

Results of Proficiency Test
REN/Food Ethanol
November 2010

Organised by: Institute for Interlaboratory Studies (iis)
Spijkenisse, the Netherlands

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1. INTRODUCTION

Since 2007, a proficiency test for REN/Food Ethanol is organised every year by the Institute for Interlaboratory Studies. During the planning of the annual proficiency testing program 2010/2011, it was decided to continue the round robin for the analysis of REN/Food grade Ethanol.

In this interlaboratory study, 33 laboratories in 17 different countries have participated. See appendix 2 for a list of number of participants per country. In this report, the results of the proficiency test are presented and discussed.

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 #1091). 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 accordance with the ISO-guide G13:2007, (R007) since January 2000 by the Dutch Accreditation Council RvA (Raad voor Accreditatie). This ensures 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 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' (iis-protocol, version 3.2) of January 2010.

2.3 CONFIDENTIALITY STATEMENT

All data present 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 #1091 was obtained from a local trader. The approximately 25 litre bulk sample was, after homogenisation in a precleaned can, divided over 47 amber glass bottles of 0.5 L and labelled #1091. The homogeneity of these subsamples was checked by determination of Density in accordance with ASTM D4052:02e1 and Water in accordance with ASTM D1364:07 on 8 stratified random selected samples.

Sample	Density @ 20°C in kg/L	Water in %M/M
Sample #1091-1	0.80561	5.490
Sample #1091-2	0.80556	5.504
Sample #1091-3	0.80561	5.494
Sample #1091-4	0.80561	5.482
Sample #1091-5	0.80561	5.509
Sample #1091-6	0.80556	5.500
Sample #1091-7	0.80558	5.495
Sample #1091-8	0.80561	5.490

table 1: Homogeneity tests of subsamples #1091

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 @ 20°C in kg/L	Water in %M/M
r (Observed)	0.00007	0.024
reference method	ASTM D4052:02e1	ASTM D1364:07
0.3 * R (ref. method)	0.00015	0.042

table 2: Repeatability of subsamples #1091

The repeatabilities of the results from the homogeneity test were in agreement with 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 #1091 was sent on October 27, 2010.

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 #1091: Density @ 20°C, Nonvolatile matter, Permanganate Time Test, Water (titrimetric), Purity on dry basis, Strength (in %V/V and %M/M) and UV transmittance at 300, 270, 240, 230 and 220nm.

To get comparable results a detailed report form, on which the units were printed, was sent together with each sample. In addition, a letter of instructions and a SDS were added to the 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 'i.i.s. Interlaboratory Studies: Protocol for the Organisation, Statistics and Evaluation' (i.i.s.-protocol, version 3.2) of January 2010.

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. After removal of outliers, this check was repeated. Not all data sets proved to have a normal distribution, in which cases the statistical evaluation should be used with due care.

In accordance with ISO 5725 (1986 and 1994) the original results per determination were submitted subsequently to Dixon and Grubbs outlier tests. Outliers are marked by D(0.01) for the Dixon test, by G(0.01) or DG(0.01) for the Grubbs test. Stragglers are marked by D(0.05) for the Dixon test, by G(0.05) or DG(0.05) for the Grubbs test. Both outliers and stragglers were not included in the calculations of averages and standard deviations. 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 under 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, nr.13-14).

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:

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

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

4. EVALUATION

In this proficiency test, some problems were encountered with despatch of the samples. Several laboratories in Brazil and Pakistan did receive the samples very late. Four participants reported results after the final reporting date. Five participants did not report any results at all. Not all laboratories were able to perform all analysis requested. Finally, the 28 reporting laboratories did send in 189 (numerical) results. Observed were 13 outlying results, which is 6.9%. 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 are 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.

Not normal distribution was found for the following determination: Nonvolatile matter. In this case the statistical evaluation should be used with due care.

Density: This determination was not problematic. No statistical outliers were observed and the calculated reproducibility is in good agreement with the requirements of ASTM D4052:02e1.

Nonvolatile matter: This determination was not problematic. No statistical outliers were observed and the calculated reproducibility is in good agreement with the requirements of ASTM D1353:09.

Water: This determination was problematic for two laboratories. Two statistical outliers were observed. However, the calculated reproducibility, after rejection of the statistical outliers, is in full agreement with the requirements of ASTM D1364:07.

Permanganate Time Test: Regretfully, no precision data are given in ASTM D1363:06 for Ethanol. Therefore, no conclusions were drawn. All participants reported a time larger than 20 minutes.

Purity on dry basis: Regretfully, no standard test method with precision data exists. Therefore no conclusions were drawn. One statistical outlier was observed. The calculated reproducibility is somewhat large in comparison with the calculated reproducibility in the previous proficiency test (iis09C13b) of December 2009 (0.0124 vs 0.0108).

Strength (%V/V): This determination is not problematic. Two statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is in good agreement with the reproducibility derived from the OIML table and ASTM D4052:02e1.

Strength(%M/M): This determination may be not problematic. Regretfully, no standard test method with precision data exists. The calculated reproducibility is large in comparison with the calculated reproducibility in the previous proficiency test (iis09C13b) of December 2009 (0.095 vs 0.062).

UV absorbance: Regretfully, no standard test method with precision data exists. Therefore no significant conclusions were drawn. In total 6 statistical outliers were observed. The calculated reproducibilities are all small in comparison with the calculated reproducibilities in a previous proficiency test (iis09C13b) of December 2009, except for UV 220nm.

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	28	0.80555	0.00024	0.00050
Nonvolatile matter	mg/100mL	5	0.18	0.13	2.40
Water	%M/M	14	5.465	0.124	0.148
Permanganate Time Test	min.	14	36.9	17.9	(9.3)
Purity on dry basis	%M/M	10	99.9955	0.0124	(0.0108)
Strength	%V/V	25	96.453	0.056	0.120
Strength	%M/M	14	94.507	0.095	(0.062)
UV-absorbance 300 nm		9	0.0005	0.0016	(0.0060)
UV-absorbance 270 nm		12	0.0031	0.0065	(0.0110)
UV-absorbance 240 nm		13	0.0441	0.0093	(0.0179)
UV-absorbance 230 nm		15	0.1036	0.0284	(0.0306)
UV-absorbance 220 nm		14	0.1982	0.0344	(0.0334)

Table 7: Reproducibilities of sample #1091

Results between brackets are compared with the spread of the previous proficiency test or estimated from target reproducibility

4.3 COMPARISON OF THE PROFICIENCY TEST OF NOVEMBER 2010 WITH PREVIOUS PT'S

	<i>November 2010</i>	<i>December 2009</i>	<i>December 2008</i>	<i>December 2007</i>
Number of reporting labs	28	31	22	40
Number of results reported	189	299	153	595
Number of statistical outliers	13	34	8	30
Percentage outliers	6.9%	11.4%	5.2%	5.0%

table 10: 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 the following table:

Parameter	<i>November 2010</i>	<i>December 2009</i>	<i>December 2008</i>	<i>December 2007</i>
Density @ 20°C	++	++	++	++
Nonvolatile matter	++	n.e.	n.e.	n.e.
Water	++	--	--	--
Permanganate Time Test	(--)	--	--	--
Purity on dry basis	(--)	(++)	(+/-)	(--)
Strength %V/V	++	-	(++)	(+)
Strength %M/M	(--)	(++)	(--)	(--)
UV-absorbance 300 nm	(++)	(++)	(++)	(+/-)
UV-absorbance 270 nm	(++)	(++)	(++)	(--)
UV-absorbance 240 nm	(++)	(++)	(++)	(-)
UV-absorbance 230 nm	(+)	(++)	(++)	(+)
UV-absorbance 220 nm	(-)	(++)	(++)	(--)

Table 11: comparison determinations of sample #1091 against the standard results between brackets are compared with the spread of the previous round robin

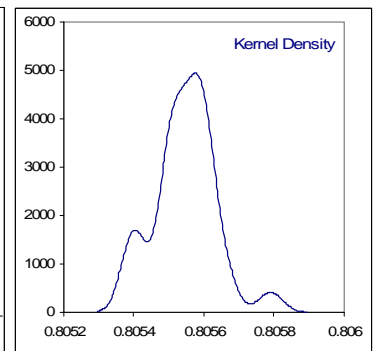
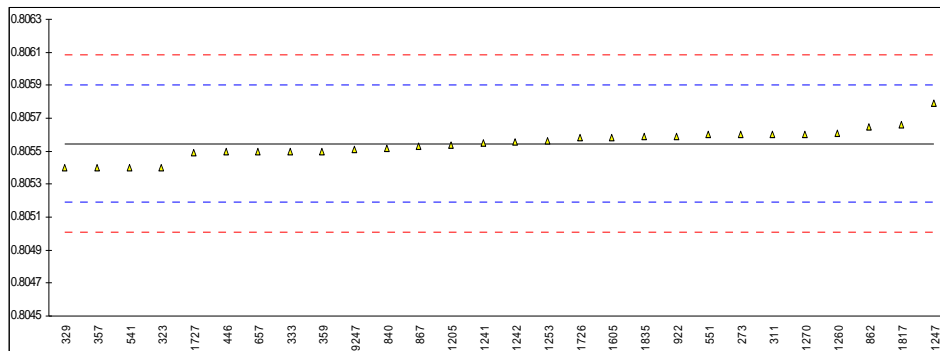
The performance of the determinations against the requirements of the respective standards is listed in the above table. The following performance categories were used:

- ++: 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

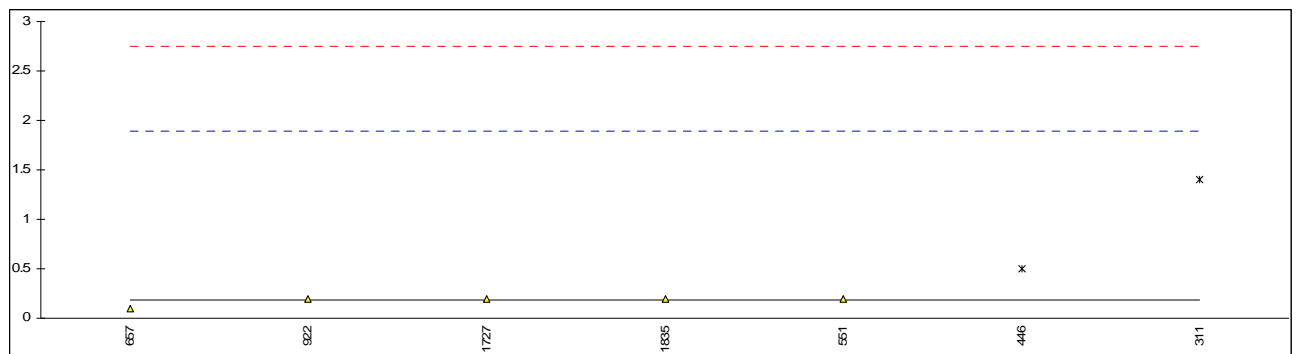
Determination of Density @ 20°C on sample #1091; results in kg/L

lab	method	value	mark	z(targ)	remarks
273	D4052	0.8056		0.30	
311	D4052	0.8056		0.30	
323	D4052	0.8054		-0.82	
329	D4052	0.8054		-0.82	
333	D4052	0.8055		-0.26	
357	D4052	0.8054		-0.82	
359	D4052	0.8055		-0.26	
446	D4052	0.8055		-0.26	
541	D4052	0.8054		-0.82	
551	D4052	0.8056		0.30	
556		----		----	
559		----		----	
657	D4052	0.8055		-0.26	
840	D4052	0.80552		-0.15	
862	D4052	0.80565		0.58	
867	D4052	0.80553		-0.09	
922	D4052	0.80559		0.24	
1006		----		----	
1126		----		----	
1205	In house	0.805535		-0.06	
1241	In house	0.80555		0.02	
1242	D4052	0.805556		0.05	
1247	D4052	0.80579		1.36	
1253	D4052	0.80556		0.08	
1260	D4052	0.805607		0.34	
1270	D4052	0.805604		0.32	
1425		----		----	
1605	D4052	0.80558		0.19	
1726	D4052	0.80558		0.19	
1727	D4052	0.80549		-0.32	
1817	In house	0.805660		0.64	
1835	D4052	0.80559		0.24	
2160		----		----	
9247	D4052	0.80551		-0.20	
normality		OK			
n		28			
outliers		0			
mean (n)		0.80555			
st.dev. (n)		0.000087			
R(calc.)		0.00024			
R(D4052:02e1)		0.00050			



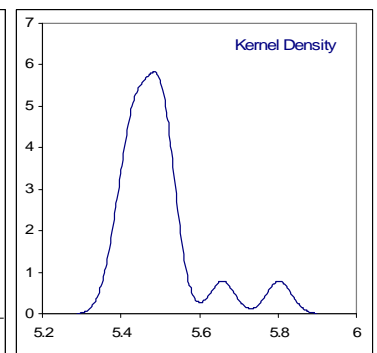
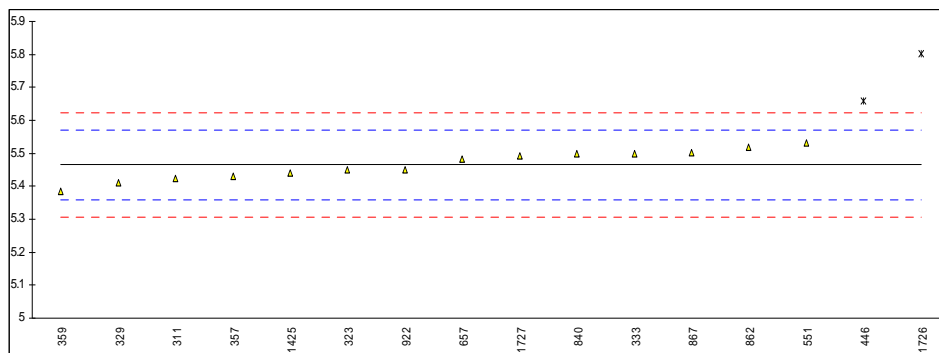
Determination of Nonvolatile matter on sample #1091; results in mg/100mL

lab	method	value	mark	z(targ)	remarks
273		----		----	
311	D1353	1.4	G(0.01)	1.42	
323	D1353	<1		----	
329	D1353	<1		----	
333		----		----	
357	D1353	<1		----	
359	D1353	<1		----	
446	INH-4524	0.5	G(0.05)	0.37	
541		----		----	
551	D1353	0.2		0.02	
556		----		----	
559		----		----	
657	D1353	0.1		-0.09	
840	D1353	<0.1		----	
862	D1353	<0.1		----	
867	D1353	<1		----	
922	D1353	0.2		0.02	
1006		----		----	
1126		----		----	
1205		----		----	
1241		----		----	
1242		----		----	
1247		----		----	
1253		----		----	
1260		----		----	
1270		----		----	
1425		----		----	
1605		----		----	
1726		----		----	
1727	EN15691	0.2		0.02	
1817		----		----	
1835	EN15691	0.2		0.02	
2160		----		----	
9247		----		----	
normality		not OK			
n		5			
outliers		2			
mean (n)		0.18			
st.dev. (n)		0.045			
R(calc.)		0.13			
R(D1353:09)		2.40			



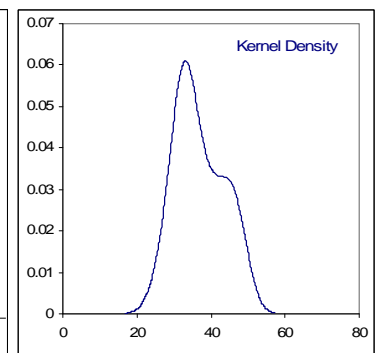
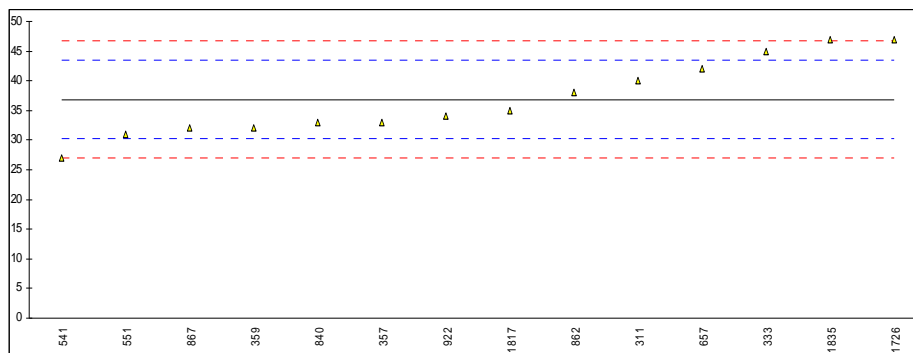
Determination of Water on sample #1091; results in %M/M

lab	method	value	mark	z(targ)	remarks
273		----		----	
311	D1364	5.423		-0.80	
323	D1364	5.45		-0.29	
329	E203	5.41		-1.05	
333	D1364	5.5		0.66	
357	E203	5.429		-0.69	
359	E203	5.385		-1.52	
446	E203	5.6585	G(0.05)	3.67	
541		----		----	
551	D1364	5.531		1.25	
556		----		----	
559		----		----	
657	D1364	5.481		0.30	
840	D1364	5.4997		0.66	
862	E203	5.518		1.00	
867	D1364	5.5033		0.72	
922	E203	5.45		-0.29	
1006		----		----	
1126		----		----	
1205		----		----	
1241		----		----	
1242		----		----	
1247		----		----	
1253		----		----	
1260		----		----	
1270		----		----	
1425	In house	5.44		-0.48	
1605		----		----	
1726	D1364	5.8028	G(0.01)	6.41	
1727	D1364	5.4923		0.51	
1817		----		----	
1835		----		----	
2160		----		----	
9247		----		----	
normality		OK			
n		14			
outliers		2			
mean (n)		5.465			
st.dev. (n)		0.0444			
R(calc.)		0.124			
R(D1364:07)		0.148			



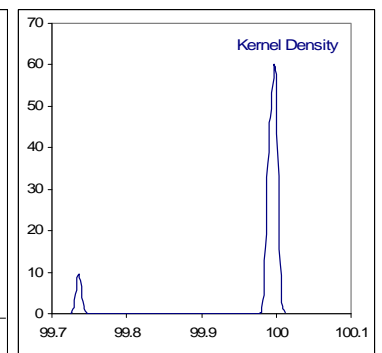
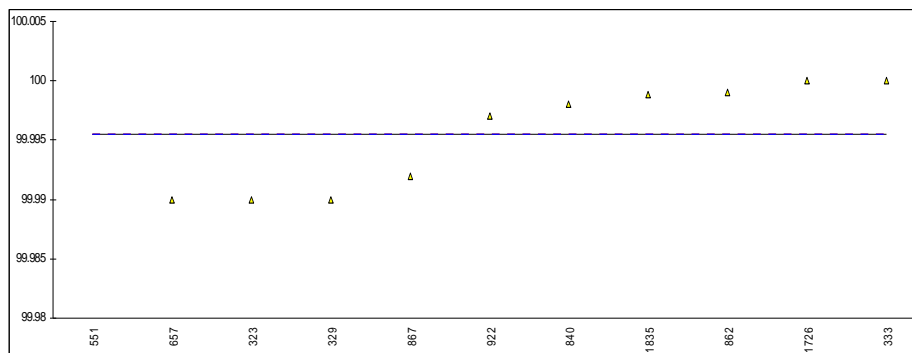
Determination of Permanganate Time Test @ 15 °C on sample #1091; results in minutes

lab	method	value	mark	z(targ)	remarks
273		----		----	
311	D1363	40		----	
323	D1363	>20		----	
329	D1363	>20		----	
333	D1363	45		----	
357	D1363	33		----	
359	D1363	32		----	
446		----		----	
541	D1363	27		----	
551	D1363	31		----	
556		----		----	
559		----		----	
657	D1363	42		----	
840	D1363	33		----	
862	D1363	38		----	
867	D1363	32		----	
922	D1363	34		----	
1006		----		----	
1126		----		----	
1205		----		----	
1241		----		----	
1242		----		----	
1247		----		----	
1253		----		----	
1260		----		----	
1270		----		----	
1425		----		----	
1605		----		----	
1726	D1363	47		----	
1727		----		----	
1817	INH-392	35		----	
1835	D1363	47		----	
2160		----		----	
9247		----		----	
normality		OK			
n		14			
outliers		0			
mean (n)		36.9			
st.dev. (n)		6.38			
R(calc.)		17.9			
R(D1363:06)		(9.3)			



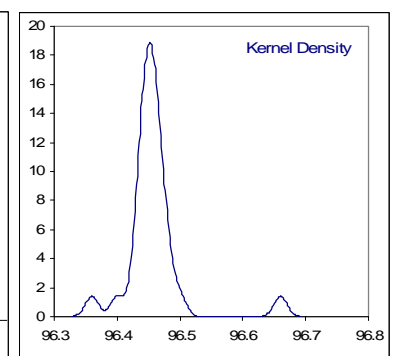
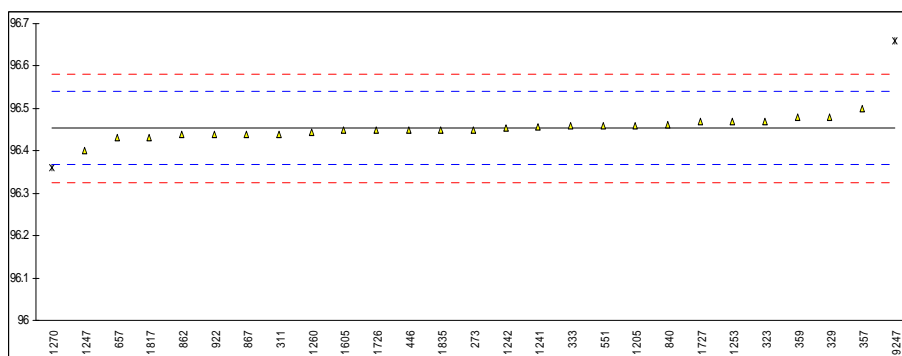
Determination of Purity on dry basis on sample #1091; results in %M/M

lab	method	value	mark	z(targ)	remarks
273		----		----	
311	INH-529	>99.99		----	
323	INH-001	99.99		----	
329	INH-001	99.99		----	
333		100.0		----	
357	INH-012	>99.99		----	
359		----		----	
446	INH-17	>99.99		----	
541		----		----	
551	INH-GLC	99.736	G(0.01)	----	
556		----		----	
559		----		----	
657	INH-001	99.99		----	
840	INH-001	99.998		----	
862	INH-001	99.999		----	
867	INH-001	99.992		----	
922	INH-001	99.997		----	
1006		----		----	
1126		----		----	
1205		----		----	
1241		----		----	
1242		----		----	
1247		----		----	
1253		----		----	
1260		----		----	
1270		----		----	
1425		----		----	
1605		----		----	
1726	In house	100		----	
1727		----		----	
1817		----		----	
1835	In house	99.9988		----	
2160		----		----	
9247		----		----	
normality		OK			
n		10			
outliers		1			
mean (n)		99.9955			
st.dev. (n)		0.00441			
R(calc.)		0.0124			
R(lit)		unknown			
				Compare R(iis09C13b) = 0.0108	



Determination of Strength on sample #1091; results in %V/V

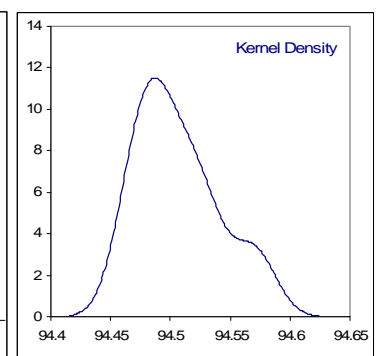
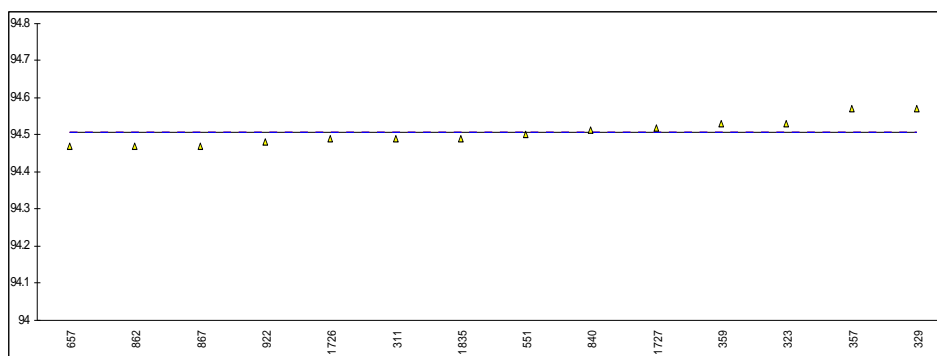
lab	method	value	mark	z(targ)	remarks
273		96.45		----	
311	OIML-73	96.44		----	
323	Osborn table	96.47		----	
329	Osborn table	96.48		----	
333	OIML-IT590	96.46		----	
357	OIML	96.50		----	
359	OIML	96.48		----	
446	OIML	96.45		----	
541		----		----	
551	D4052/OIML	96.46		----	
556		----		----	
559		----		----	
657	D4052/OIML	96.43		----	
840	D4052/OIML	96.462		----	
862	Alc table	96.44		----	
867	D4052/OIML	96.44		----	
922	OIML	96.44		----	
1006		----		----	
1126		----		----	
1205	OIML-IT590	96.460		----	
1241	Density det.	96.457		----	
1242		96.455		----	
1247		96.40		----	
1253	DE45 + Buchi	96.47		----	
1260	OIML	96.443		----	
1270		96.36	G(0.01)	----	
1425		----		----	
1605		96.45		----	
1726	OIML-ITS90	96.45		----	
1727	OIML	96.47		----	
1817	AOAC 26.1.09	96.43		----	
1835	OIML	96.45		----	
2160		----		----	
9247		96.66	G(0.01)	----	
normality		OK			
n		25			
outliers		2			
mean (n)		96.453			
st.dev. (n)		0.0199			
R(calc.)		0.056			
R(see §4.1)		0.120			Compare R(iis09C13b) = 0.103



Determination of Strength on sample #1091; results in %M/M

lab	method	value	mark	z(targ)	remarks
273		----		----	
311	OIML-73	94.49		----	
323	Osborn table	94.53		----	
329	Osborn table	94.57		----	
333		----		----	
357	OIML	94.57		----	
359	OIML	94.53		----	
446		----		----	
541		----		----	
551	D4052/OIML	94.50		----	
556		----		----	
559		----		----	
657	D4052/OIML	94.47		----	
840	D4052/OIML	94.512		----	
862	Alc table	94.47		----	
867	D4052/OIML	94.47		----	
922	OIML	94.48		----	
1006		----		----	
1126		----		----	
1205		----		----	
1241		----		----	
1242		----		----	
1247		----		----	
1253		----		----	
1260		----		----	
1270		----		----	
1425		----		----	
1605		----		----	
1726	OIML-ITS90	94.49		----	
1727	OIML	94.52		----	
1817		----		----	
1835	OIML	94.49		----	
2160		----		----	
9247		----		----	
normality		OK			
n		14			
outliers		0			
mean (n)		94.507			
st.dev. (n)		0.0339			
R(calc.)		0.095			
R(lit)		unknown			

Compare R(iis09C13b) = 0.062

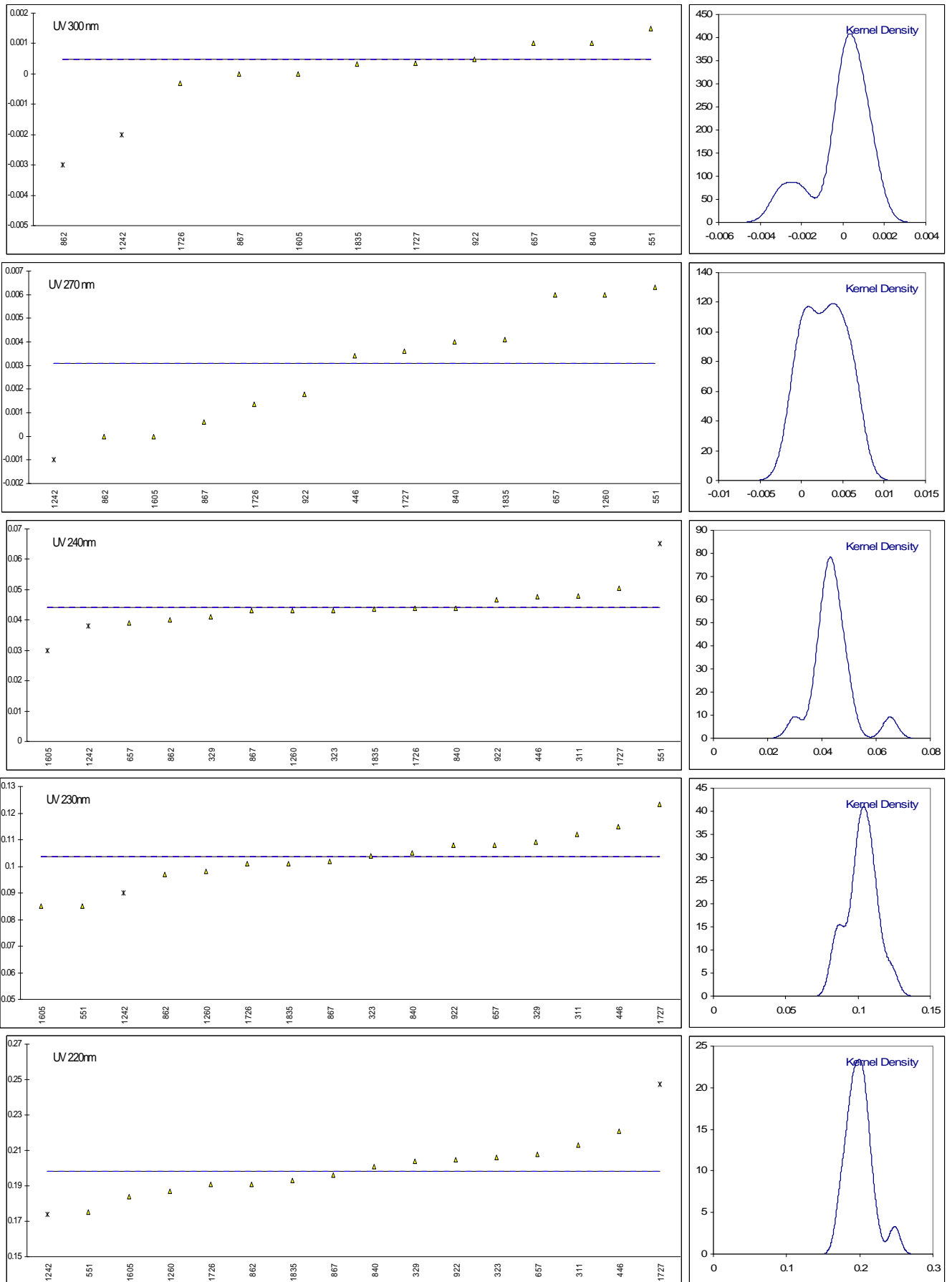


Determination of UV absorbance on sample #1091;

lab	method	300nm	mark	270nm	mark	240nm	mark	230nm	mark	220nm	mark
273		----		----		----		----		----	
311	INH-094	<0.005		<0.005		0.048		0.112		0.213	
323	Customer meth.	<0.001		<0.001		0.043		0.104		0.206	
329	Customer meth.	<0.001		<0.001		0.041		0.109		0.204	
333		----		----		----		----		----	
357		----		----		----		----		----	
359		----		----		----		----		----	
446	INH-13	<0.001		0.0034		0.0476		0.1150		0.2210	
541		----		----		----		----		----	
551	UV	0.0015		0.0063		0.0652	G(0.01)	0.0851		0.1753	
556		----		----		----		----		----	
559		----		----		----		----		----	
657	INH-060	0.001		0.006		0.039		0.108		0.208	
840	IMPCA004-08	0.001		0.004		0.044		0.105		0.201	
862	UV	-0.003	DG(0.05)	0.000		0.040		0.097		0.191	
867	IMPCA004-08	0.000		0.0006		0.043		0.102		0.196	
922		0.000474		0.001778		0.046591		0.10797		0.20461	
1006		----		----		----		----		----	
1126		----		----		----		----		----	
1205		----		----		----		----		----	
1241		----		----		----		----		----	
1242		-0.002	DG(0.05)	-0.001	G(0.05)	0.038	ex	0.090	ex	0.174	ex,fr 0.151
1247		----		----		----		----		----	
1253		----		----		----		----		----	
1260		----		0.006		0.043		0.098		0.187	
1270		----		----		----		----		----	
1425		----		----		----		----		----	
1605		0.000		0.000		0.030	G(0.05)	0.085		0.184	
1726		-0.00032		0.001357		0.043803		0.10110		0.19085	
1727		0.000357		0.00361		0.0505		0.1234		0.2476	G(0.05)
1817		----		----		----		----		----	
1835		0.000330		0.00409		0.0436		0.1011		0.1930	
2160		----		----		----		----		----	
9247		----		----		----		----		----	
	normality	OK		OK		OK		OK		OK	
	N	9		12		13		15		14	
	outliers	2		1		2		0		1	
	mean (n)	0.00048		0.00310		0.0441		0.1036		0.1982	
	st.dev. (n)	0.000583		0.002325		0.00330		0.01014		0.01230	
	R(calc.)	0.00163		0.00651		0.0093		0.0284		0.0344	
	R(lit)	unknown		unknown		unknown		unknown		unknown	
	R(iis09C13b)	0.00604		0.01101		0.0179		0.0306		0.0334	

NB. All laboratories reported to have used a 10 mm cuvette and measured against water, except for laboratory 1242 that reported to have used a 5mm cuvette.

Determination of UV absorbance on sample #1091; (graphics)



APPENDIX 2

Number of participants per country

1 laboratory in ARGENTINA
4 laboratories in BELGIUM
3 laboratories in BRAZIL
2 laboratories in FINLAND
1 laboratory in FRANCE
1 laboratory in HONG KONG
2 laboratories in P.R. of CHINA
1 laboratory in PAKISTAN
1 laboratory in SINGAPORE
1 laboratory in SOUTH AFRICA
3 laboratories in SPAIN
1 laboratory in TAIWAN R.O.C.
1 laboratory in THAILAND
8 laboratories in THE NETHERLANDS
1 laboratory in TURKEY
1 laboratory in UNITED KINGDOM
1 laboratory in VIETNAM

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
E	= error in calculations
ex	= excluded from calculations
n.a.	= not applicable
U	= unit error
SDS	= safety data sheet

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