 outlying test results, which is 2.2%. 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 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 explained in appendix 3.

In the iis PT reports, ASTM test methods are referred to with a number (e.g. D1209) and an added designation for the year that the test method was adopted or revised (e.g. D1209:05). If applicable, a designation in parentheses is added to designate the year of reapproval (e.g. D1209:05(2019)). In the tables of appendix 1 only the test method number and year of adoption or revision will be used.

Sample #19210

Acidity as Acetic Acid: This determination was not problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is in agreement with the requirements of ASTM D1613:17

Appearance: No problems have been observed with this determination. All reporting participants agreed on a test result of ‘Pass (Clear and Bright)’.

Inorganic Chloride: Twelve test results were reported. Most of the participants agreed that the sample was low on Inorganic Chloride as Cl (<0.5 mg/kg). Therefore, no z-scores were calculated.

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

Density: 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 over three distillation parameters. All three calculated reproducibilities are in agreement with the requirements of ASTM D1078:11(2019) automated and manual modes.

Iron: This determination was not problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is in agreement with the requirements of ASTM E394:15.

Purity by GC as received: This determination was not problematic. Two statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is in agreement with the requirements of ASTM E202:18.

Dipropylene Glycol: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of E202:18.

Specific Gravity 20/20°C: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of E202:18.

Water: This determination was problematic dependent on the test method used. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of ASTM E202:05, but is not at all in agreement with the more strict requirements of 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 reproducibilities derived from reference test methods (in casu ASTM and ISO test methods) are presented in the next table.

Parameter	unit	n	average	2.8 * sd	R (lit)
Acidity as Acetic Acid	%M/M	19	0.0006	0.0008	0.0014
Appearance		20	Pass	n.a.	n.a.
Inorganic Chloride as Cl	mg/kg	11	<0.5	n.e.	n.e.
Color Pt/Co		16	1.9	3.4	7
Density at 20°C	kg/L	20	1.0362	0.0003	0.0005
Initial Boiling Point	°C	9	186.9	0.6	2.9
50% recovered	°C	9	187.3	0.8	1.3
Dry Point	°C	9	187.6	1.2	2.0
Iron as Fe	mg/kg	15	0.14	0.05	0.08
Purity by GC as received	%M/M	17	99.971	0.038	0.17
Dipropylene Glycol	%M/M	16	0.011	0.029	0.14
Specific Gravity 20/20°C		21	1.0381	0.0004	0.0005
Water	mg/kg	21	247	131	500

Table 3: reproducibilities of tests on sample #19210

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

4.3 COMPARISON OF THE PROFICIENCY TEST OF OCTOBER 2019 WITH PREVIOUS PTS

	October 2019	October 2017	October 2015	October 2013	October 2011
Number of reporting labs	22	21	23	19	18
Number of test results	181	177	207	189	185
Number of statistical outliers	4	2	4	5	6
Percentage outliers	2.2%	1.1%	1.9%	2.7%	3.2%

Table 4: comparison with previous proficiency tests

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

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

	October 2019	October 2017	October 2015	October 2013	October 2011
Acidity as Acetic Acid	+	+	+	+	++
Inorganic Chloride as Cl	n.e.	--	+	n.e.	++
Color Pt/Co	++	++	++	++	++
Density at 20°C	+	+/-	+	++	++
Initial Boiling Point	++	--	--	-	-
50% recovered	+	--	--	+	--

	October 2019	October 2017	October 2015	October 2013	October 2011
Dry Point	+	++	++	++	++
Iron as Fe	+	(--)	+	++	++
Purity by GC as received	++	(--)	++	++	++
Dipropylene Glycol	++	++	++	++	++
Specific Gravity 20/20°C	+	+/-	+	++	++
Water	++	++	++	++	++

Table 5: comparison determinations against the reference test method

Results between brackets were not subject for evaluation as the group was divided bimodal (or trimodal), therefore evaluation should be done with due care

The following performance categories in above table were used:

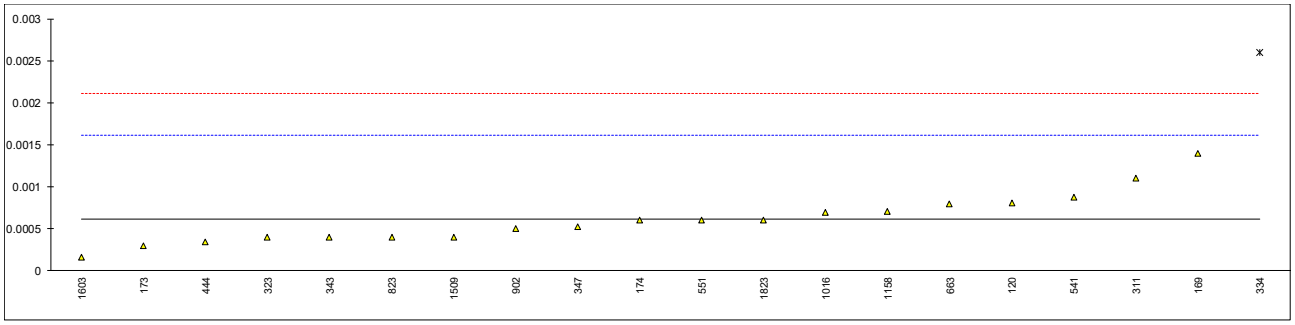
++ : group performed much better than the reference test method
+ : group performed better than the reference test method
+/- : group performance equals the reference test method
- : group performed worse than the reference test method
-- : group performed much worse than the reference test method
n.e.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

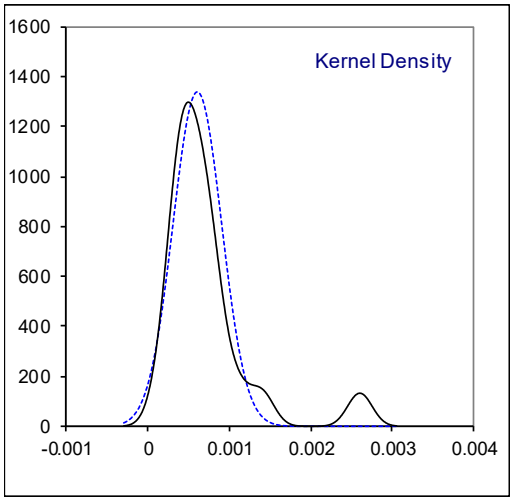
APPENDIX 1

Determination of Acidity as Acetic Acid on sample #19210; results in %M/M

lab	method	value	mark	z(targ)	remarks
120	D1613	0.00081	C	0.40	reported 8.1 %M/M, possibly unit error ?
169	D1613	0.0014		1.58	
171		-----		-----	
173	E202	0.0003		-0.62	
174	D1613	0.0006		-0.02	
311	D1613	0.0011		0.98	
323	D1613	0.0004		-0.42	
334	D1613	0.0026	C,G(0.01)	3.98	first reported 0.00081
343	INH-CM	0.0004		-0.42	
347	D1613	0.00052		-0.18	
444	INH-CM370	0.00034		-0.54	
446		-----		-----	
541	D1613	0.00087		0.52	
551	D1613	0.0006		-0.02	
663	D1613	0.00080		0.38	
823	D1613	0.0004		-0.42	
902	D1613	0.0005		-0.22	
1016	D1613	0.000698		0.18	
1158	D1613	0.0007		0.18	
1509	D1613	0.00040		-0.42	
1603	In house	0.00016		-0.90	
1823	D1613	0.00060		-0.02	
6111		-----		-----	
6262		-----		-----	

normality	not OK
n	19
outliers	1
mean (n)	0.00061
st.dev. (n)	0.000297
R(calc.)	0.00083
st.dev.(D1613:17)	0.000500
R(D1613:17)	0.0014





Determination of Appearance on sample #19210;

lab	method	value	mark	z(targ)	remarks
120	Visual	clear and bright		-----	
169	E2680	Pass		-----	
171		-----		-----	
173	E2680	Pass		-----	
174	Visual	Clear & free		-----	
311	E2680	pass		-----	
323	D4176	clear & bright		-----	
334	Visual	Pass		-----	
343	E2680	PASS		-----	
347	E2680	Pass		-----	
444	E2680	Pass		-----	
446	E2680	PASS		-----	
541	E2680	Pass		-----	
551	E2680	Pass		-----	
663	Visual	Bright and Clear		-----	
823	E2680	Pass		-----	
902	E2680	Pass		-----	
1016	Visual	Pass		-----	
1158		-----		-----	
1509	E2680	Pass		-----	
1603	Visual	PASS		-----	
1823	D4176	Pass		-----	
6111		-----		-----	
6262		-----		-----	
	n	20			
	mean (n)	Pass (Clear and Bright)			

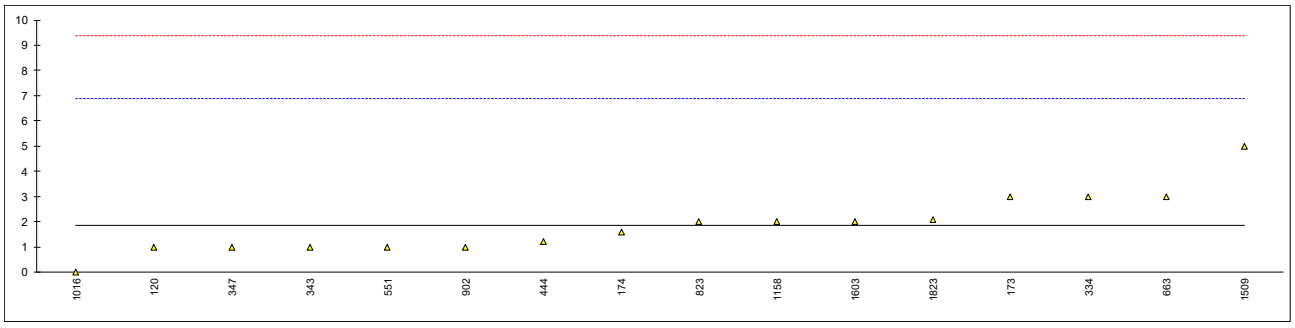
Determination of Inorganic Chloride as Cl on sample #19210; results in mg/kg

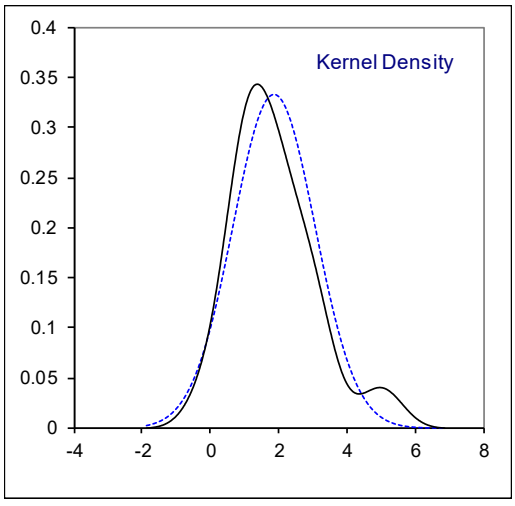
lab	method	value	mark	z(targ)	remarks
120		-----		-----	
169	E2469	0.0		-----	
171		-----		-----	
173	INH-0221	<0.5		-----	
174	INH-0221	<0.5		-----	
311	INH-158	<0.2		-----	
323	E2469	<0.03		-----	
334		-----		-----	
343	INH-CM	<0.5		-----	
347		-----		-----	
444	INH-CM867	0		-----	
446	INH-CM	<1		-----	
541		-----		-----	
551		-----		-----	
663		-----		-----	
823	E2469	0.14		-----	
902	E2469	<0.05		-----	
1016		-----		-----	
1158		-----		-----	
1509	In house	0.0149		-----	
1603	In house	0.09		-----	
1823		-----		-----	
6111		-----		-----	
6262		-----		-----	
	n	11			
	mean (n)	<0.5			

Determination of Color Pt/Co on sample #19210;

lab	method	value	mark	z(targ)	remarks
120	D1209	1		-0.35	
169	D1209	<5.0		-----	
171		-----		-----	
173	D1209	3	C	0.45	first reported 5
174	D5386	1.6		-0.11	
311	D1209	<5		-----	
323	D1209	<5		-----	
334	D1209	3		0.45	
343	D5386	1		-0.35	
347	D5386	1		-0.35	
444	D5386	1.2		-0.27	
446	D1209	<5		-----	
541	D5386	<1		-----	
551	D1209	1		-0.35	
663	D1209	3		0.45	
823	D5386	2		0.05	
902	D5386	1		-0.35	
1016	D1209	0		-0.75	
1158	D1209	2		0.05	
1509	D1209	5		1.25	
1603	In house	2		0.05	
1823	D5386	2.1		0.09	
6111		-----		-----	
6262		-----		-----	

normality	not OK
n	16
outliers	0
mean (n)	1.87
st.dev. (n)	1.198
R(calc.)	3.35
st.dev.(D1209:05)	2.500
R(D1209:05)	7
compare	
R(D5386:16)	4.89

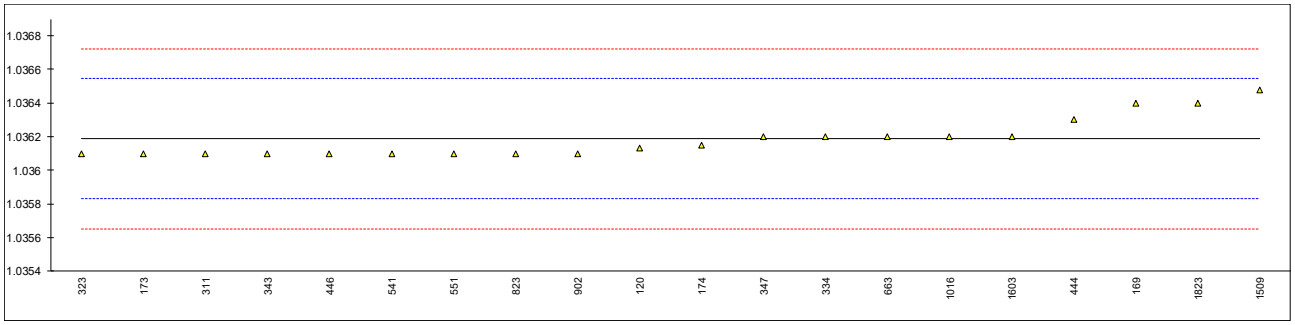


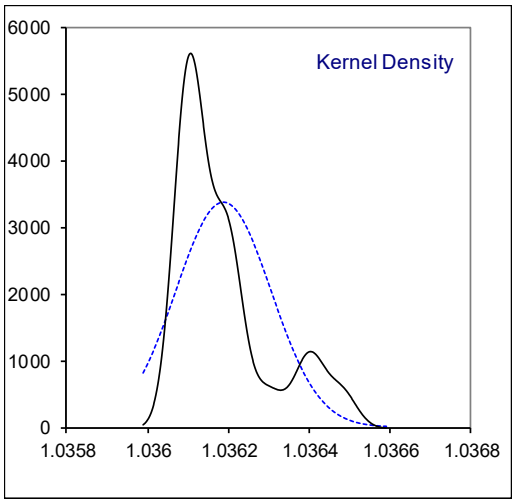


Determination of Density at 20°C on sample #19210; results in kg/L

lab	method	value	mark	z(targ)	remarks
120	D4052	1.03613		-0.32	
169	D4052	1.0364		1.19	
171		-----		-----	
173	D4052	1.0361		-0.49	
174	D4052	1.03615		-0.21	
311	D4052	1.0361		-0.49	
323	ISO12185	1.0361		-0.49	
334	ISO12185	1.0362		0.07	
343	D4052	1.0361		-0.49	
347	D4052	1.03620		0.07	
444	D4052	1.0363		0.63	
446	D4052	1.0361		-0.49	
541	D4052	1.0361		-0.49	
551	D4052	1.0361		-0.49	
663	D4052	1.0362		0.07	
823	ISO12185	1.0361		-0.49	
902	D4052	1.0361		-0.49	
1016	D4052	1.0362		0.07	
1158		-----		-----	
1509	D4052	1.03648		1.64	
1603	In house	1.03620		0.07	
1823	D4052	1.0364		1.19	
6111		-----		-----	
6262		-----		-----	

normality	not OK
n	20
outliers	0
mean (n)	1.03619
st.dev. (n)	0.000118
R(calc.)	0.00033
st.dev.(ISO12185:96)	0.000179
R(ISO12185:96)	0.0005

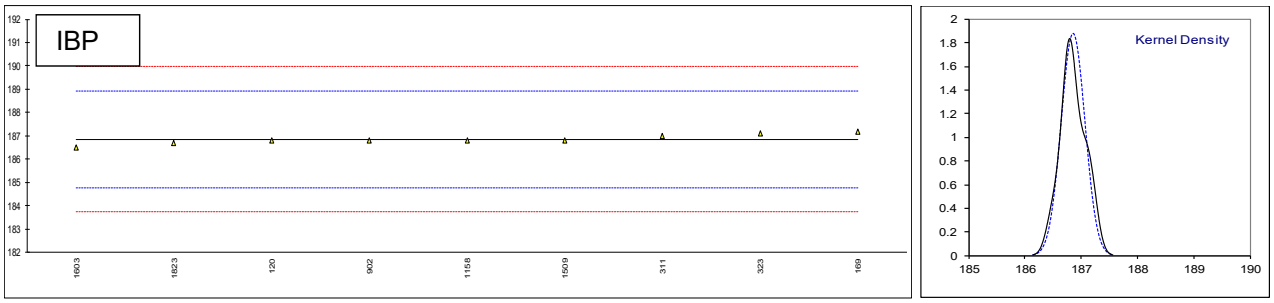


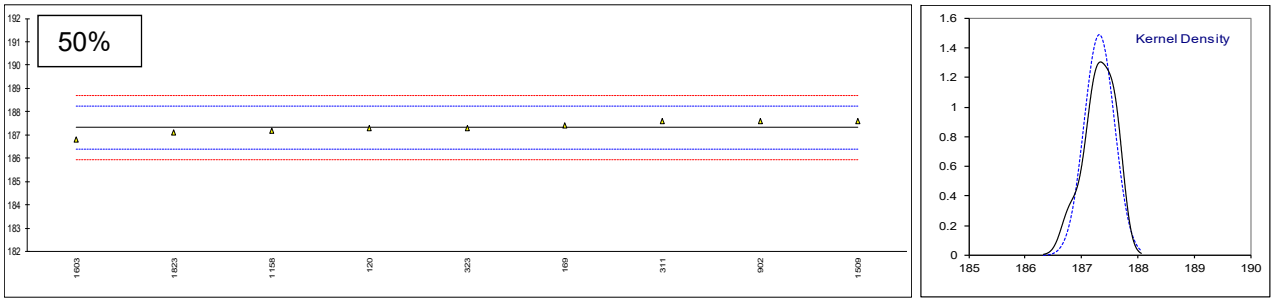


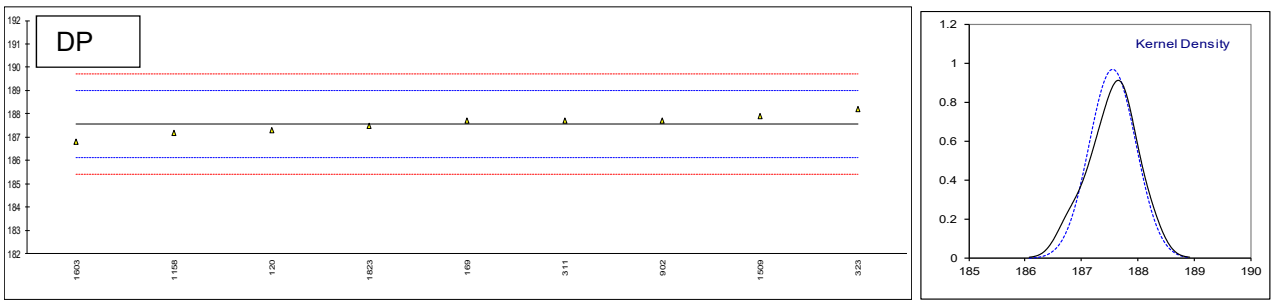
Determination of Distillation: IBP, 50% recovered, Dry Point on sample #19210; results in °C

lab	method	IBP	mark	z(targ)	50% rec	mark	z(targ)	DP	mark	z(targ)
120	D1078-automated	186.8		-0.05	187.3		-0.05	187.3		-0.36
169	D1078-automated	187.2		0.33	187.4		0.17	187.7		0.20
171		-----		-----	-----		-----	-----		-----
173		-----		-----	-----		-----	-----		-----
174		-----		-----	-----		-----	-----		-----
311	D1078-automated	187.0		0.14	187.6		0.61	187.7		0.20
323	D1078-manual	187.1	C	0.23	187.3		-0.05	188.2		0.90
334		-----		-----	-----		-----	-----		-----
343		-----		-----	-----		-----	-----		-----
347		-----		-----	-----		-----	-----		-----
444		-----		-----	-----		-----	-----		-----
446		-----		-----	-----		-----	-----		-----
541		-----		-----	-----		-----	-----		-----
551		-----		-----	-----		-----	-----		-----
663		-----		-----	-----		-----	-----		-----
823		-----		-----	-----		-----	-----		-----
902	D1078-automated	186.8		-0.05	187.6		0.61	187.7		0.20
1016		-----		-----	-----		-----	-----		-----
1158		186.8		-0.05	187.2		-0.27	187.2		-0.50
1509	D1078-automated	186.8		-0.05	187.6		0.61	187.9		0.48
1603	D1078-automated	186.5		-0.34	186.8		-1.14	186.8		-1.05
1823	D1078-automated	186.7		-0.15	187.1		-0.49	187.5		-0.08
6111		-----		-----	-----		-----	-----		-----
6262		-----		-----	-----		-----	-----		-----
	normality	OK			OK			OK		
	n	9			9			9		
	outliers	0			0			0		
	mean (n)	186.86			187.32			187.56		
	st.dev. (n)	0.213			0.268			0.413		
	R(calc.)	0.60			0.75			1.16		
	st.dev.(D1078-A:11)	1.041			0.457			0.717		
	R(D1078-A:11)	2.91			1.28			2.01		
	compare									
	R(D1078-M:11)	2.00			1.21			2.44		

Lab 323 first reported 184.8



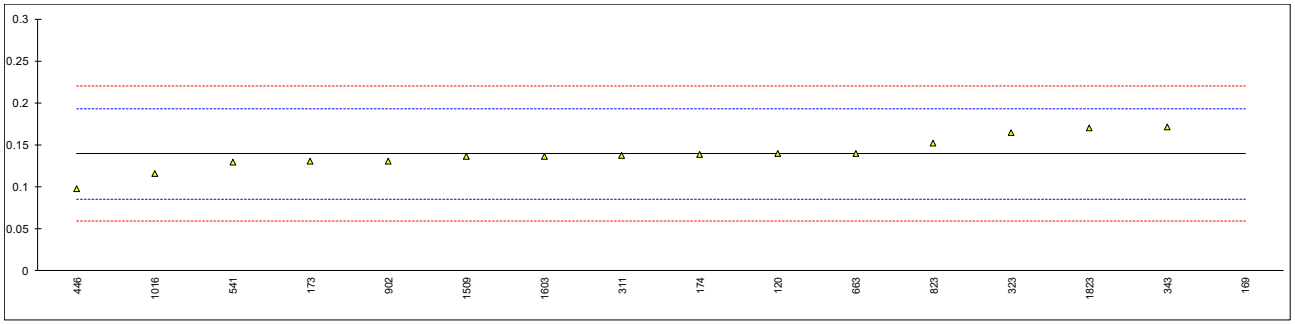


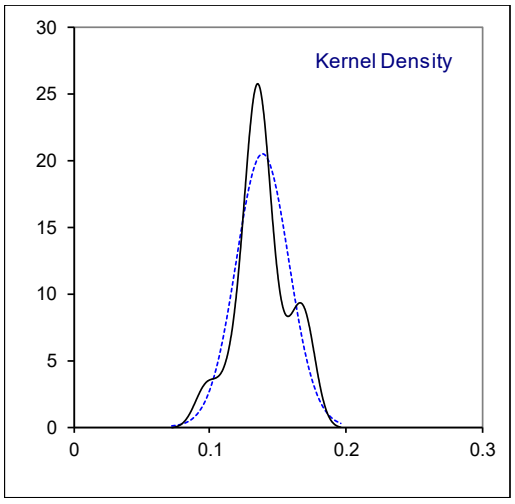


Determination of Iron as Fe on sample #19210; results in mg/kg

lab	method	value	mark	z(targ)	remarks
120	E394	0.140		0.03	
169	E394	6.9	G(0.01)	252.15	
171		-----		-----	
173	E394	0.13		-0.34	
174	E202	0.138		-0.04	
311	E1615	0.137		-0.08	
323	E394	0.164		0.93	
334		-----		-----	
343	E1615	0.171		1.19	
347		-----		-----	
444		-----		-----	
446	E202	0.098		-1.53	
541	E394	0.129		-0.38	
551		-----		-----	
663	E394	0.140		0.03	
823	E394	0.152		0.48	
902	E394	0.13		-0.34	
1016	NEN6966	0.116		-0.86	
1158		-----		-----	
1509	E394	0.136		-0.12	
1603	In house	0.136		-0.12	
1823	E394	0.170		1.15	
6111		-----		-----	
6262		-----		-----	

normality	OK
n	15
outliers	1
mean (n)	0.1391
st.dev. (n)	0.01941
R(calc.)	0.0544
st.dev.(E394:15)	0.02681
R(E394:15)	0.0751

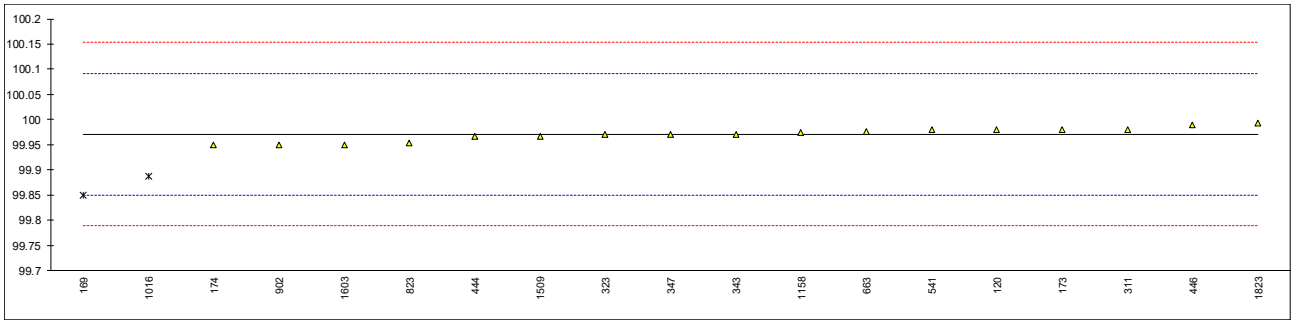


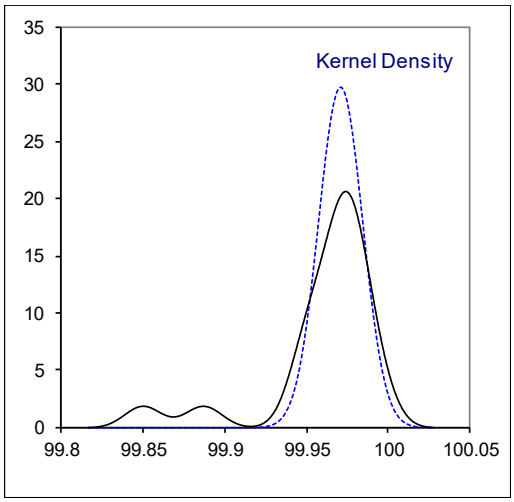


Determination of Purity by GC as received on sample #19210; results in %M/M

lab	method	value	mark	z(targ)	remarks
120	INH-CM	99.98		0.15	
169	E2409	99.85	C,DG(0.05)	-1.99	first reported 99.92
171		-----		-----	
173	INH-0540	99.98		0.15	
174	INH-0540	99.95		-0.34	
311	INH-103	99.98		0.15	
323	E2409	99.97		-0.01	
334		-----		-----	
343	INH-CM	99.97		-0.01	
347	E2409	99.970		-0.01	
444	INH-CM687	99.9667		-0.07	
446	INH-CM	99.99		0.32	
541	INH-CM687	99.979		0.14	
551		-----		-----	
663	E2409	99.976		0.09	
823	E2409	99.9538		-0.28	
902	INH-72	99.95		-0.34	
1016	E202	99.887	C,DG(0.05)	-1.38	first reported 99.912
1158	In house	99.975		0.07	
1509	E202	99.967		-0.06	
1603	In house	99.95		-0.34	
1823	E202	99.994		0.38	
6111		-----		-----	
6262		-----		-----	

normality	OK
n	17
outliers	2
mean (n)	99.9707
st.dev. (n)	0.01345
R(calc.)	0.0377
st.dev.(E202:18)	0.06071
R(E202:18)	0.17

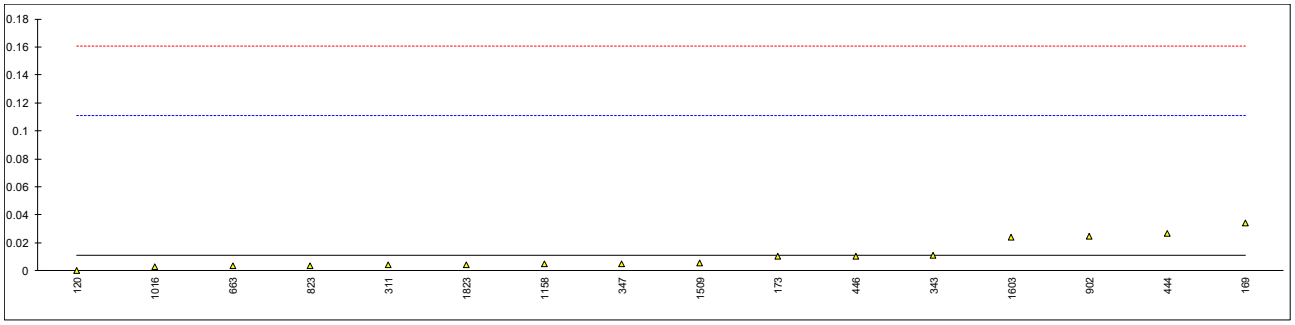


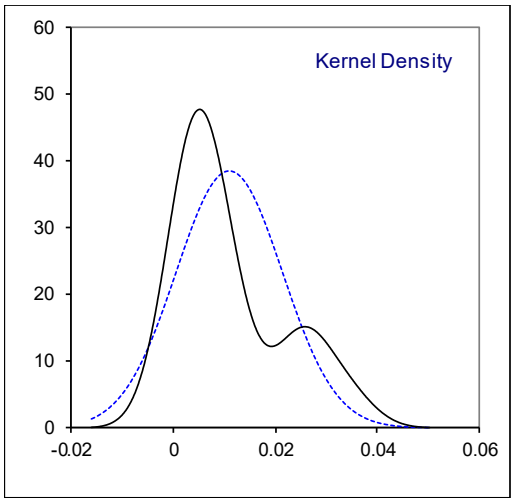


Determination of Dipropylene Glycol on sample #19210; results in %M/M

lab	method	value	mark	z(targ)	remarks
120	INH-CM	0.00		-0.22	
169	E2409	0.034		0.46	
171		-----		-----	
173	INH-0540	0.01		-0.02	
174		-----		-----	
311	INH-103	0.004		-0.14	
323	E202	<0.01		-----	
334		-----		-----	
343	INH-CM	0.011		0.00	
347	E2409	0.0051		-0.12	
444	INH-CM687	0.0266		0.31	
446	INH-CM	0.01		-0.02	
541	INH-CM687	<0.0023		-----	
551		-----		-----	
663	E2409	0.0032		-0.15	
823	E2409	0.0038		-0.14	
902	INH-72	0.0249		0.28	
1016	E202	0.003		-0.16	
1158	In house	0.005		-0.12	
1509	E202	0.0056		-0.11	
1603	In house	0.0238		0.26	
1823	E202	0.0040		-0.14	
6111		-----		-----	
6262		-----		-----	

normality	suspect
n	16
outliers	0
mean (n)	0.01087
st.dev. (n)	0.010414
R(calc.)	0.02916
st.dev.(E202:18)	0.050000
R(E202:18)	0.14

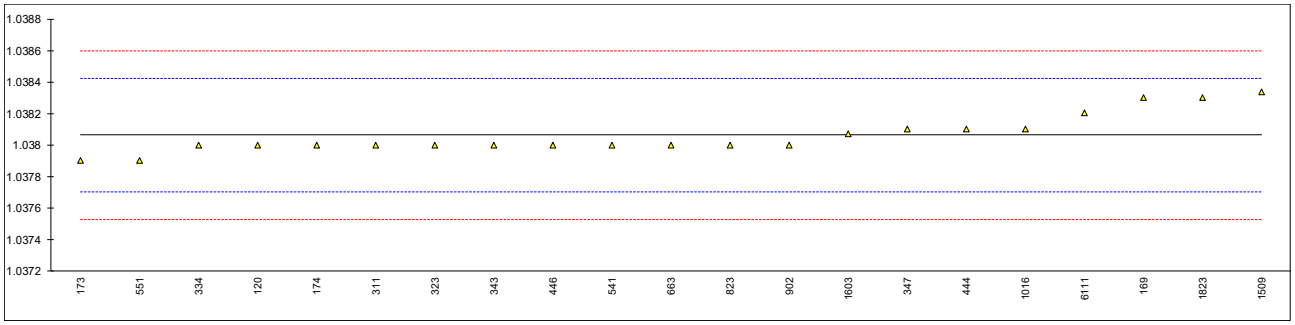


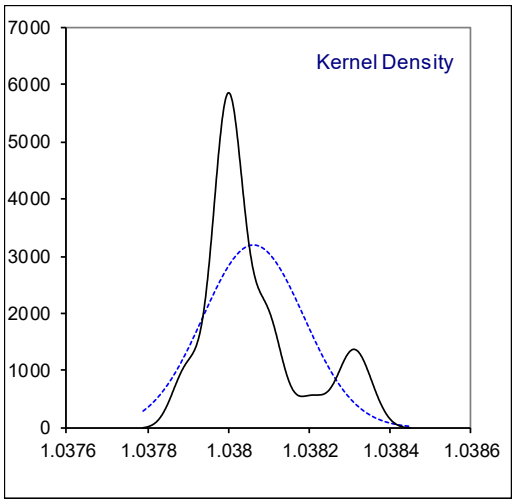


Determination of Specific Gravity at 20/20°C on sample #19210;

lab	method	value	mark	z(targ)	remarks
120	D4052	1.03800		-0.35	
169	D4052	1.0383		1.33	
171		-----		-----	
173	D4052	1.0379		-0.91	
174	D4052	1.0380		-0.35	
311	D4052	1.0380		-0.35	
323	E202	1.0380		-0.35	
334	D4052	1.038		-0.35	
343	D4052	1.0380		-0.35	
347	D4052	1.0381		0.21	
444	D4052	1.0381		0.21	
446	D4052	1.0380		-0.35	
541	D4052	1.0380		-0.35	
551	D4052	1.0379		-0.91	
663	D4052	1.0380		-0.35	
823	D4052	1.0380		-0.35	
902	D4052	1.0380		-0.35	
1016	D4052	1.0381	C	0.21	first reported 0.9982
1158		-----		-----	
1509	D4052	1.03834		1.55	
1603	In house	1.03807		0.04	
1823	D4052	1.0383		1.33	
6111	D5355	1.0382054		0.80	
6262		-----		-----	

normality	suspect
n	21
outliers	0
mean (n)	1.03806
st.dev. (n)	0.000125
R(calc.)	0.00035
st.dev.(E202:18)	0.000179
R(E202:18)	0.0005

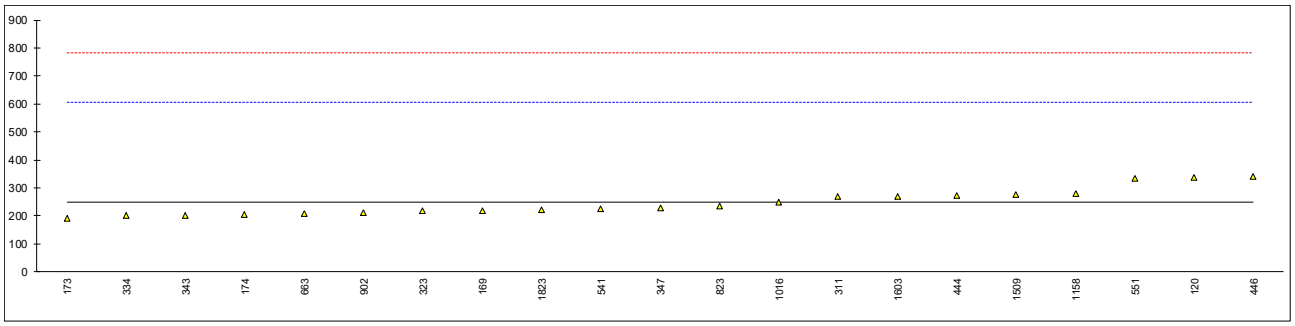


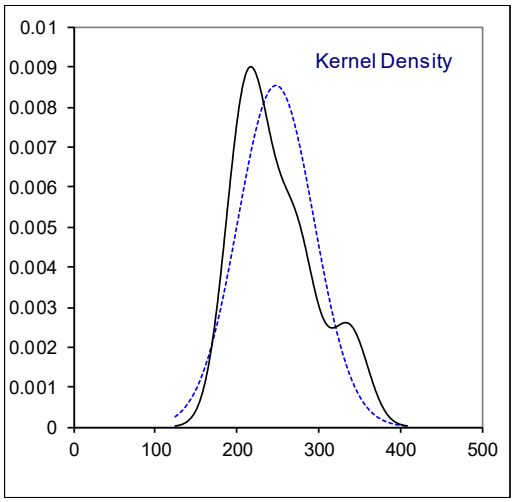


Determination of Water on sample #19210; results in mg/kg

lab	method	value	mark	z(targ)	remarks
120	E203	337.3		0.50	
169	E1064	218		-0.16	
171		-----		-----	
173	E203	192		-0.31	
174	E203	203		-0.25	
311	D1364	270	C	0.13	first reported 0.027 mg/kg
323	E1064	218		-0.16	
334	E1064	200		-0.26	
343	E1064	200		-0.26	
347	E1064	230		-0.10	
444	E203	274	C	0.15	first reported 0.0274 mg/kg
446	E203	340		0.52	
541	E1064	224	C	-0.13	first reported 0.0224 mg/kg
551	E1064	333		0.48	
663	E1064	208.0		-0.22	
823	E1064	236		-0.06	
902	E1064	210		-0.21	
1016	D1364	250		0.02	
1158	E203	280		0.18	
1509	E203	277.5		0.17	
1603	In house	270	C	0.13	first reported 0.0270 mg/kg
1823	E1064	221.4		-0.14	
6111		-----		-----	
6262		-----		-----	

normality	OK
n	21
outliers	0
mean (n)	247.248
st.dev. (n)	46.668
R(calc.)	130.671
st.dev.(E202:05)	178.571
R(E202:05)	500
compare	
R(E1064:16)	42.279





APPENDIX 2

Number of participants per country

1 lab in ARGENTINA
2 labs in BELGIUM
1 lab in BRAZIL
1 lab in CHINA, People's Republic
1 lab in FRANCE
1 lab in GERMANY
1 lab in KUWAIT
2 labs in NETHERLANDS
1 lab in ROMANIA
1 lab in SINGAPORE
1 lab in SOUTH KOREA
2 labs in SPAIN
1 lab in THAILAND
1 lab in TURKEY
2 labs in UNITED KINGDOM
5 labs in UNITED STATES OF AMERICA

APPENDIX 3

Abbreviations:

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

Literature:

1 iis Interlaboratory Studies, Protocol for the Organisation, Statistics & Evaluation, June 2018
2 ASTM E178:02
3 ASTM E1301:03
4 ISO 5725:86
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6 ISO 13528:05
7 M. Thompson and R. Wood, J. AOAC Int, 76, 926, (1993)
8 W.J. Youden and E.H. Steiner, Statistical Manual of the AOAC, (1975)
9 IP 367:84
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11 P.L. Davies, Fr. Z. Anal. Chem, 331, 513, (1988)
12 J.N. Miller, Analyst, 118, 455, (1993)
13 Analytical Methods Committee, Technical brief, No 4, January 2001.
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15 Bernard Rosner, Percentage Points for a Generalized ESD Many-Outlier Procedure, Technometrics, 25(2), 165-172, (1983)
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