Results of Proficiency Test
Ethanol (REN & Food)
November 2014

CONTENTS

Appendices:

1. INTRODUCTION

Since 2007, a proficiency test for REN/Food grade Ethanol is organised every year by the Institute for Interlaboratory Studies. During the planning of the annual proficiency testing program 2014/2015, it was decided to continue the round robin for the analysis of REN/Food grade Ethanol.

In this interlaboratory study, 28 laboratories in 17 different countries have participated. See appendix 2 for the number of participants per country. In this report, the results of the 2014 proficiency test are presented and discussed. This report is also electronically available through the iis internet site www.iisnl.com.

2 SET-UP

The Institute for Interlaboratory Studies (iis) in Spijkenisse, the Netherlands, was the organiser of this proficiency test. Analysis for fit-for-use and homogeneity testing were subcontracted. It was decided to send one sample (1* 0.5 L of 95% REN/Food grade Ethanol, labelled #14232). Participants were requested to report rounded and unrounded results. The unrounded results were preferably used for statistical evaluation.

2.1 ACCREDITATION

The Institute for Interlaboratory Studies in Spijkenisse, the Netherlands, is accredited in agreement with ISO/IEC 17043:10, (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% confidentially of participant's data. Also customer's satisfaction is measured on regular basis by sending out questionnaires.

2.2 PROTOCOL

The protocol followed in the organisation 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 April 2014 (iis-protocol, version 3.3).
The protocol can be downloaded from iis website http://www.iisnl.com.

2.3 CONFIDENTIALITY STATEMENT

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

2.4 SAMPLES

The necessary bulk material for sample #14232 was obtained from a local trader. The approximately 50 litre bulk sample was, after homogenisation in a precleaned drum, divided over 50 amber glass bottles of 0.5 L and labelled #14232. The homogeneity of these subsamples was checked by determination of Density in accordance with ASTM D4052 and Water in accordance with ASTM D1364 on 8 stratified randomly selected samples.

Sample	Density @ 20ºC in kg/L	Water in %M/M
Sample #14232-1	0.80594	5.605
Sample #14232-2	0.80594	5.638
Sample #14232-3	0.80594	5.644
Sample #14232-4	0.80594	5.644
Sample #14232-5	0.80594	5.649
Sample #14232-6	0.80594	5.634
Sample #14232-7	0.80594	5.648
Sample #14232-8	0.80595	5.652

table 1: Homogeneity test results of subsamples #14232

From the test results of table 1, the repeatabilities were calculated and compared with 0.3 times the corresponding target reproducibility in agreement with the procedure of ISO 13528, Annex B2 in the next table:

	Density @ 20ºC in kg/L	Water in %M/M
r (Observed)	0.00001	0.042
reference method	ISO12185:96	ASTM D1364:12
0.3 * R (ref. method)	0.00015	0.043

table 2: Repeatability of subsamples #14232

The repeatabilities of the results from the homogeneity test were equal or less than the requirements of the respective standards. Therefore, homogeneity of all the prepared subsamples was assumed.

To each of the participating laboratories 1*0.5 L bottle of sample #14232 was sent on November 12, 2014.

2.5 STABILITY OF THE SAMPLES

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

2.6 ANALYSES

The participants were asked to determine on sample #14232: Density at 20°C, Non-volatile matter, Permanganate Time Test, pHe, Purity on dry basis, Strength (in %M/M and %V/V), Water (titrimetric) and UV transmittance at 300, 270, 260, 250, 240, 230 and 220nm.

To get comparable results a detailed report form, on which the units were prescribed as well as the required standards and a letter of instructions were prepared and made available on the data entry portal www.kpmd.co.uk/sgs-iis/. The detailed report form was also made available for download on the iis website www.iisnl.com.
A SDS and a form to confirm receipt of the samples were added to the sample package.

3 RESULTS

During four weeks after sample despatch, the results of the individual laboratories were received. The original reported results are tabulated per determination in appendix 1 of this report. The laboratories are presented by their code numbers.

Directly after deadline, a reminder fax was sent to those laboratories that had not yet reported any results at that moment.
Shortly after the deadline, the available results were screened for suspect data. A 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 results. Additional or corrected results are used for data analysis and original results are placed under 'Remarks' in the result tables in appendix 1.

3.1 STATISTICS

Statistical calculations were performed as described in the report 'iis Interlaboratory Studies: Protocol for the Organisation, Statistics and Evaluation' (iis-protocol, version 3.3) of April 2014.

For the statistical evaluation the *unrounded* (when available) figures were used instead of the rounded results. 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. Not all data sets proved to have a normal distribution, in which cases the statistical evaluation of the results should be used with due care.

According to ISO 5725 the original 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 (ref. 15). 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. When the uncertainty passed the evaluation, no remarks are made in the report. However, when the uncertainty failed the evaluation it is mentioned in the report and it will have consequences for the evaluation of the test results.

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 analysis 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 standard. 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 (see appendix 3, nos.13-14). Also a normal Gauss curve was projected over the Kernel Density Graph for reference.

3.3 Z-SCORES

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

The z-scores were calculated according to:

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

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

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, this in order to evaluate whether the reported test result is fit-for-use.

4.   EVALUATION

In this proficiency test, some problems were encountered with the despatch of the samples. Four participants reported results after the final reporting date and three participants did not report any results at all. Not all laboratories were able to perform all analysis requested.
In total 25 laboratories reported 210 numerical results. Observed were 13 outlying results, which is 6.2%. In proficiency studies, outlier percentages of 3% - 7.5% are normal.

4.1   EVALUATION PER TEST

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

In the iis PT reports, ASTM methods are referred to with a number (e.g. D1363) and an added designation for the year that the method was adopted or revised (e.g. D1363:06). If applicable, a designation in parentheses is added to designate the year of reapproval (e.g. D1363:06(2011)). In the results tables of Appendix 1 only the method number and year of adoption or revision e.g. D1363:06 will be used.

All original data sets proved to have a normal Gaussian distribution

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

| Nonvolatile matter: | Six participants reported a "less than" result and eleven a numerical value. The determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of ASTM D1353:13. |

Permanganate Time Test: This determination was problematic. No statistical outliers were observed. However, the calculated reproducibility is not in agreement with the requirements of ASTM D1363:06(2011).

pHe: This determination was very problematic. No statistical outliers were observed. However, the calculated reproducibility was not at all in agreement with the requirements of ASTM D6423:08. Looking at the Kernel Density graph, the data appear to have a bimodal distribution. When both sets of data are evaluated separately the spread becomes smaller.

Purity on dry basis: Regretfully, no standard test method with precision data exists. Therefore no significant conclusions could be drawn. No statistical outliers were observed. The calculated reproducibility is large in comparison to the calculated reproducibility of the previous proficiency test iis13C13 of November 2013 (0.018 vs 0.012).

Strength(%M/M): This determination may not be problematic. One statistical outlier was observed. Regretfully, no standard test method with precision data exists. The calculated reproducibility, after rejection of the statistical outlier, is small in comparison to the calculated reproducibility in the previous proficiency test iis13C13 of November 2013 (0.053 vs 0.075).

Strength (%V/V): This determination may not be problematic. Two statistical outlier were observed. However, the calculated reproducibility after rejection of the statistical outlier is in agreement with the reproducibility derived from the OIML table and ISO12185:96. The spread found is small in comparison to the calculated reproducibility of the previous proficiency test iis13C13 of November 2013 (0.028 vs. 0.041).

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 D1364:02(2012).

UV absorbance: Regretfully, no standard test method with precision data exists. Therefore no significant conclusions were drawn.

Laboratory 357 and 859 reported results obtained with a 50 mm cell, these were converted to results of a 10 mm cell by dividing them by 5. Test results from laboratories 551, 1242 and 1835 were outliers for a number of wavelengths. Since the test results are not independent, the other values were excluded. In total 9 outlying results were found and 10 other test results were excluded.

For 270 nm, 230 nm and 220 nm, the calculated reproducibilities are small in comparison with the calculated reproducibilities from the previous proficiency test iis13C13 of November 2013. For 300 nm and 240 nm, the calculated reproducibilities are larger than in the PT of 2013.

4.2 PERFORMANCE EVALUATION FOR THE GROUP OF LABORATORIES

A comparison has been made between the reproducibility as declared by the relevant standard and the reproducibility as found for the group of participating laboratories. The average results per sample, calculated reproducibilities and reproducibilities derived from literature standards (in casu ASTM, EN standards) or previous proficiency tests are compared in the next table.

Parameter	unit	n	average	2.8 *sd_R	R (lit)
Density @ 20°C	kg/L	22	0.8060	0.0001	0.0005
Nonvolatile matter	mg/100mL	11	0.8	1.2	2.1
Permanganate Time Test	min.	13	22.9	10.6	5.8
pHe		11	6.94	1.35	0.52
Purity on dry basis	%M/M	9	99.994	0.018	(0.012)
Strength	%M/M	13	94.36	0.05	(0.08)
Strength	%V/V	17	96.36	0.03	0.06
Water	%M/M	14	5.589	0.232	0.142
UV-absorbance 300 nm		11	0.001	0.003	(0.002)
UV-absorbance 270 nm		11	0.019	0.005	(0.018)
UV-absorbance 260 nm		10	0.021	0.007	n.a.
UV-absorbance 250 nm		11	0.044	0.009	n.a.
UV-absorbance 240 nm		12	0.115	0.016	(0.011)
UV-absorbance 230 nm		12	0.213	0.020	(0.035)
UV-absorbance 220 nm		12	0.306	0.036	(0.456)

Table 3: Reproducibilities of sample #14232

() Results between brackets are compared with the observed reproducibility of the previous proficiency test.

4.3   COMPARISON OF THE PROFICIENCY TEST OF NOVEMBER 2014 WITH PREVIOUS PTS

	November 2014	*November 2013*	*November 2012*	*November 2011*	*November 2010*
Number of reporting labs	25	24	24	23	28
Number of results reported	210	160	169	151	189
Number of statistical outliers	13	9	5	9	13
Percentage outliers	6.2%	5.6%	3.0%	6.0%	6.9%

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 standards. The conclusions are given in the following table:

Parameter	*November 2014*	*November 2013*	*November 2012*	*November 2011*	*November 2010*
Density @ 20°C	++	++	++	++	++
Nonvolatile matter	++	n.e.	++	n.e	++
Permanganate Time Test	-	+	--	(--)	(--)
pHe	--	n.e.	n.e.	n.e.	n.e.
Purity on dry basis	(-)	(-)	(+)	(+)	(--)
Strength %M/M	(+)	(+)	(--)	++	(--)
Strength %V/V	+	+	--	++	++
Water	-	--	--	+/-	++
UV-absorbance 300 nm	(-)	(++)	(-)	(--)	(++)
UV-absorbance 270 nm	(++)	(+/-)	(--)	(-)	(++)
UV-absorbance 240 nm	(-)	(++)	(+/-)	(-)	(++)
UV-absorbance 230 nm	(+)	(-)	(++)	(-)	(+)
UV-absorbance 220 nm	(++)	(--)	(--)	(-)	(-)

Table 5: comparison determinations of sample #14232 against the standard

() results between brackets are compared with the observed reproducibility of the previous round robin

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

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

APPENDIX 1

Determination of Density at 20°C on sample #14232; results in kg/L

lab	method	value	mark	z(targ)	remarks
273	D4052	0.8059		-0.29	
311	D4052	0.80594		-0.06	
357	D4052	0.80586		-0.51	
446	D4052	0.8059		-0.29	
522		-----		-----	
529	D4052	0.8059		-0.29	
541	D4052	0.8059		-0.29	
551	D4052	0.80600		0.27	
559		-----		-----	
786	D4052	0.8059		-0.29	
859	D4052	0.8060		0.27	
912	D4052	0.8060		0.27	
913	D4052	0.8060		0.27	
922	D4052	0.80597		0.11	
1126	D4052	0.80598	C	0.16	First reported: 805.98
1201		-----		-----	
1205	in house	0.805992		0.23	
1241	INH-50	0.806017		0.37	
1242	D4052	0.805989		0.21	
1263	ISO12185	0.8059395		-0.07	
1574		-----		-----	
1605	D4052	0.805947		-0.02	
1726	D4052	0.80595		-0.01	
1727	D4052	0.80594		-0.06	
1729		-----		-----	
1835	D4052	0.8060		0.27	
1927	INH-4052	0.8059		-0.29	
1933		-----		-----	

|	
normality	OK
n	22
outliers	0
mean (n)	0.805951
st.dev. (n)	0.0000463
R(calc.)	0.000130
R(ISO12185:96)	0.000500

Kernel Density
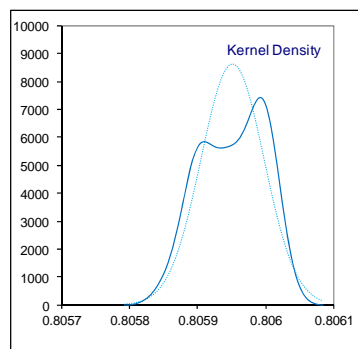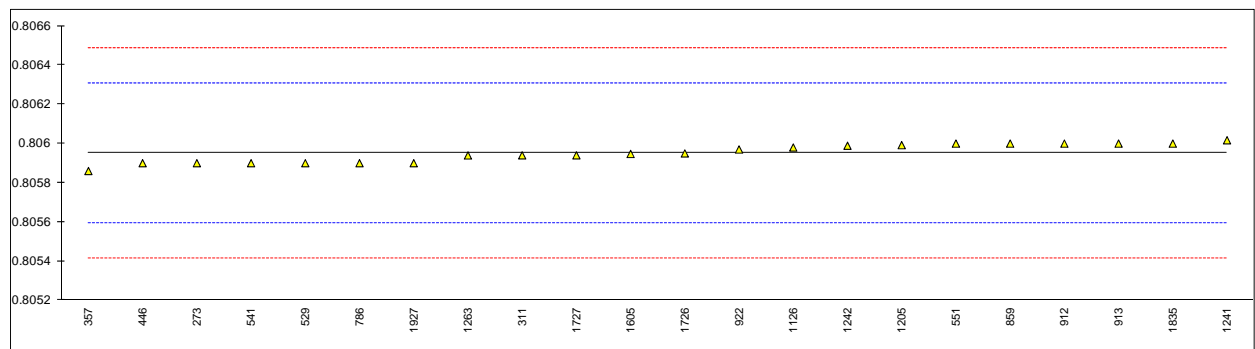
Determination of Nonvolatile matter on sample #14232; results in mg/100mL

lab	method	value	mark	z(targ)	remarks
273		-----		-----	
311	D1353	<10		-----	
357	D1353	0.6		-0.31	
446	D1353	1.4		0.75	
522		-----		-----	
529	D1353	0.2		-0.84	
541	D1353	<1		-----	
551	D1353	0.5		-0.45	
559		-----		-----	
786	D1353	0.70		-0.18	
859	D1353	<1		-----	
912	D1353	0.5		-0.45	
913	D1353	<1.0		-----	
922	D1353	0.9		0.08	
1126		-----		-----	
1201	D1353	1.6		1.01	
1205		-----		-----	
1241		-----		-----	
1242		-----		-----	
1263	D1353	<1.0		-----	
1574		-----		-----	
1605		-----		-----	
1726	EN15691	1.30		0.62	
1727		0.7		-0.18	
1729	D1353	0.80		-0.05	
1835	EN15691	<10		-----	
1927		-----		-----	
1933		-----		-----	

normality	OK
n	11
outliers	0
mean (n)	0.84
st.dev. (n)	0.430
R(calc.)	1.20
R(D1353:13)	2.11
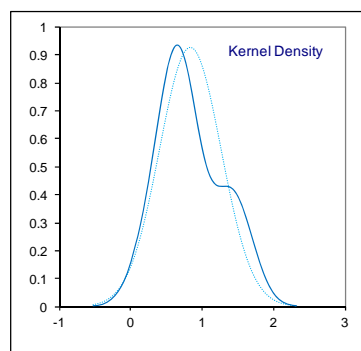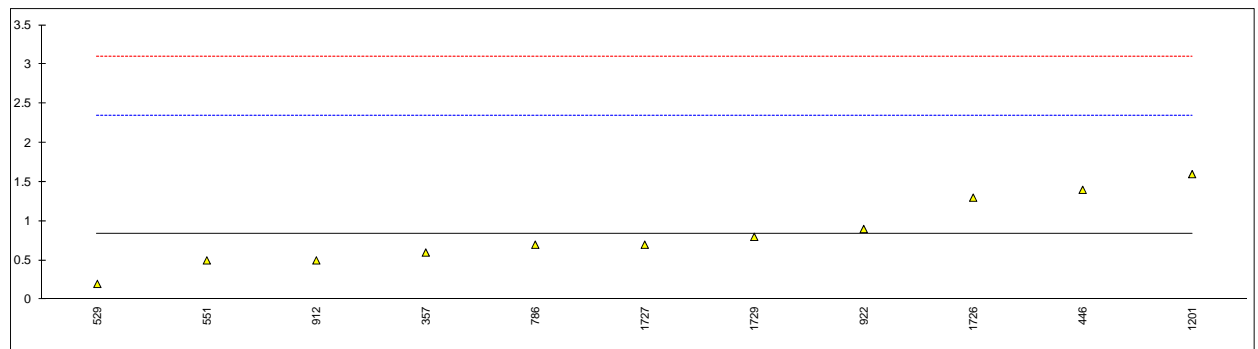
Determination of Permanganate Time Test @ 15 ^{o}C on sample #14232; results in minutes

lab	method	value	mark	z(targ)	remarks
273		-----		-----	
311	D1363	18		-2.36	
357	D1363	20		-1.38	
446		-----		-----	
522		-----		-----	
529	D1363	31.0		3.97	
541	D1363	22		-0.41	
551	D1363	28		2.51	
559		-----		-----	
786	D1363	25		1.05	
859	D1363	23		0.07	
912	D1363	26		1.53	
913	D1363	20		-1.38	
922	D1363	23		0.07	
1126		-----		-----	
1201		-----		-----	
1205		-----		-----	
1241		-----		-----	
1242		-----		-----	
1263		-----		-----	
1574		-----		-----	
1605		-----		-----	
1726	D1363	20		-1.38	
1727		-----		-----	
1729	D1363	22		-0.41	
1835	D1363	19		-1.87	
1927		-----		-----	
1933		-----		-----	

normality	OK
n	13
outliers	0
mean (n)	22.85
st.dev. (n)	3.783
R(calc.)	10.59
R(D1363:06)	5.76

Kernel Density
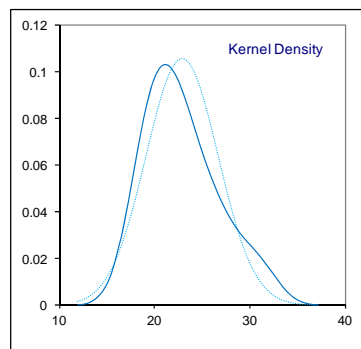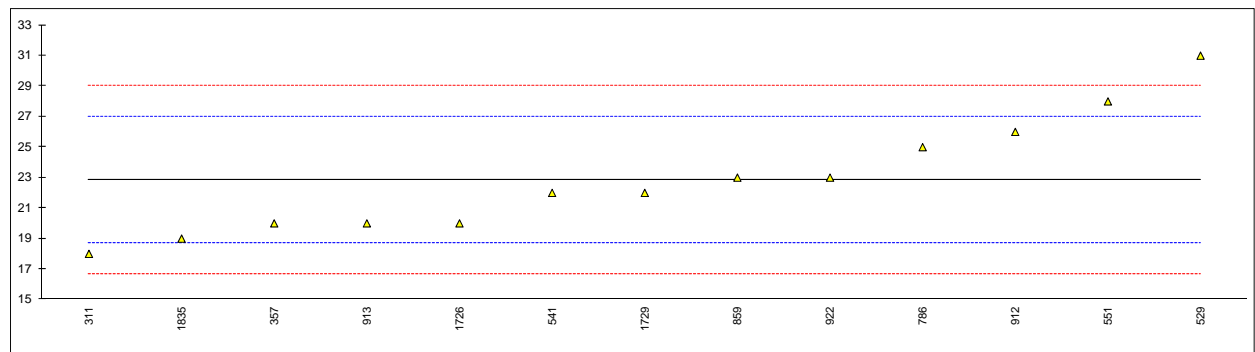
Determination of pHe on sample #14232;

lab	method	value	mark	z(targ)	remarks
273		-----		-----	
311	D6423	7.47		2.86	
357	D6423	7.5		3.02	
446		-----		-----	
522		-----		-----	
529	D6423	7.46		2.80	
541	D6423	7.40		2.48	
551	D6423	6.12		-4.41	
559		-----		-----	
786		-----		-----	
859		-----		-----	
912		-----		-----	
913	D6423	6.8		-0.75	
922	D6423	6.74		-1.07	
1126		-----		-----	
1201	EN15490	7.18		1.30	
1205		-----		-----	
1241		-----		-----	
1242		-----		-----	
1263		-----		-----	
1574		-----		-----	
1605		-----		-----	
1726	EN15490	6.61		-1.77	
1727		6.45		-2.63	
1729		-----		-----	
1835	EN15490	6.6		-1.83	
1927		-----		-----	
1933		-----		-----	

|			Group 1	Group 2
normality	OK			
n	11		6	5
outliers	0		0	0
mean (n)	6.939		6.553	7.402
st.dev. (n)	0.4828		0.2448	0.1293
R(calc.)	1.352		0.685	0.3621
R(D6423:08)	0.520		0.520	0.520
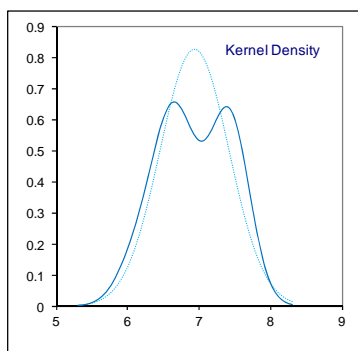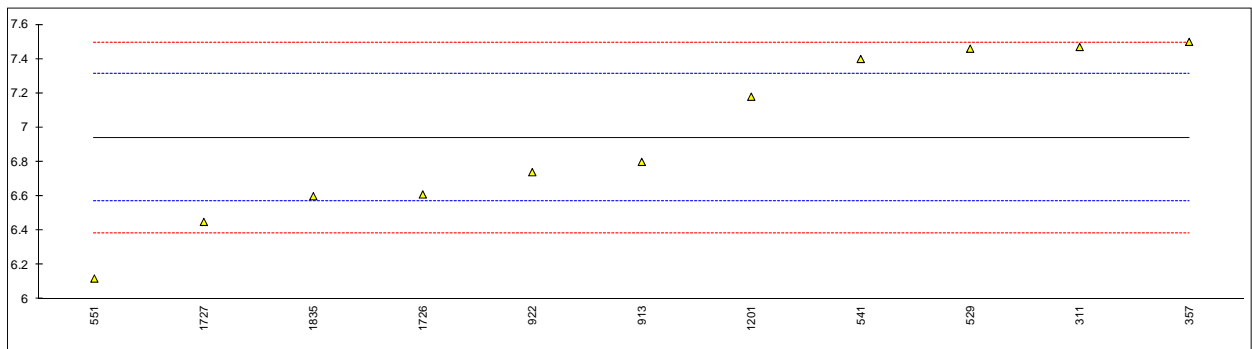
Determination of Purity of Ethanol on dry basis on sample #14232; results in %M/M

lab	method	value	mark	z(targ)	remarks
273		-----		-----	
311	INH-529	99.99		-----	
357	EN15721	>99.99		-----	
446		-----		-----	
522		-----		-----	
529		-----		-----	
541		-----		-----	
551	INH-1313	99.98139		-----	
559		-----		-----	
786		-----		-----	
859		99.996		-----	
912	INH-0001	99.99		-----	
913	D5501	99.99		-----	
922	INH-0001	99.9994		-----	
1126		-----		-----	
1201		-----		-----	
1205		-----		-----	
1241		-----		-----	
1242		-----		-----	
1263		-----		-----	
1574		-----		-----	
1605		-----		-----	
1726	EN15721	99.9991		-----	
1727		99.999		-----	
1729		-----		-----	
1835	in house	99.999		-----	
1927		-----		-----	
1933		-----		-----	

|		
normality	OK	
n	9	
outliers	0	
mean (n)	99.9938	
st.dev. (n)	0.00628	
R(calc.)	0.0176	
R(lit.)	unknown	Compare R(iis13C13) = 0.0123
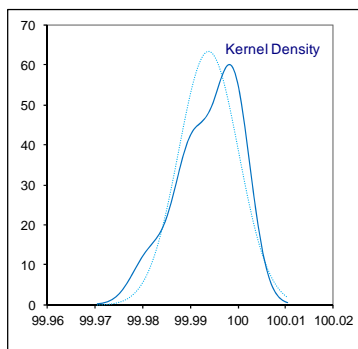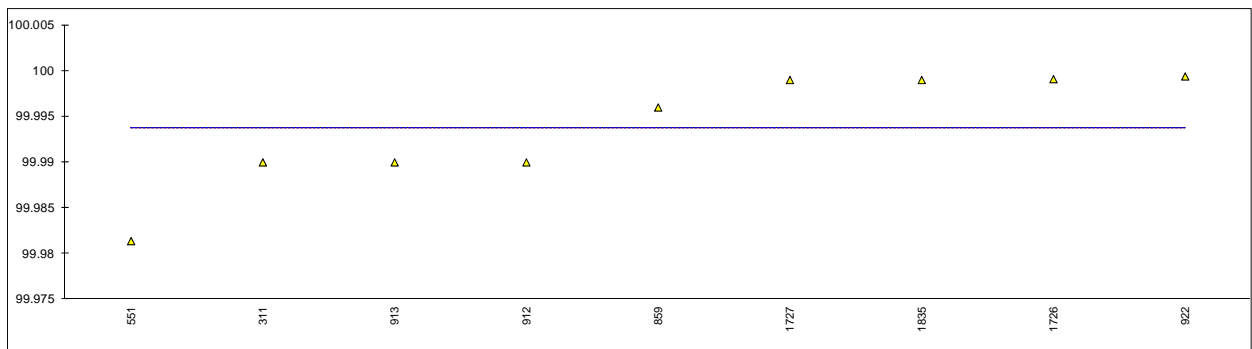
Determination of Strength on sample #14232; results in %M/M

lab	method	value	mark	z(targ)	remarks
273		-----		-----	
311	Table OIML	94.38		-----	
357	Table OIML	94.34		-----	
446		-----		-----	
522		-----		-----	
529	D4052	94.36		-----	
541	Table OIML	94.35		-----	
551	INH-15639	94.4		-----	
559		-----		-----	
786		-----		-----	
859	Table OIML	94.36		-----	
912	Table OIML	94.35		-----	
913	D5501	94.48	G(0.01)	-----	
922	Table OIML	94.36		-----	
1126		-----		-----	
1201		-----		-----	
1205	Table OIML	94.344		-----	
1241		-----		-----	
1242		-----		-----	
1263	Table OIML	94.38		-----	
1574		-----		-----	
1605		-----		-----	
1726	Table OIML	94.37		-----	
1727	Table OIML	94.36		-----	
1729		-----		-----	
1835	Table OIML	94.33		-----	
1927		-----		-----	
1933		-----		-----	

normality	OK	
n	13	
outliers	1	
mean (n)	94.360	
st.dev. (n)	0.0188	
R(calc.)	0.053	
R(lit.)	unknown	Compare R(iis13C13) = 0.075
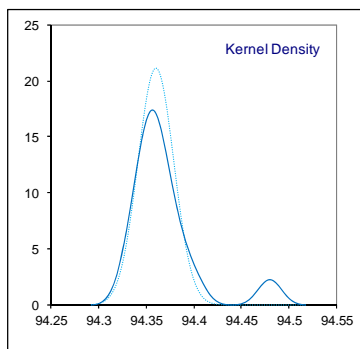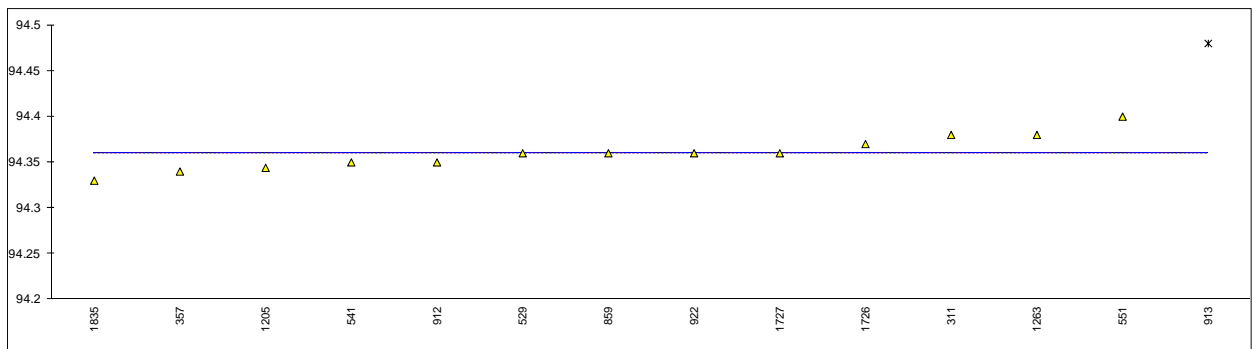
Determination of Strength on sample #14232; results in %V/V

lab	method	value	mark	z(targ)	remarks
273	Table OIML	96.37		0.52	
311	Table OIML	96.37		0.52	
357	Table OIML	96.35		-0.41	
446	Table OIML	96.40	G(0.05)	1.92	
522		-----		-----	
529	D4052	96.36		0.05	
541	Table OIML	96.36		0.05	
551	INH-15639	96.38		0.99	
559		-----		-----	
786		-----		-----	
859	Table OIML	96.36		0.05	
912	Table OIML	96.35		-0.41	
913		-----		-----	
922	Table OIML	96.36		0.05	
1126	Table OIML	96.35		-0.41	
1201		-----		-----	
1205	Table OIML	96.349		-0.46	
1241	INH-50	96.303	G(0.05)	-2.61	
1242	Table OIML	96.352		-0.32	
1263	Table OIML	96.37		0.52	
1574		-----		-----	
1605	Table OIML	96.360		0.05	
1726	Table OIML	96.36		0.05	
1727	Table OIML	96.36		0.05	
1729		-----		-----	
1835	Table OIML	96.34		-0.88	
1927		-----		-----	
1933		-----		-----	

|		
normality	OK	
n	17	
outliers	2	
mean (n)	96.359	
st.dev. (n)	0.0099	
R(calc.)	0.028	
R(OIML table)	0.060	Compare R(iis13C13) = 0.041
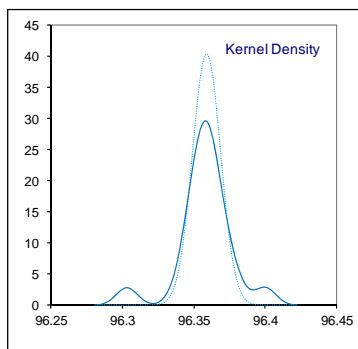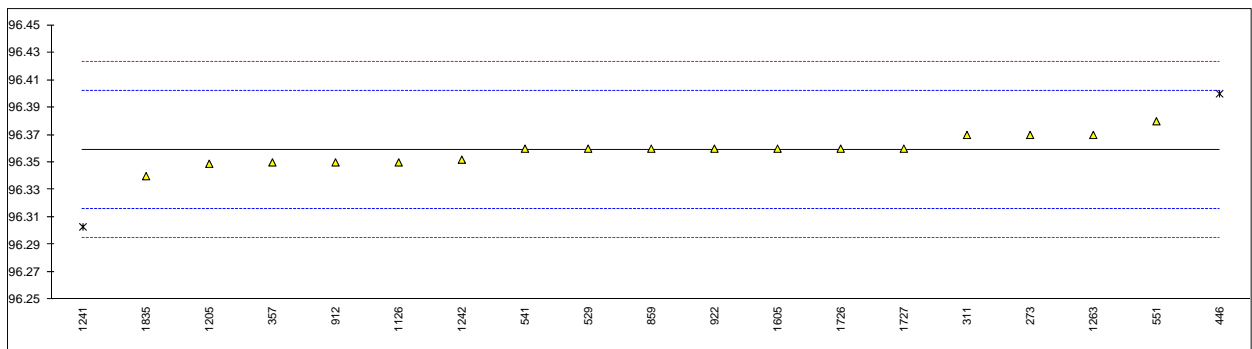
Determination of Water (Titrimetric) on sample #14232; results in %M/M

lab	method	value	mark	z(targ)	remarks
273	E203	5.670		1.60	
311	D1364	5.625		0.71	
357	E203	5.637		0.94	
446	E203	5.747		3.12	
522		-----		-----	
529	D1364	5.5598		-0.58	
541	E1064	5.555		-0.67	
551	D1364	5.578		-0.22	
559		-----		-----	
786	D1364	5.6242	C	0.69	First reported: 6.099
859	D1364	5.572		-0.34	
912	E203	5.641		1.02	
913	D1364	5.51		-1.56	
922	E203	5.6235		0.68	
1126		-----		-----	
1201		-----		-----	
1205		-----		-----	
1241		-----		-----	
1242		-----		-----	
1263		-----		-----	
1574	INH-76	5.4909		-1.94	
1605		-----		-----	
1726	D1364	5.9328	G(0.05)	6.78	
1727		5.4146		-3.45	
1729		-----		-----	
1835		-----		-----	
1927		-----		-----	
1933		-----		-----	

normality	OK
n	14
outliers	1
mean (n)	5.5891
st.dev. (n)	0.08272
R(calc.)	0.2316
R(D1364:02)	0.1418
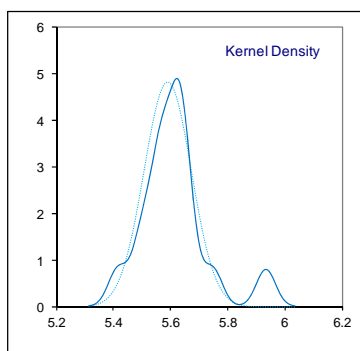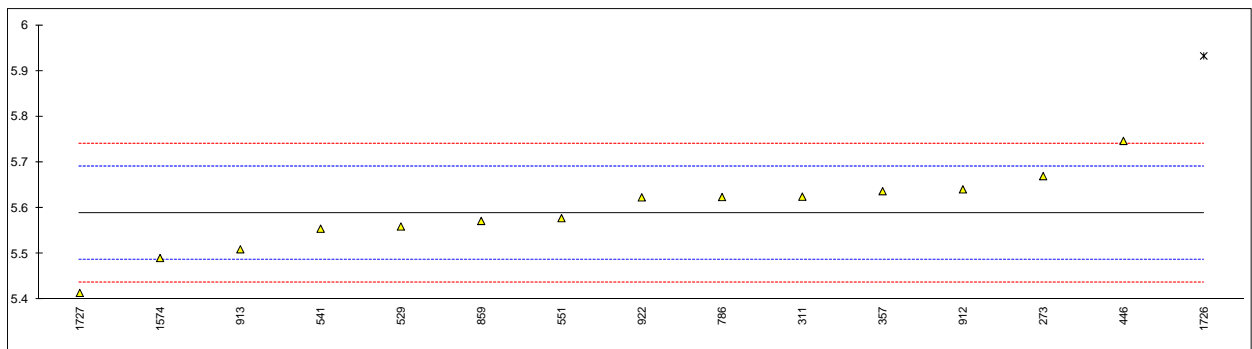
Determination of UV absorbance on sample #14232;

| lab	method	cuvette	300nm	270nm	260nm	250nm	240nm	230nm	220nm	Pass/Fail
273	IMPCA004	-----	0.0004	0.0174	0.0175	0.0385	0.1046	0.2039	0.2961	-----
311	INH-094	10 mm	0.0013	0.0206	0.0237	0.0480	0.1205	0.2138	0.2971	Fail
357	INH-13	50 mm	0.0017*	0.0202*	0.0217*	0.0445*	0.1165*	0.2152*	0.3096*	Fail
446	INH-CM13	10 mm	0	0.0176	0.0191	0.0418	0.1150	0.2107	0.3057	Fail
522		-----	-----	-----	-----	-----	-----	-----	-----	-----
529		10 mm	0.0001	0.0182	0.0194	0.0418	0.1109	0.2118	0.3062	Pass
541		-----	-----	-----	-----	-----	-----	-----	-----	-----
551	INH-3063	10 mm	**_0.011_**	**_0.030_**	**_0.031_**	0.046	0.111	0.210	0.282	Fail
559		-----	-----	-----	-----	-----	-----	-----	-----	-----
786		-----	-----	-----	-----	-----	-----	-----	-----	-----
859		50 mm	0.0022*	0.020*	0.022*	0.0456*	0.1198*	0.2236*	0.3256*	Fail
912		-----	-----	-----	-----	-----	-----	-----	-----	-----
913		-----	-----	-----	-----	-----	-----	-----	-----	-----
922	INH-UV	10 mm	0.0006	0.0186	0.0201	0.0429	0.1151	0.2131	0.3076	Fail
1126		-----	-----	-----	-----	-----	-----	-----	-----	-----
1201		-----	-----	-----	-----	-----	-----	-----	-----	-----
1205		-----	-----	-----	-----	-----	-----	-----	-----	-----
1241		-----	-----	-----	-----	-----	-----	-----	-----	-----
1242		10 mm	**_-0.007_**	**_0.008_**	**_0.011_**	**_0.031_**	**_0.097_**	**_0.197_**	**_0.274_**	**_Pass_**
1263		-----	-----	-----	-----	-----	-----	-----	-----	-----
1574		-----	-----	-----	-----	-----	-----	-----	-----	-----
1605		10 mm	0.002	0.017	-----	-----	0.108	0.200	0.298	-----
1726	in house	10 mm	0.00149	0.02048	0.02165	0.04495	0.11880	0.21580	0.30716	Pass
1727		10 mm	0.00363	0.02220	0.02450	0.05010	0.125	0.226	0.33	Pass
1729	in house	10 mm	0.000	0.0165	0.0181	0.0410	0.1137	0.2114	0.3054	-----
1835		10mm	**_0.012_**	**_0.032_**	**_0.038_**	**_0.066_**	**_0.140_**	**_0.250_**	**_0.340_**	**_Pass_**
1927		-----	-----	-----	-----	-----	-----	-----	-----	-----
1933		-----	-----	-----	-----	-----	-----	-----	-----	-----
	normality		OK	OK	OK	OK	OK	OK	OK	
	n		11	11	10	11	12	12	12	11
	outliers		3	0 (+3ex)	3	2	0 (+2ex)	1 (+1ex)	0 (+2ex)	0 (+2ex)
	mean (n)		0.0012	0.0190	0.0208	0.0441	0.1149	0.2129	0.3059	
	st.dev. (n)		0.00114	0.00184	0.00232	0.00333	0.00573	0.00716	0.01277	Fail: 6
	R(calc.)		0.0032	0.0052	0.0065	0.0093	0.0161	0.0201	0.0358	Pass:3
	R(lit)		unknown	unknown	unknown	unknown	unknown	unknown	unknown	(+2ex)
	R(iis13C13)		0.0023	0.0183			0.0105	0.0350	0.4560	

*) Lab 357 and 859 used a 50 mm cell. The reported values were divided by 5 for evaluation.
   Lab 357 reported: 0.0086 – 0.1008 – 0.1085 – 0.2226 – 0.5826 – 1.0758 – 1.5481
   Lab 859 reported: 0.011 – 0.102 – 0.110 – 0.228 – 0.599 – 1.118 – 1.628

Bold and underlined results: outliers according to Dixon/Grubbs
Bold and italic results: results of lab 551, 1242 and 1835 excluded, see §4.1
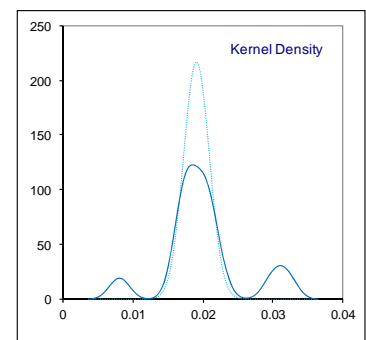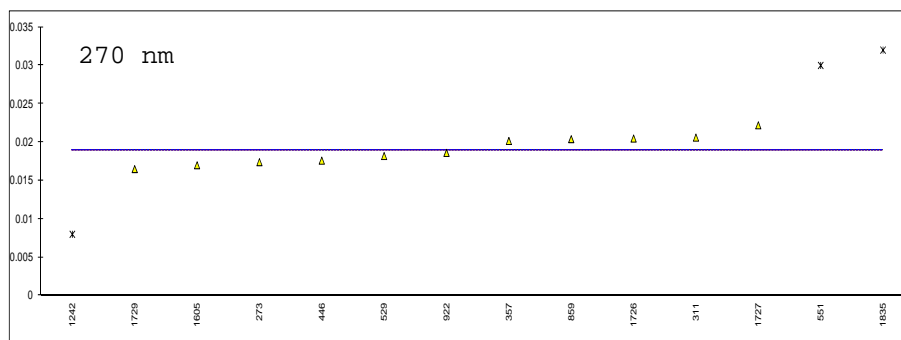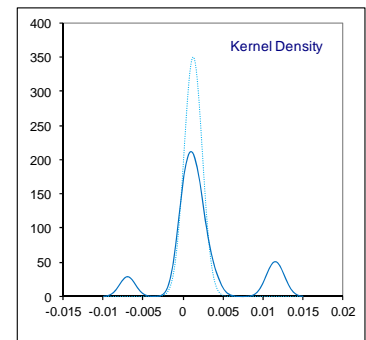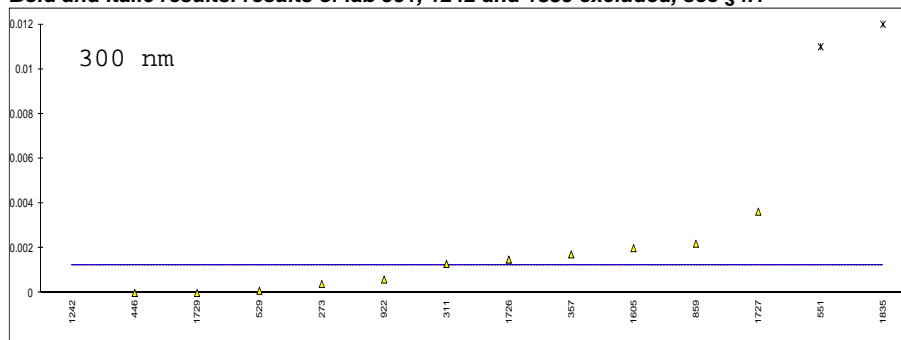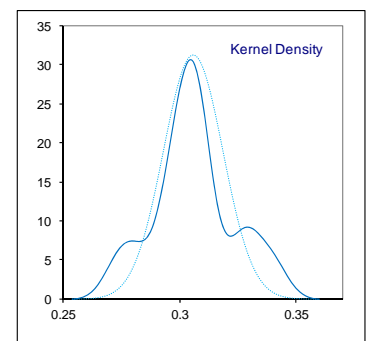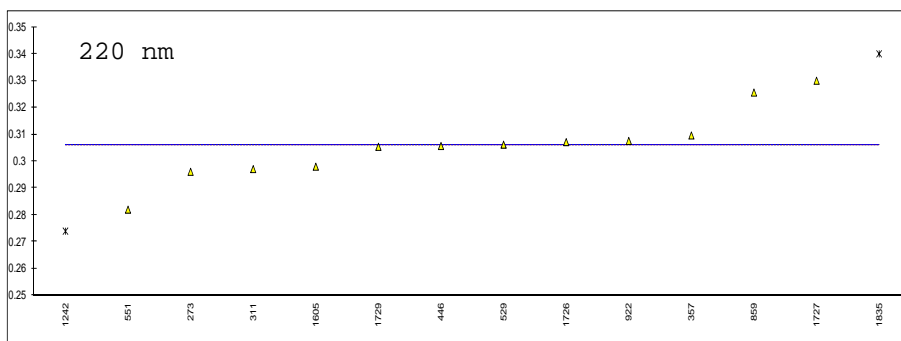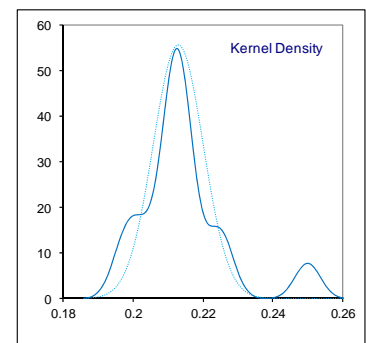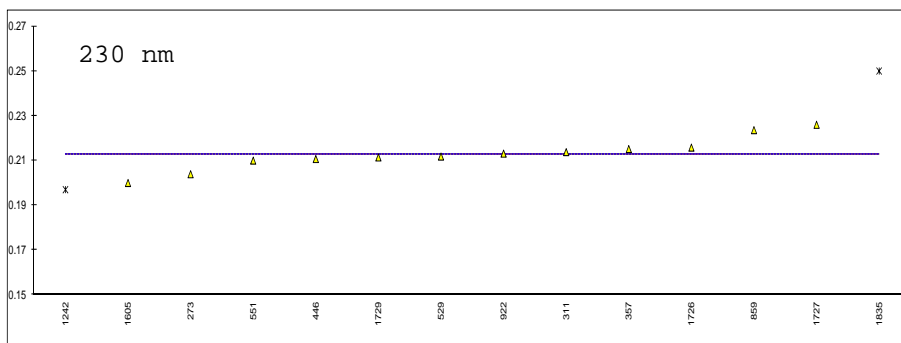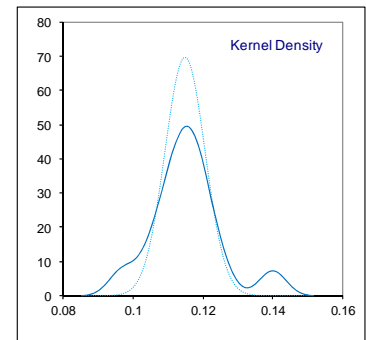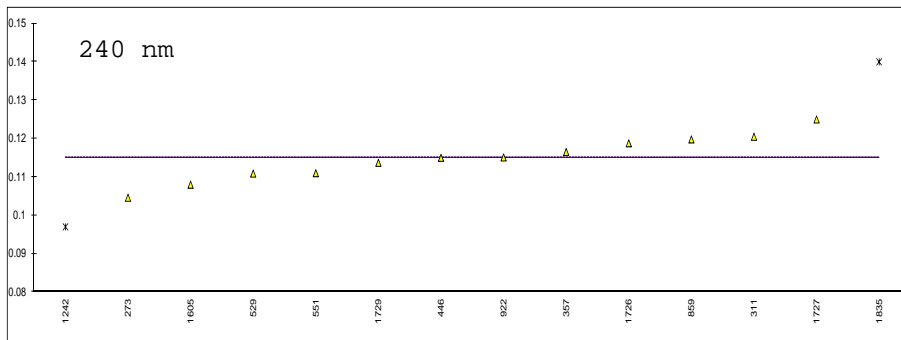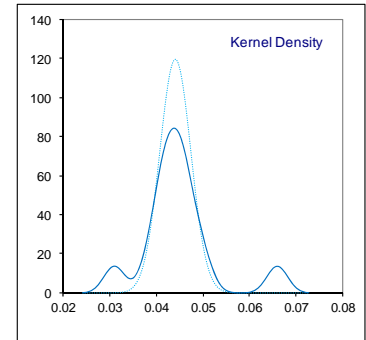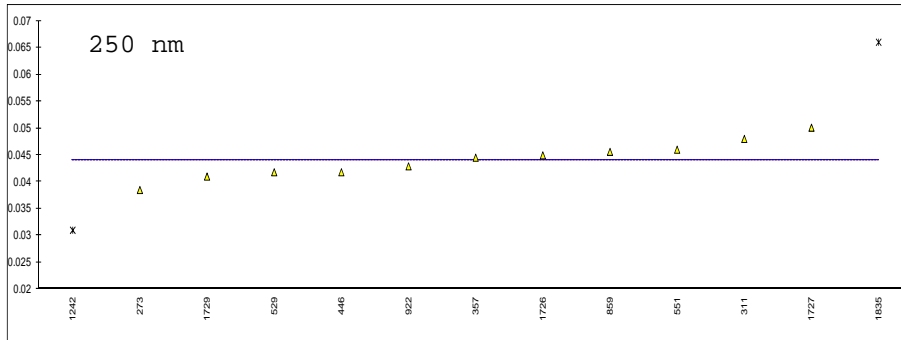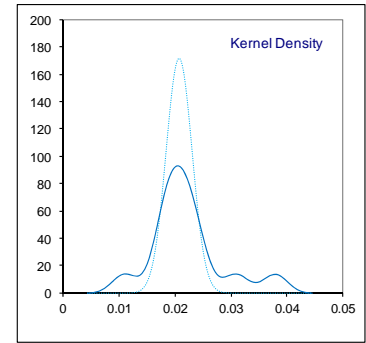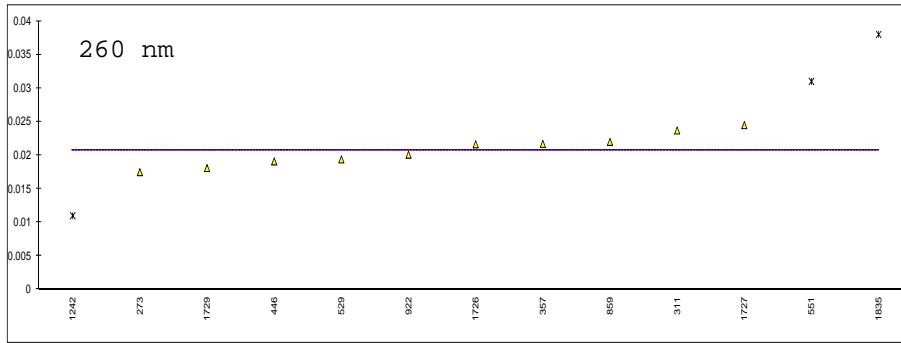
APPENDIX 2

Number of participants per country

1 lab in ARGENTINA

1 lab in AUSTRIA

2 labs in BELGIUM

2 labs in BRAZIL

1 lab in CHINA, People's Republic

1 lab in FINLAND

1 lab in FRANCE

1 lab in HONG KONG

2 labs in INDIA

2 labs in MEXICO

5 labs in NETHERLANDS

2 labs in PAKISTAN

1 lab in RUSSIAN FEDERATION

1 lab in SOUTH AFRICA

3 labs in SPAIN

1 lab in THAILAND

1 lab in UNITED KINGDOM

APPENDIX 3

Abbreviations:

C   = final result after checking of first reported suspect 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 outlier test
R(0.05)   = straggler in Rosner outlier test
E   = error in calculations
ex   = excluded from calculations
n.a.   = not applicable
OILM   = International Organization of Legal Metrology
U   = unit error
SDS   = safety data sheet

Literature:

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4   ASTM E1301-03
5   ISO13528-05
5   ISO 5725-86
6   ISO 5725, parts 1-6, 1994
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10   DIN 38402 T41/42
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15   Bernard Rosner, Percentage Points for a Generalized ESD Many-Outlier Procedure, *Technometrics*,
         25(2), pp. 165-172, (1983)