Results of Proficiency Test
Unused Lubricating Oil
May 2010

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Appendices:

1   INTRODUCTION

Since 1997, a proficiency test for Lubricating Oil is organized every year by the Institute for Interlaboratory Studies. During the annual proficiency testing program 2009/2010, it was decided to continue the round robin for the analyses of unused Lubricating Oil. In this international interlaboratory study, 98 laboratories in 47 different countries have participated. See appendix 2 for a list of number of participants in alphabetical country order. In this report, the results of the Lubricating Oil (unused oil) proficiency test are presented and discussed.

2   SET UP

The Institute for Interlaboratory Studies (i.i.s.) in Spijkenisse, The Netherlands, was the organizer of this proficiency test. It was decided to send 1 sample of 1L (labelled #1041) of unused Lubricating Oil that was purchased from a local supplier. The analyses for fit-for-use and homogeneity were subcontracted. 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 guide 43 and ILAC-G13:2007, (R007), since January 2000, by the Dutch Accreditation Council (Raad voor Accreditatie). This ensures 100% confidentially of participant's data. Also customer's satisfaction is measured on a regular basis by sending 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 'i.i.s. Interlaboratory Studies: Protocol for the Organization, Statistics and Evaluation' of January 2010 (i.i.s.-protocol, version 3.2), which can be downloaded from www.iisnl.com.

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 was obtained from a local supplier. The 200 litre bulk material (Delvac XHP 10W-40) was after homogenizing transferred into 136 brown glass bottles of 1 litre and labelled #1041. The homogeneity of the subsamples #1041 was checked by determination of Density @ 15°C in accordance with ASTM D4052:09, Kinematic Viscosity at 40ºC in accordance with ASTM D445:09 and Water in accordance with ASTM D6304:07 (proc. C) on 8 stratified randomly selected samples.

	Density @ 15 ^{o}C in kg/L	Viscosity @40°C in mm^2/s	Water in %M/M
Sample #1041-1	0.86703	88.39	0.0036
Sample #1041-2	0.86703	88.45	0.0038
Sample #1041-3	0.86703	88.45	0.0037
Sample #1041-4	0.86703	88.45	0.0041
Sample #1041-5	0.86703	88.45	0.0045
Sample #1041-6	0.86703	88.45	0.0042
Sample #1041-7	0.86703	88.44	0.0039
Sample #1041-8	0.86703	88.42	0.0039

Table 1: homogeneity test of subsamples #1041

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

	Density @ 15 ^{o}C in kg/L	Viscosity @40°C in mm^2/s	Water in %M/M
r (sample #1041)	0.00000	0.06	0.0008
reference test	ASTM D4052:09	ASTM D445:09	ASTM D6304:07
r (reference test)	0.00015	0.20	0.0046

Table 2: repeatabilities of the subsamples #1041

The calculated repeatabilities are all less than 0.3 times the corresponding reproducibilities of the reference methods. Therefore, homogeneity of the subsamples #1041 was assumed.

To each of the participating laboratories, 1 sample of 1 L in a brown glass bottle (labelled #1041) was sent on April 25, 2010.

2.5   ANALYSES

The participants were requested to determine on sample #1041: Acid Number (Total), Base Number (Total), Colour ASTM, Conradson Carbon Residue, Density @ 15°C, Flash Point PMcc, Flash Point COC, Kinematic Viscosity @ 40°C and @ 100°C, Viscosity Stabinger @ 40°C, Nitrogen, Pour Point (manual, automated), Sulphated Ash, Sulphur, Water, Calcium, Phosphorus and Zinc.

To get comparable results a detailed report form, on which the units were prescribed as well as some of the required standards, was sent together with each set of samples. Also, 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 gathered. The original data are tabulated per determination in the appendix of this report. The laboratories are presented by their code numbers.

Directly after the deadline, a reminder fax was sent to those laboratories that had not reported 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 of the results should be used with due care.

In accordance to 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 them with a factor of 2.8.

3.2   GRAPHICS

In order to visualize the data against the reproducibilities from literature, Gauss plots were made, using the sorted data for one determination (see appendix 1). On the Y-axis the reported 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 "x". Accepted data are represented as a triangle. Furthermore, Kernel Density Graphs were made. The Kernel Density 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.12 and 13).

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 target standard deviation was calculated from the literature reproducibility by division with 2.8. The z-scores were calculated according to:

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

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:

$$| z | < 1 \quad good$$
$$1 < | z | < 2 \quad satisfactory$$
$$2 < | z | < 3 \quad questionable$$
$$3 < | z | \quad unsatisfactory$$

4   EVALUATION

In this Interlaboratory study, some problems were encountered with the dispatch of the samples to laboratories in Azerbaijan, Gabon, Ghana, Nigeria, P.R. of China, Sudan and Thailand. Twenty-five participants reported after the final reporting date and two participants did not report any results at all. Not all laboratories were able to report all analyses requested. In total 96 participants reported 985 results. Observed were 52 outlying results, which is 5.3% of the numerical results. In proficiency studies, outlier percentages of 3% - 7.5% are quite normal.

Not all original data sets proved to have a normal distribution. Non-Gaussian distributions were found for the following determinations: Base Number (Total), Colour, Density @ 15°C, Flash Point C.O.C., Pour Point (manual and automated), Sulphated Ash, Water and Calcium. In these cases the statistical evaluation should be used with due care.

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.

Total Acid Number: This determination was very problematic. Four statistical outliers were observed. Another eight test results were excluded from the statistical evaluation, as the reported test method is not equivalent with ASTM D664. The calculated reproducibility after rejection of the statistical outliers is not at all in agreement with ASTM D664:09a.

Total Base Number: This determination was problematic. Three statistical outliers were observed. Another four test results were excluded from the statistical evaluation, as the reported test method is not equivalent with ASTM D2896. The calculated reproducibility after rejection of the statistical outliers is not in agreement with the requirements of ASTM D2896:07a.

Colour: This determination was not problematic. No statistical outliers were observed and the calculated reproducibility is in good agreement with ASTM D1500:07.

CCR: This determination was not problematic. Only one statistical outlier was observed and the calculated reproducibility after rejection of the statistical outlier is in good agreement with the requirements of ASTM D189:06e2.

Density @ 15°C: This determination was problematic. Seven statistical outliers were observed. Also, the calculated reproducibility, after rejection of the statistical outliers, is not at all in agreement with the requirements of ASTM D4052:09.

Flash Point PMcc: This determination was problematic for several laboratories. Four test results were outside the reproducibility limits. However, the calculated reproducibility after rejection of the statistical outliers is in good agreement with the requirements of ASTM D93:08 procedure A.
 When the ASTM D93 manual and automated (electric and flame ignition) modes are evaluated separately, the calculated reproducibilities of all groups remain in good agreement with the requirements of ASTM D93 procedure A.

Flash Point COC: This determination was not problematic. No statistical outliers were observed. One test result was excluded for statistical evaluation as the test method used is not equivalent with ASTM D92. The calculated reproducibility is in good agreement with ASTM D92:05a.

Kin.Visco.@ 40°C: This determination was problematic. Seven statistical outliers were observed. Also, the calculated reproducibility after rejection of the statistical outliers is not in agreement with the strict requirements of ASTM D445:09.

Kin.Visco.@ 100°C: This determination was very problematic. Four statistical outliers were observed. Also, the calculated reproducibility after rejection of the statistical outliers is not at all in agreement with the strict requirements of ASTM D445:09.

Visco. Stabinger   This determination was very problematic. Although, no statistical outliers
at 40ºC   were observed, the calculated reproducibility is not at all in agreement with ASTM D7042:04.

Nitrogen: This determination was very problematic. Only one statistical outlier was observed, but the calculated reproducibility after rejection of the statistical outlier is not at all in agreement with ASTM D3228:08. The variety of test methods used may (partly) explain the large spread.

Pour Point (manual): This determination was not problematic. No statistical outliers were observed and the calculated reproducibility is in good agreement with ASTM D97:09.

Pour Point (automated): This determination was not problematic. No statistical outliers were observed and the calculated reproducibility is in full agreement with ASTM D5950:07.

Sulphated Ash: This determination was not problematic. Only one statistical outlier was observed and the calculated reproducibility after rejection of the statistical outlier is in good agreement with the requirements of ASTM D874:07.

Sulphur: This determination was very problematic. Nine statistical outliers were observed and the calculated reproducibility after rejection of the statistical outliers is not at all agreement with the requirements of ASTM D2622:10. When the results of the ASTM D2622 are evaluated separately, the calculated reproducibility is still not in agreement.

Water: This determination was very problematic for a large number of laboratories. The preferred method to use for a product containing interfering components may be ASTM D6304:07 method C. This method is applicable for oils with difficult matrix interferences. At least seven laboratories reported results determined according ASTM D6304 method C. These results were low, which suggests that the low average may be more reliable than the higher results. After excluding of the high results and one statistical outlier, the calculated reproducibility is in good agreement with the requirements of ASTM D6304:07.
Direct coulometric titration will lead to incorrect high results for lube oil, containing strong base additives.

Calcium: This determination was problematic for several laboratories. Three statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers is in agreement with the requirements of ASTM D5185:09.

Phosphorus: This determination was problematic. Five statistical outliers were observed and the calculated reproducibility after rejection of the statistical outliers is not in agreement with the requirements of ASTM D5185:09.

Zinc: This determination was problematic. Although only two statistical outliers were observed, the calculated reproducibility after rejection of the statistical outliers is not in agreement with the requirements of ASTM D5185:09.

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 that participated. The average results, calculated reproducibilities and reproducibilities derived from literature standards (in casu ASTM and IP standards), are compared in the next table.

Parameter	unit	n	Average	2.8 * sd	R(lit)
Total Acid Number	mg KOH/g	43	4.246	2.285	0.740
Total Base Number	mg KOH/g	50	16.390	1.505	1.147
Colour		46	3.0	0.5	1.0
Conradson Carbon Residue	%M/M	41	1.786	0.264	0.365
Density @ 15 °C	kg/L	72	0.86715	0.00074	0.00050
Flash Point PMcc	^{o}C	71	205.41	10.57	14.58
Flash Point COC	^{o}C	69	229.54	13.95	18.00
Kinematic Viscosity @ 40 °C	mm^2/s	79	88.148	0.752	0.670
Kinematic Viscosity @ 100 °C	mm^2/s	78	13.3317	0.2478	0.1013
Stabinger Viscosity @ 40 °C	mm^2/s	10	87.720	1.997	0.474
Nitrogen	mg/kg	13	883.7	361.1	200.0
Pour Point, manual	^{o}C	48	-34.24	6.61	9.00
Pour Point, automated	^{o}C	19	-36.74	3.94	4.50
Sulphated Ash	%M/M	45	1.952	0.218	0.334
Sulphur	%M/M	27	0.3375	0.0499	0.0288
Water	mg/kg	19	228.9	314.9	440.0
Calcium	mg/kg	54	4822	937	921
Phosphorus	mg/kg	51	1191	187	148
Zinc	mg/kg	59	1352	296	231

Table 4: reproducibilities of results of sample #1041

Without further statistical calculations it can be concluded that for a number of tests there is a not a good compliance of the group of participants with the relevant standards. The tests that are problematic have been discussed in paragraph 4.1.

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

	May 2010	April 2009	April 2008	April 2007
Number of reporting participants	96	86	86	71
Number of results reported	985	813	656	1644
Statistical outliers	52	45	48	84
Percentage outliers	5.3%	5.5%	7.3%	5.1%

Table 5: 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:

Determination	May 2010	April 2009	April 2008 *)	April 2007
Total Acid Number	--	--	n.a.	--
Total Base Number	--	--	--	+/-
Colour	++	++	n.a.	++
Conradson Carbon Residue	++	++	++	++
Density @ 15 °C	--	--	--	--
Flash Point PMcc	++	+	--	+/-
Flash Point COC	++	++	--	++
Kinematic Viscosity @ 40 °C	--	--	--	--
Kinematic Viscosity @ 100 °C	--	--	--	+/-
Stabinger Viscosity @ 40 °C	--	--	n.a.	--
Nitrogen	--	--	--	+/-
Pour Point, manual	++	-	--	+/-
Pour Point, automated	++	n.e.	n.e.	n.e.
Sulphated Ash	++	+/-	++	-
Sulphur	--	--	++	--
Water	++	--	n.a.	--
Calcium	+/-	+	(++)	+
Phosphorus	--	--	(+/-)	+
Zinc	--	+	(--)	+

Table 6: comparison determinations against the standard
*) no regular Lubrication Oil but pure Additive

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.a.:   not applicable
      n.e.:   not evaluated

APPENDIX 1

Determination of Acid Number (Total) on sample #1041; results in mg KOH/g

lab	method	value	mark	z(targ)	remarks
176	D664	4.742		1.88	
233	D974	3.03	ex	-4.60	result excluded as test method is not equivalent
237	D974	3.093	C,ex	-4.36	First reported 1.70, result excluded as test method is not equivalent
252	D974	4.1141	ex	-0.50	result excluded as test method is not equivalent
254		-----		-----	
255		-----		-----	
311	D664	3.20		-3.96	
315		-----		-----	
318		-----		-----	
331	D664	4.399		0.58	
333		-----		-----	
340	D664	4.11		-0.51	
343	D664	4.27		0.09	
353	D664	3.64		-2.29	
360	D664	4.433		0.71	
432		-----		-----	
445	D664	3.948		-1.13	
446		-----		-----	
450		-----		-----	
451	D664	4.74		1.87	
473	D664Mod	4.6935		1.70	
496	D664	4.707		1.75	
593		-----		-----	
609	D664	5.513		4.80	
614	D974	2.61	ex	-6.19	result excluded as test method is not equivalent
622	D664	3.44		-3.05	
657	D664	3.84		-1.54	
663		-----		-----	
704	D664	5.066	C	3.11	First reported 6.066
840	D664	9.94	G(0.01)	21.56	
850		-----		-----	
862	D664	4.846		2.27	
875		-----		-----	
886	D664	4.095		-0.57	
912	D664	5.39	C	4.33	First reported 6.770
963	D664	3.39		-3.24	
994	D664	4.93		2.59	
1013		-----		-----	
1017	D974	4.0413	ex	-0.77	result excluded as test method is not equivalent
1023	D664	4.75		1.91	
1047	D664	4.36	C	0.43	First reported 6.31
1059	ISO6619	3.83	ex	-1.57	result excluded as test method is not equivalent
1080	D664	4.82		2.17	
1094	D664	1.9881		-8.55	
1106	D664	3.2293		-3.85	
1113		-----		-----	
1128		-----		-----	
1132		-----		-----	
1146	D664	4.71		1.76	
1162		-----		-----	
1173		-----		-----	
1189		-----		-----	
1201	D664	0.92	G(0.05)	-12.59	
1203	D664	4.39		0.55	
1213	D664	3.69		-2.10	
1231	D664	3.76		-1.84	
1243		-----		-----	
1293		-----		-----	
1295		-----		-----	
1316	D664	2.77		-5.59	
1323		-----		-----	
1324		-----		-----	
1325		-----		-----	
1326	D664	4.365		0.45	
1327		-----		-----	
1328	D664	4.63		1.45	
1329		-----		-----	
1330		-----		-----	
1331		-----		-----	
1332		-----		-----	
1333		-----		-----	
1334		-----		-----	
1335		-----		-----	
1402	D664	6.4		8.16	

1406	D664	3.95		-1.12	
1407		-----		-----	
1428		-----		-----	
1431	D664	4.24		-0.02	
1435	D664	4.12		-0.48	
1526		-----		-----	
1535		-----		-----	
1540	D664	3.743		-1.90	
1543		-----		-----	
1613		-----		-----	
1620	D664	4.89		2.44	
1650	D664	4.09		-0.59	
1652		-----		-----	
1658		-----		-----	
1660	IEC-62021-1	3.672		-2.17	
1708	D974	2.8	C,ex	-5.47	First reported 2.388, result excluded as test method is not equivalent
1720	D664	1.40	DG(0.05)	-10.77	
1722		-----		-----	
1800		-----		-----	
1825	D974	1.04	ex	-12.14	First reported 1.24, result excluded as test method is not equivalent
1827	D664	1.337	DG(0.05)	-11.01	
1833	D664	3.04		-4.56	
1842		-----		-----	
1850	ISO6619	4.04	ex	-0.78	result excluded as test method is not equivalent
1903		-----		-----	
2122	IP177	5.735		5.64	

normality	OK	
n	43	
outliers	4	
mean (n)	4.246	
st.dev. (n)	0.8161	
R(calc.)	2.285	
R(D664:09a)	0.740	
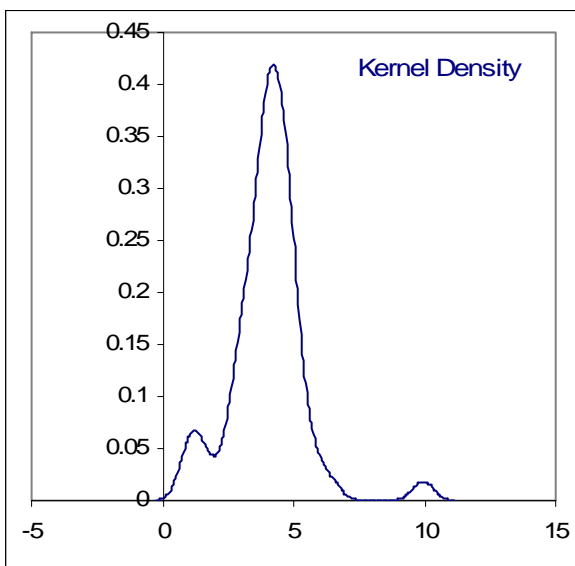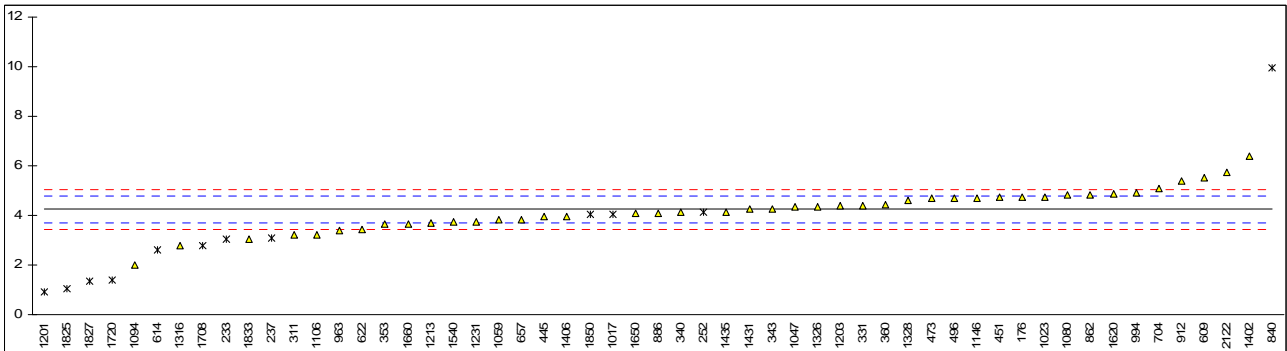
Determination of Base Number (Total) on sample #1041; results in mg KOH/g

lab	method	value	mark	z(targ)	remarks
176		-----		-----	
233	D974	17.36	ex	2.37	result excluded as test method is not equivalent
237	D2896	16.59	C	0.49	First reported 13.1584
252	D2896	15.92		-1.15	
254	D2896	17.18		1.93	
255		-----		-----	
311	D2896	16.2		-0.46	
315		-----		-----	
318		-----		-----	
331	D2896	16.48		0.22	
333		-----		-----	
340	D2896	16.33		-0.15	
343	D4739	15.30	ex	-2.66	result excluded as test method is not equivalent
353		-----		-----	
360	D2896	16.163		-0.55	
432	D2896	16.403		0.03	
445	D2896	16.28		-0.27	
446		-----		-----	
450		-----		-----	
451	D2896	17.30		2.22	
473		-----		-----	
496	D2896	16.275		-0.28	
593	D2896	6.9180	G(0.01)	-23.12	
609	D2896	18.463	G(0.05)	5.06	
614	D2896	17.99		3.90	
622	D2896	16.43		0.10	
657	D2896	15.79		-1.46	
663		-----		-----	
704		-----		-----	
840	D2896	16.45		0.15	
850		-----		-----	
862	D2896	16.811		1.03	
875		-----		-----	
886	D2896	16.39		0.00	
912	D2896	16.350		-0.10	
963	D2896	17.89		3.66	
994	D4739	13.106	ex	-8.01	result excluded as test method is not equivalent
1013	D2896	16.1		-0.71	
1017		-----		-----	
1023	D2896	16.0		-0.95	
1047	ISO3771	16.22		-0.41	
1059		-----		-----	
1080	D2896	14.80	C	-3.88	First reported 0.02
1094		-----		-----	
1106		-----		-----	
1113		-----		-----	
1128		-----		-----	
1132		-----		-----	
1146	D2896	16.27		-0.29	
1162		-----		-----	
1173		-----		-----	
1189		-----		-----	
1201	D2896	3.27	G(0.01)	-32.02	
1203	ISO3771	17.29		2.20	
1213	D2896	16.4	C	0.02	First reported 1.00
1231	D2896	16.42		0.07	
1243	D2896	16.5		0.27	
1293		-----		-----	
1295		-----		-----	
1316		-----		-----	
1323	inh-251	16.30		-0.22	
1324	inh-251	16.25		-0.34	
1325		-----		-----	
1326	D2896	16.20		-0.46	
1327	D2896	16.37		-0.05	
1328	inh-251	16.4		0.02	
1329	inh-251	16.34		-0.12	
1330	inh-251	16.2		-0.46	
1331	inh-251	16.2		-0.46	
1332	inh-251	16.20		-0.46	
1333	inh-251	16.30		-0.22	
1334	inh-251	16.22		-0.41	
1335		-----		-----	
1402	D2896	16.3		-0.22	

1406	D2896	16.25		-0.34	
1407		-----		-----	
1428		-----		-----	
1431	D2896	16.44		0.12	
1435		-----		-----	
1526		-----		-----	
1535	inh-362	15.52		-2.12	
1540	D2896	16.960		1.39	
1543		-----		-----	
1613	D2896	16.44		0.12	
1620	D2896	16.83		1.07	
1650	D2896	16.36		-0.07	
1652		-----		-----	
1658		-----		-----	
1660		-----		-----	
1708	D2896	16.90		1.24	
1720		-----		-----	
1722		-----		-----	
1800		-----		-----	
1825	D2896	15.17		-2.98	
1827		-----		-----	
1833		-----		-----	
1842		-----		-----	
1850	ISO3771	16.13		-0.63	
1903		-----		-----	
2122	IP400	17.43	ex	2.54	result excluded as test method is not equivalent

normality	not OK
n	50
outliers	3
mean (n)	16.390
st.dev. (n)	0.5376
R(calc.)	1.505
R(D2896:07a)	1.147
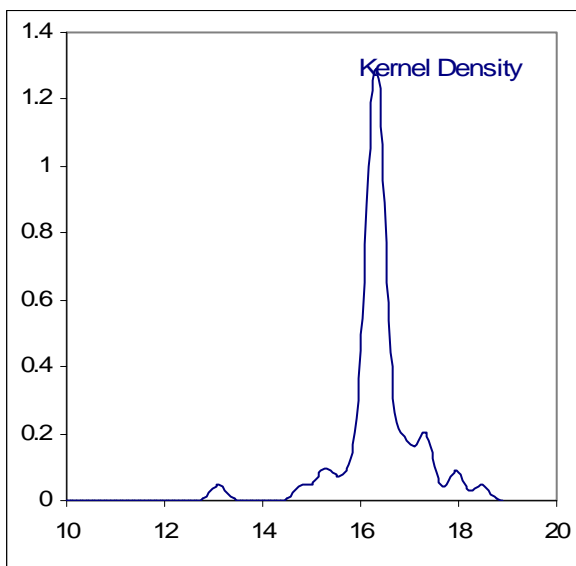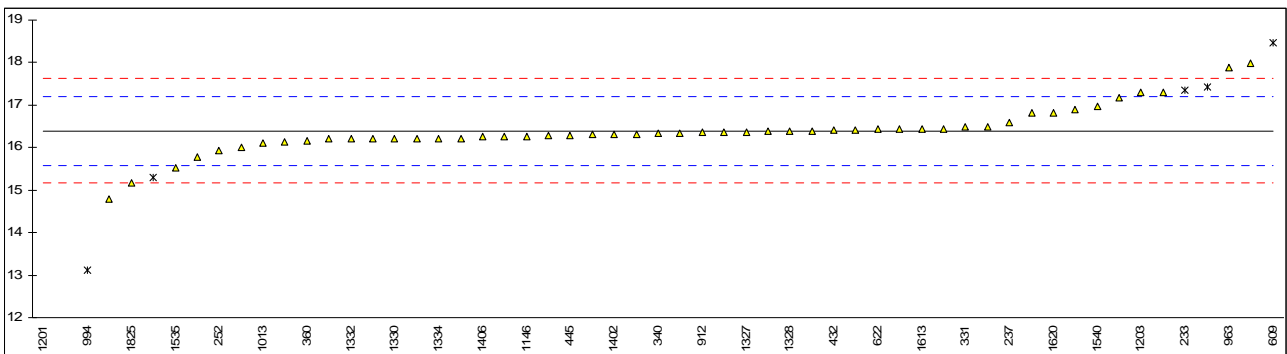
Determination of Colour on sample #1041

lab	method	value	mark	z(targ)	remarks
176	D1500	<3.0		-----	
233		-----		-----	
237	D1500	3.0		0.06	
252	D1500	3.0		0.06	
254	D1500	L3.0		-----	
255		-----		-----	
311	D1500	L3.5		-----	
315	D1500	L3.5		-----	
318		-----		-----	
331	D1500	3.0		0.06	
333		-----		-----	
340	D1500	3.0		0.06	
343	D1500	3.0		0.06	
353	D6045	3.1		0.34	
360	D1500	3.0		0.06	
432	D1500	3.0		0.06	
445	D1500	3.0		0.06	
446	D1500	3.0		0.06	
450		-----		-----	
451		-----		-----	
473		-----		-----	
496	D1500	3.0		0.06	
593		-----		-----	
609	D1500	L2.5		-----	
614	D1500	2.9		-0.22	
622	D1500	L3.0		-----	
657	D1500	L3.5		-----	
663	D1500	L3.0		-----	
704	D1500	L3.5		-----	
840	D1500	3.0		0.06	
850	D1500	3.0		0.06	
862	D1500	3.1		0.34	
875	D6045	3.0		0.06	
886	D1500	3.0		0.06	
912	D1500	L3.5		-----	
963	D1500	3.0		0.06	
994	D1500	L3.0		-----	
1013	D1500	2.9		-0.22	
1017		-----		-----	
1023		-----		-----	
1047		-----		-----	
1059	D1500	L3.0		-----	
1080	D1500	L3.5		-----	
1094		-----		-----	
1106		-----		-----	
1113		-----		-----	
1128		-----		-----	
1132	D1500	L3.0		-----	
1146		-----		-----	
1162	D1500	3.0		0.06	
1173		-----		-----	
1189	D1500	2.5		-1.34	
1201	D1500	L3.0		-----	
1203	D1500	3.5		1.46	
1213	D1500	L3.5		-----	
1231		-----		-----	
1243	D1500	3.0		0.06	
1293		-----		-----	
1295		-----		-----	
1316		-----		-----	
1323	inh-540	L3.0		-----	
1324	inh-540	3.0		0.06	
1325	inh-540	3.0		0.06	
1326	D1500	3.0		0.06	
1327	D1500	2.5		-1.34	
1328	D1500	3.0		0.06	
1329	inh-540	3.0		0.06	
1330	inh-540	3.0		0.06	
1331	inh-540	3.0		0.06	
1332	inh-540	3.0		0.06	
1333	inh-540	3.0		0.06	
1334	inh-540	3.0		0.06	
1335		-----		-----	
1402	D1500	3		0.06	

1406	D1500	L3.0	-----
1407		-----	-----
1428		-----	-----
1431	D1500	3	0.06
1435	D1500	3.5	1.46
1526		-----	-----
1535	D1500	3.0	0.06
1540	D1500	3.0	0.06
1543		-----	-----
1613	D1500	3.0	0.06
1620	D1500	L3.5	-----
1650		-----	-----
1652	D1500	3.0	0.06
1658		-----	-----
1660	D1500	2.5	-1.34
1708	D1500	3.0	0.06
1720	D1500	3.0	0.06
1722		-----	-----
1800		-----	-----
1825	D1500	2.5	-1.34
1827		-----	-----
1833	D1500	3.0	0.06
1842		-----	-----
1850	ISO2049	L3.0	-----
1903		-----	-----
2122		-----	-----

	normality	not OK
	n	46
	outliers	0
	mean (n)	2.98
	st.dev. (n)	0.184
	R(calc.)	0.51
	R(D1500:07)	1.00
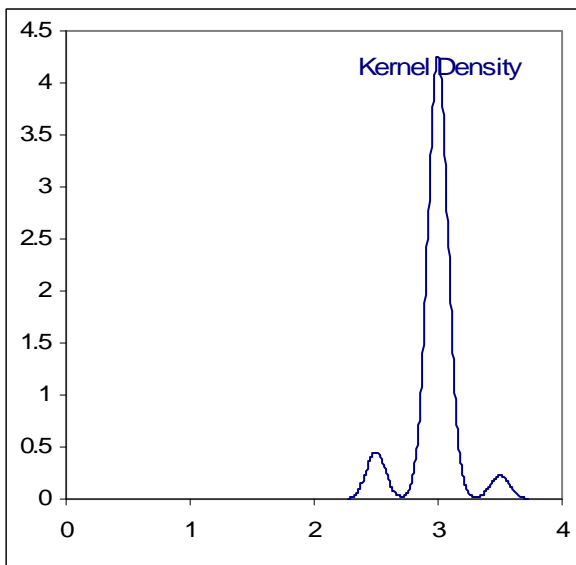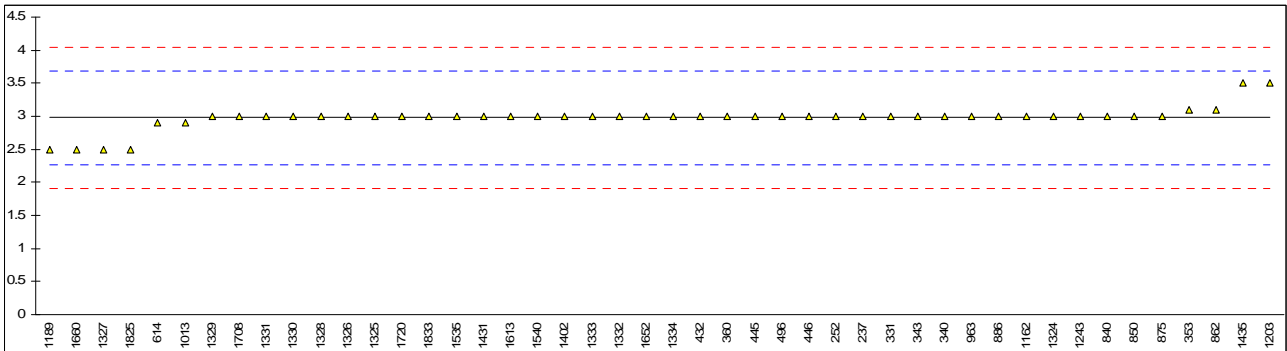
Determination of Conradson Carbon Residue on sample #1041; results in %M/M

lab	method	value	mark	z(targ)	remarks
176	D189	1.7396		-0.35	
233		-----		-----	
237	D189	1.732		-0.41	
252	D189	1.7920		0.05	
254		-----		-----	
255		-----		-----	
311	D189	1.82		0.26	
315		-----		-----	
318		-----		-----	
331		-----		-----	
333		-----		-----	
340	D189	1.861		0.58	
343	D4530	1.964		1.37	
353		-----		-----	
360	D189	1.99		1.57	
432		-----		-----	
445	D189	1.72		-0.50	
446		-----		-----	
450		-----		-----	
451		-----		-----	
473		-----		-----	
496	D4530	1.80		0.11	
593	D189	1.7710		-0.11	
609		-----		-----	
614		-----		-----	
622	D189	1.71		-0.58	
657	D4530	1.91		0.95	
663	D189	1.65		-1.04	
704	D189	1.673		-0.86	
840	D189	1.71		-0.58	
850	D189	1.749		-0.28	
862	D189	1.737		-0.37	
875	D4530	1.83		0.34	
886	D4530	1.92		1.03	
912		-----		-----	
963	D189	1.705		-0.62	
994	D189	1.724		-0.47	
1013		-----		-----	
1017	D189	1.875		0.68	
1023		-----		-----	
1047		-----		-----	
1059	D189	1.84		0.42	
1080	D4530	1.85		0.49	
1094		-----		-----	
1106		-----		-----	
1113		-----		-----	
1128		-----		-----	
1132	D4530	1.87		0.65	
1146		-----		-----	
1162		-----		-----	
1173		-----		-----	
1189		-----		-----	
1201		-----		-----	
1203	ISO10370	1.84		0.42	
1213	D4530	1.92		1.03	
1231		-----		-----	
1243	D189	1.73		-0.43	
1293		-----		-----	
1295		-----		-----	
1316	D189	1.8375		0.40	
1323		-----		-----	
1324		-----		-----	
1325		-----		-----	
1326	D189	1.6970		-0.68	
1327		-----		-----	
1328	inh-268	1.740		-0.35	
1329		-----		-----	
1330	inh-268	1.735		-0.39	
1331	inh-268	1.80		0.11	
1332		-----		-----	
1333		-----		-----	
1334		-----		-----	
1335		-----		-----	
1402	D189	1.67		-0.89	

1406	ISO10370	1.775		-0.08
1407		-----		-----
1428	ISO10370	1.89		0.80
1431		-----		-----
1435		-----		-----
1526		-----		-----
1535		-----		-----
1540		-----		-----
1543		-----		-----
1613		-----		-----
1620	D189	1.50		-2.19
1650	D189	1.738		-0.37
1652		-----		-----
1658		-----		-----
1660		-----		-----
1708	D189	1.832		0.35
1720	D4530	1.78		-0.04
1722		-----		-----
1800		-----		-----
1825		-----		-----
1827		-----		-----
1833	D189	2.35	G(0.01)	4.33
1842		-----		-----
1850	ISO6615	1.79		0.03
1903		-----		-----
2122		-----		-----

normality	OK	
n	41	
outliers	1	
mean (n)	1.786	
st.dev. (n)	0.0941	
R(calc.)	0.264	
R(D189:06e2)	0.365	
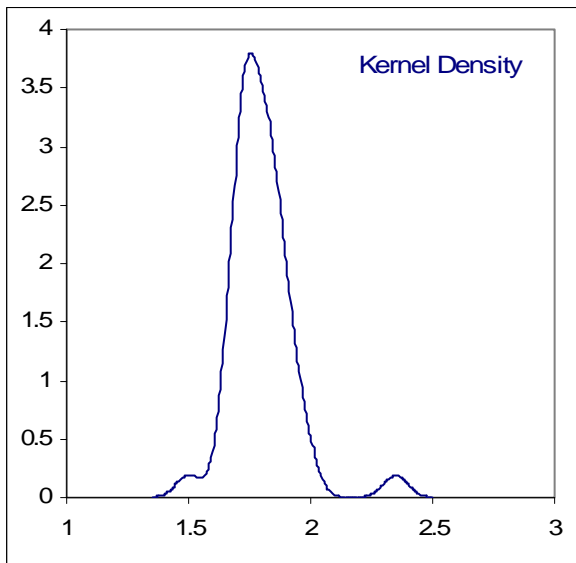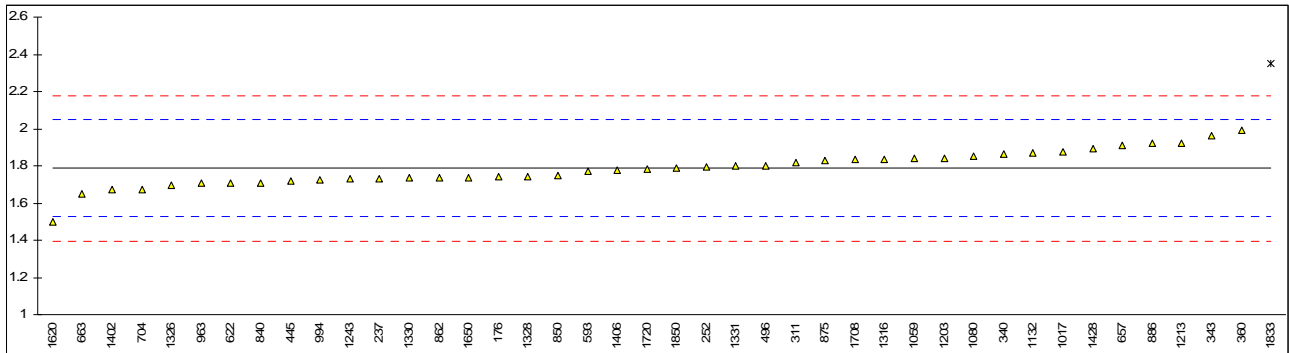
Determination of Density @ 15°C on sample #1041; results in kg/L

lab	method	value	mark	z(targ)	remarks
176	D4052	0.8671	C	-0.26	First reported 867.06
233	D4052	0.8778	CG(0.01)	59.66	First reported 877.8
237	D1298	0.8673		0.86	
252	D4052	0.8654	G(0.01)	-9.78	
254	D4052	0.8672		0.30	
255		-----		-----	
311	D4052	0.8670		-0.82	
315	D4052	0.8673		0.86	
318		-----		-----	
331		-----		-----	
333	D4052	0.8677		3.10	
340	D4052	0.8676	C	2.54	First reported 867.58
343	D4052	0.86698		-0.93	
353	D4052	0.8670	C	-0.82	First reported 867
360	D4052	0.8669		-1.38	
432	D4052	0.86727		0.70	
445	D4052	0.8676		2.54	
446	D4052	0.8670		-0.82	
450		-----		-----	
451	D4052	0.867	C	-0.82	First reported 867
473	D4052	0.8668		-1.94	
496	D4052	0.86697		-0.98	
593		-----		-----	
609	D4052	0.8674	C	1.42	First reported 0.8661
614	D4052	0.8674		1.42	
622	D4052	0.8670		-0.82	
657	D4052	0.8670		-0.82	
663	D4052	0.8670		-0.82	
704	D4052	0.8673		0.86	
840	D4052	0.86701		-0.76	
850	D4052	0.8678	G(0.05)	3.66	
862	D4052	0.86698		-0.93	
875	D4052	0.8673		0.86	
886		-----		-----	
912	D4052	0.8670		-0.82	
963	D4052	0.8674	C	1.42	First reported 0.8682
994	D4052	0.8672		0.30	
1013	D4052	0.8671		-0.26	
1017	D4052	0.8675		1.98	
1023	D4052	0.8670		-0.82	
1047	D4052	0.8673		0.86	
1059	D4052	0.867	C	-0.82	First reported 867.0
1080	ISO12185	0.867		-0.82	
1094	D4052	0.86705		-0.54	
1106	D5002	0.8673		0.86	
1113		-----		-----	
1128		-----		-----	
1132	D4052	0.8670		-0.82	
1146	D4052	0.86679		-1.99	
1162	D1298	0.86770		3.10	
1173		-----		-----	
1189	D1298	0.8681	CG(0.05)	5.34	First reported 868.1
1201	D4052	0.8677		3.10	
1203	ISO12185	0.8669		-1.38	
1213	D4052	0.86708		-0.37	
1231	D4052	0.86704		-0.59	
1243	D4052	0.8676		2.54	
1293	ISO12185	0.8675		1.98	
1295	ISO3675	0.86658		-3.17	
1316	D4052	0.8670		-0.82	
1323	inh-884	0.86710		-0.26	
1324	inh-604	0.86800	CG(0.05)	4.78	First reported 0.86860
1325		-----		-----	
1326	D4052	0.86706		-0.48	
1327	D4052	0.8670		-0.82	
1328		-----		-----	
1329	inh-604	0.86704		-0.59	
1330	inh-604	0.8676		2.54	
1331		-----		-----	
1332	inh-884	0.8667		-2.50	
1333		-----		-----	
1334		-----		-----	
1335	D4052	0.86699		-0.87	
1402	IP365	0.8674		1.42	

1406	ISO3675	0.8671		-0.26	
1407	ISO12185	0.8670		-0.82	
1428	ISO12185	0.8670		-0.82	
1431	D4052	0.86695		-1.10	
1435	D4052	0.868	G(0.05)	4.78	
1526	D5002	0.867		-0.82	
1535	ISO3675	0.86704	C	-0.59	First reported 0.86643
1540		-----		-----	
1543		-----		-----	
1613	D1298	0.86697		-0.98	
1620	D4052	0.8671		-0.26	
1650	D4052	0.8675		1.98	
1652		-----		-----	
1658		-----		-----	
1660	D4052	0.8670		-0.82	
1708	D4052	0.8672		0.30	
1720	D4052	0.8671		-0.26	
1722	D4052	0.8677		3.10	
1800	inhouse	0.8669		-1.38	
1825	D1298	0.8627	CG(0.05)	-24.90	First reported 862.7
1827		-----		-----	
1833	D4052	0.8666	C	-3.06	First reported 867.4
1842	IP365	0.8676		2.54	
1850	D4052	0.8670	C	-0.82	First reported 867.0
1903		-----		-----	
2122		-----		-----	

normality	not OK
n	72
outliers	7
mean (n)	0.86715
st.dev. (n)	0.000265
R(calc.)	0.00074
R(D4052:09)	0.00050
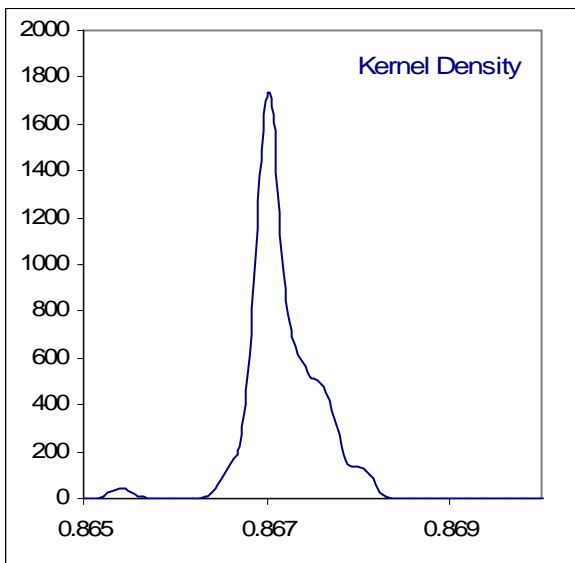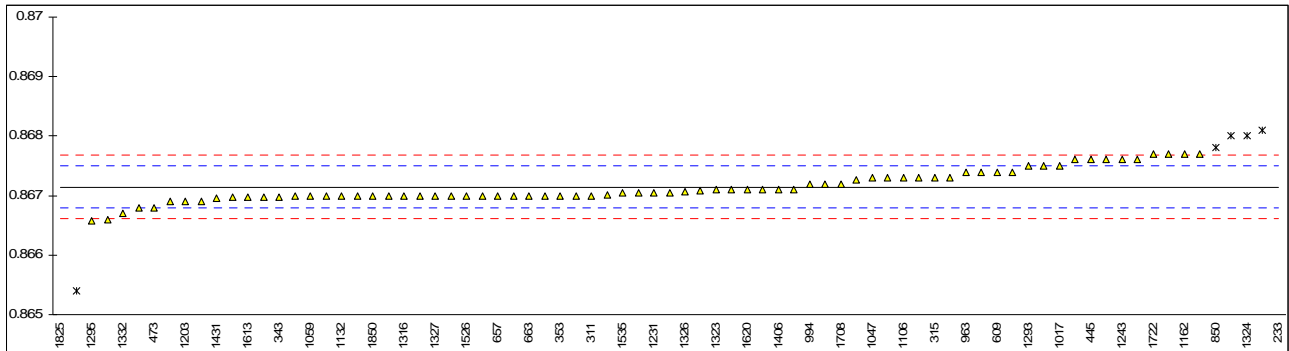
Determination of Flash Point PMcc on sample #1041; results in °C

lab	method	value	mark	z(targ)	remarks
176	D93-AF	198.9		-1.25	
233	D93-M	177	G(0.01)	-5.46	
237	D93	204.0		-0.27	
252	D93-ME	201.0		-0.85	
254		-----		-----	
255		-----		-----	
311	D93-AE	188	G(0.01)	-3.34	
315		-----		-----	
318	inh-2	202.5		-0.56	
331	D93-AE	205.5		0.02	
333	D93-AF	203.0		-0.46	
340	D93-AF	150.0	G(0.01)	-10.64	
343	D93-AE	206	C	0.11	First reported 173.0
353	IP34-ME	204.0		-0.27	
360	D93-AE	200.0		-1.04	
432	D93-AE	202.7		-0.52	
445	D93-AF	208.0		0.50	
446	D93-AF	209.5		0.78	
450		-----		-----	
451	D93	208		0.50	
473	D93-AE	207		0.30	
496	D93-AF	201		-0.85	
593	D93-E	205		-0.08	
609	D93-MF	206		0.11	
614	D93-MF	198.1		-1.40	
622	D93-MF	200.0		-1.04	
657	D93-AF	207.0		0.30	
663	D93-MF	209.0		0.69	
704	D93-MF	201.0		-0.85	
840	D93-MF	201.0		-0.85	
850	D93-MF	202.0		-0.66	
862	D93-MF	201.0		-0.85	
875	D93-AF	206.0		0.11	
886	D93-AE	200		-1.04	
912	D93-AF	207.0		0.30	
963	D93-AE	205.5		0.02	
994	D93-MF	206.5		0.21	
1013	D93-MF	210.0		0.88	
1017	D93-AF	206.0		0.11	
1023	D93-AE	207		0.30	
1047	ISO2719-AF	210.0		0.88	
1059	IOS2719-AE	208.0		0.50	
1080	D93-AE	207.0		0.30	
1094	D93-AE	207.5		0.40	
1106	D93-AE	207.0		0.30	
1113		-----		-----	
1128		-----		-----	
1132	D93-AE	206.5		0.21	
1146	D93-AE	208.1		0.52	
1162	D93-MF	203.04		-0.46	
1173	IP34-MF	207.13		0.33	
1189		-----		-----	
1201	D93-AE	187	G(0.01)	-3.54	
1203	ISO2719-AF	200		-1.04	
1213	D93-MF	206		0.11	
1231	D93-AE	202.0		-0.66	
1243	D93-MF	197		-1.62	
1293	D6450-AE	217		2.22	
1295		-----		-----	
1316	D93-AE	210		0.88	
1323		-----		-----	
1324		-----		-----	
1325		-----		-----	
1326	D93-AE	208.0		0.50	
1327	D93-AF	208		0.50	
1328	inh-261-MF	205.5		0.02	
1329	inh-261-MF	207		0.30	
1330	inh-261-AF	204		-0.27	
1331		-----		-----	
1332	inh-261-MF	214.8		1.80	
1333	inh-261-AF	202		-0.66	
1334	inh-261-MF	202.0		-0.66	
1335	D93-AE	208.0		0.50	
1402	D93-AE	205.0		-0.08	

			Only MF	Only ME	Only AF	Only AE
1406		-----	-----			
1407		-----	-----			
1428	ISO2719-AE	204.5	-0.18			
1431	D93-AF	208.6	0.61			
1435	D93-AE	209	0.69			
1526		-----	-----			
1535	ISO2719-ME	208.05	0.51			
1540		-----	-----			
1543		-----	-----			
1613		-----	-----			
1620	D93-AE	202.0	-0.66			
1650	D93-AF	204.5	-0.18			
1652	ISO2719-ME	205.54	0.02			
1658		-----	-----			
1660	D93-AE	203.0	-0.46			
1708	D93-AE	204.5	-0.18			
1720		-----	-----			
1722		-----	-----			
1800		-----	-----			
1825		-----	-----			
1827		-----	-----			
1833	D93-AF	214	1.65			
1842	D93-AF	210	0.88			
1850	ISO2719-AE	206	0.11			
1903		-----	-----			
2122	D93-MF	205	-0.08			
	normality	OK	OK	n.a.	OK	OK
	n	71	19	4	18	26
	outliers	4	0	0	1	2
	mean (n)	205.41	204.32	204.67	205.97	206.03
	st.dev. (n)	3.776	4.395	2.949	3.968	3.457
	R(calc.)	10.57	12.31	8.26	11.11	9.68
	R(D93:10)	14.58	14.51	14.53	14.62	14.63

M	= Manual mode	A	= Automated mode
MF	= Manual mode, flame ignition	AF	= Automated mode, flame ignition
ME	= Manual mode, electric ignition	AE	= Automated mode, electric ignition

Kernel Density
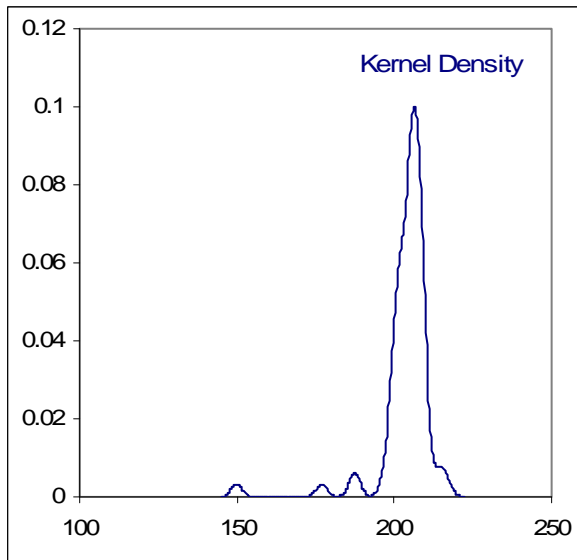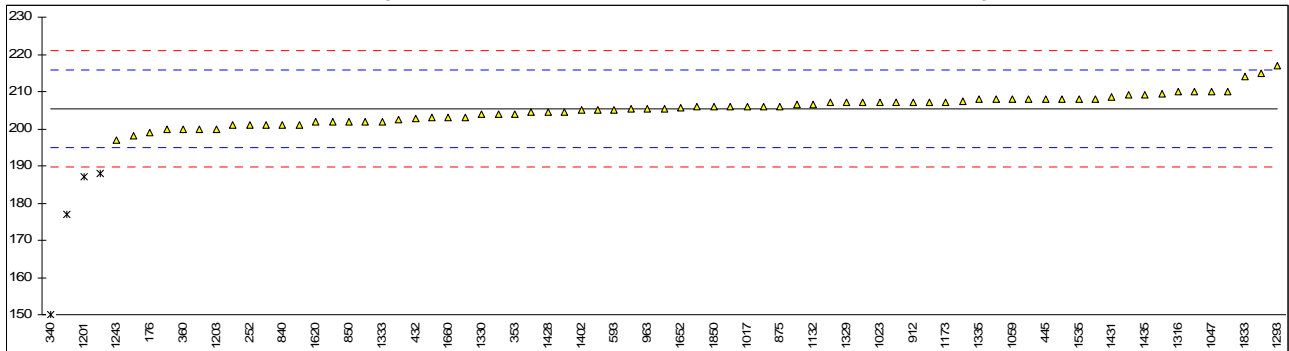
Determination of Flash Point C.O.C. on sample #1041; results in °C

lab	method	value	mark	z(targ)	remarks
176	D92	228		-0.24	
233	D92	230		0.07	
237	D92	242.0		1.94	
252	D92	228.0		-0.24	
254	D92	230.0		0.07	
255		-----		-----	
311		-----		-----	
315	D92	221		-1.33	
318		-----		-----	
331	D92	227		-0.40	
333	D92	234		0.69	
340	D92	238		1.32	
343	D92	230.0		0.07	
353	IP36	224.0		-0.86	
360	D92	228.0		-0.24	
432	D92	222.7		-1.06	
445	D92	230		0.07	
446	D92	226		-0.55	
450		-----		-----	
451		-----		-----	
473		-----		-----	
496	D92	226		-0.55	
593		-----		-----	
609	D3828	233.0	C,ex	0.54	First reported 206.5, result excluded as method is not equivalent
614		-----		-----	
622	D92	223		-1.02	
657	D92	233.0		0.54	
663	D92	225.0		-0.71	
704	D92	231.0		0.23	
840	D92	234.0		0.69	
850	D92	222.0		-1.17	
862	D92	233.7		0.65	
875	D92	224		-0.86	
886	D92	218		-1.80	
912	D92	232.0		0.38	
963	D92	228		-0.24	
994	D92	228		-0.24	
1013	D92	220		-1.48	
1017	D92	232		0.38	
1023		-----		-----	
1047		-----		-----	
1059	ISO2592	230		0.07	
1080	D92	227		-0.40	
1094		-----		-----	
1106		-----		-----	
1113		-----		-----	
1128		-----		-----	
1132	D92	231.0		0.23	
1146		-----		-----	
1162		-----		-----	
1173		-----		-----	
1189	D92	236		1.00	
1201	D92	226		-0.55	
1203	ISO2592	234		0.69	
1213		-----		-----	
1231		-----		-----	
1243	D92	234		0.69	
1293		-----		-----	
1295	ISO2592	233.55		0.62	
1316	D92	238		1.32	
1323	inh-536	228		-0.24	
1324	inh-536	226		-0.55	
1325	inh-536	230		0.07	
1326	D92	234		0.69	
1327	D92	236		1.00	
1328	inh-536	234.0		0.69	
1329	inh-536	232		0.38	
1330	inh-536	228		-0.24	
1331	inh-536	227		-0.40	
1332	inh-536	227.1		-0.38	
1333	inh-536	228		-0.24	
1334	inh-536	228		-0.24	
1335	D92	228.0		-0.24	
1402	D92	228.0		-0.24	

1406	D92	220	-1.48
1407		-----	-----
1428	D92	236	1.00
1431	D92	225	-0.71
1435	D92	234	0.69
1526	D92	228	-0.24
1535	ISO2592	225.0	-0.71
1540	D92	229	-0.08
1543		-----	-----
1613	D92	235	0.85
1620	D92	226	-0.55
1650		-----	-----
1652	ISO2592	236.5	1.08
1658		-----	-----
1660		-----	-----
1708	D92	232	0.38
1720	D92	242.5	2.02
1722		-----	-----
1800		-----	-----
1825	ISO2892	234	0.69
1827	D92	227.5	-0.32
1833	D92	228	-0.24
1842		-----	-----
1850	ISO2592	228	-0.24
1903		-----	-----
2122		-----	-----

normality	not OK
n	69
outliers	0
mean (n)	229.54
st.dev. (n)	4.981
R(calc.)	13.95
R(D92:05a)	18.00
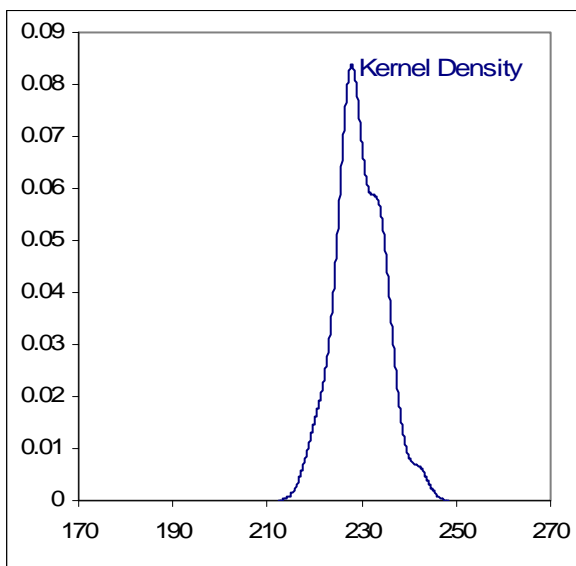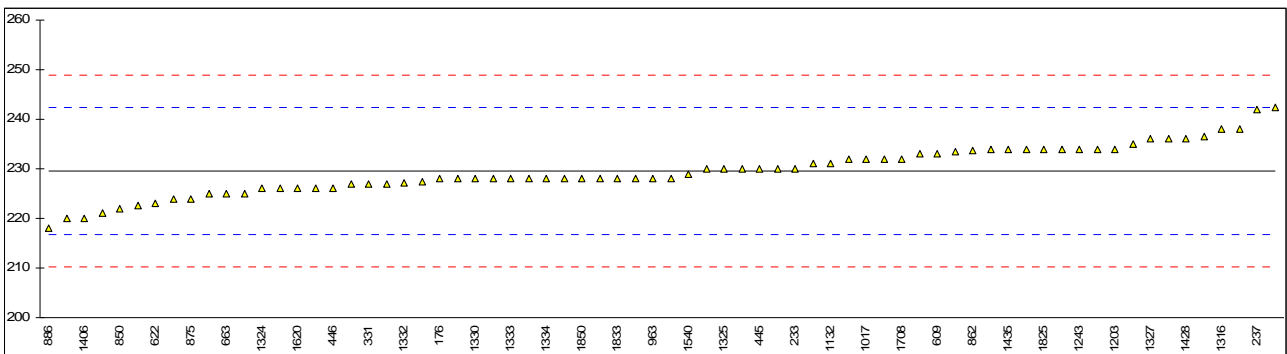
Determination of Kinematic Viscosity @ 40°C on sample #1041; results in mm^2/s

lab	method	value	mark	z(targ)	remarks
176	D445	87.85		-1.24	
233	D445	84.22	CG(0.01)	-16.42	First reported 18.43
237	D445	88.02		-0.53	
252		-----		-----	
254		-----		-----	
255		-----		-----	
311	D445	85.35	G(0.01)	-11.69	
315	D445	88.0695		-0.33	
318		-----		-----	
331	in house	88.20		0.22	
333	D445	88.22		0.30	
340	D445	87.868		-1.17	
343	D445	88.17		0.09	
353	D445	88.384		0.99	
360	D445	88.561		1.73	
432	D445	88.29		0.59	
445	D445	88.21		0.26	
446	D445	87.55		-2.50	
450	D445	88.33		0.76	
451		-----		-----	
473	D445	88.547		1.67	
496	D445	88.391		1.02	
593	D445	88.6624		2.15	
609		-----		-----	
614	D445	87.00	G(0.05)	-4.80	
622	D445	87.52		-2.62	
657	D445	88.54		1.64	
663		-----		-----	
704	D445	87.807		-1.42	
840	D445	87.897	C	-1.05	First reported 86.492
850	D445	88.026	C	-0.51	First reported 86.553
862	D445	88.352		0.85	
875	D445	87.90		-1.04	
886	D445	88.33		0.76	
912	D445	88.48		1.39	
963	D445	86.3734	G(0.01)	-7.42	
994	D445	88.05		-0.41	
1013		-----		-----	
1017	D445	87.9364		-0.88	
1023	D445	88.29		0.59	
1047	ISO3104	88.204		0.23	
1059	ISO3104	88.52		1.56	
1080	ISO3104	88.28		0.55	
1094	D445	88.17		0.09	
1106	D445	88.03		-0.49	
1113		-----		-----	
1128		-----		-----	
1132	D445	87.755		-1.64	
1146	D445	88.028		-0.50	
1162	D445	88.145		-0.01	
1173	IP71	88.16		0.05	
1189	D445	87.1464	G(0.05)	-4.19	
1201	D445	88.25		0.43	
1203	ISO3104	87.63		-2.16	
1213	D445	88.11		-0.16	
1231	D445	88.67		2.18	
1243	D445	88.35		0.84	
1293	ISO3104	83.04	G(0.01)	-21.35	
1295	ISO3104	88.635		2.04	
1316	D445	88.31		0.68	
1323	inh-265	88.08		-0.28	
1324	inh-265	88.06		-0.37	
1325	inh-265	88.08		-0.28	
1326	D445	87.88		-1.12	
1327	D445	88.06		-0.37	
1328	inh-265	87.88		-1.12	
1329	inh-265	87.96		-0.79	
1330	inh-265	87.86		-1.20	
1331	D445	88.17		0.09	
1332	inh265	87.68		-1.96	
1333	inh-265	88.08		-0.28	
1334	inh-265	88.06		-0.37	
1335	D445	88.120		-0.12	
1402	D445	88.52		1.56	

1406	D445	88.55		1.68	
1407	ISO3104	88.35		0.84	
1428	ISO3104	88.05		-0.41	
1431		-----		-----	
1435	D7042	88.5		1.47	
1526	D445	87.86		-1.20	
1535	ISO3104	88.005	C	-0.60	First reported 86.506
1540	D445	88.732		2.44	
1543		-----		-----	
1613	D445	87.65		-2.08	
1620	D445	87.91		-0.99	
1650	D445	88.219		0.30	
1652	D445	87.876		-1.14	
1658		-----		-----	
1660	D445	88.111		-0.15	
1708	D445	88.195		0.20	
1720	D445	87.06	G(0.05)	-4.55	
1722	D445	88.2732		0.52	
1800		-----		-----	
1825	D445	88.40		1.05	
1827	D445	87.985		-0.68	
1833	D445	88.163		0.06	
1842	IP71	88.08		-0.28	
1850	ISO3104	87.96		-0.79	
1903	inh-08	88.2133		0.27	
2122	in house	88.41		1.10	

normality	OK
n	79
outliers	7
mean (n)	88.148
st.dev. (n)	0.2686
R(calc.)	0.752
R(D445:09)	0.670

Kernel Density
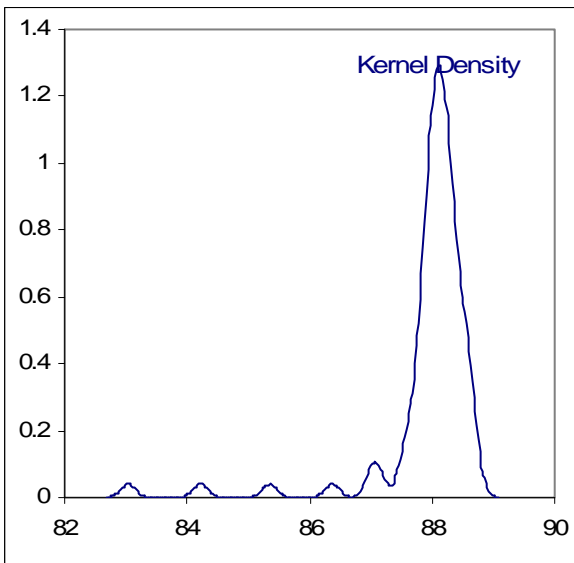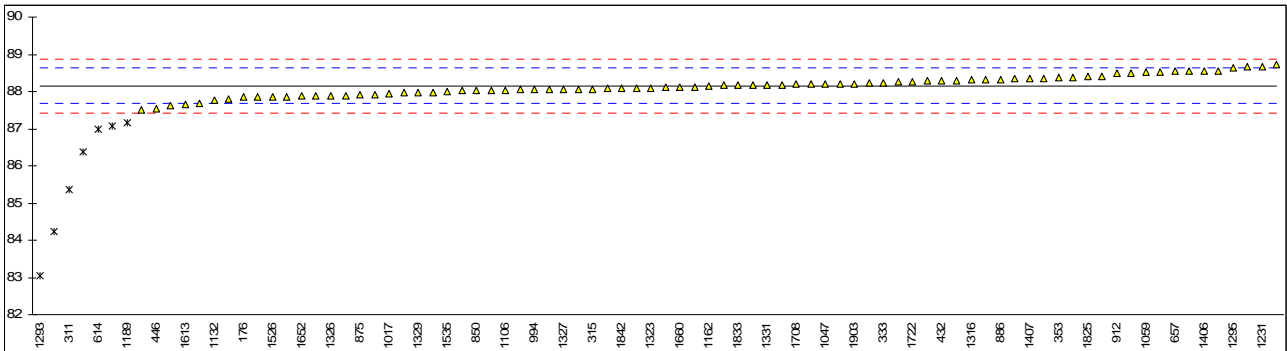
Determination of Kinematic Viscosity @ 100°C on sample #1041; results in mm^2/s

lab	method	value	mark	z(targ)	remarks
176	D445	13.219		-3.12	
233	D445	13.24		-2.54	
237	D445	13.31		-0.60	
252	D445	13.2671		-1.79	
254		-----		-----	
255		-----		-----	
311	D445	13.35		0.50	
315	D445	13.2795		-1.44	
318		-----		-----	
331	in house	13.475		3.96	
333	D445	13.42		2.44	
340	D445	13.261		-1.95	
343	D445	13.301		-0.85	
353	D445	13.341		0.26	
360	D445	13.311		-0.57	
432	D445	13.36		0.78	
445	D445	13.41		2.16	
446	D445	19.06	G(0.01)	158.30	
450	D445	13.36		0.78	
451		-----		-----	
473	D445	13.475		3.96	
496	D445	13.351		0.53	
593	D445	13.2838		-1.32	
609		-----		-----	
614	D445	13.42		2.44	
622	D445	13.18		-4.19	
657	D445	13.30		-0.88	
663		-----		-----	
704	D445	13.241		-2.51	
840	D445	13.184		-4.08	
850	D445	13.204	C	-3.53	First reported 13.877
862	D445	13.256	C	-2.09	First reported 13.556
875	D445	13.32		-0.32	
886	D445	13.34		0.23	
912	D445	13.18		-4.19	
963		-----		-----	
994	D445	13.29		-1.15	
1013		-----		-----	
1017	D445	13.5211		5.23	
1023	D445	13.35		0.50	
1047	ISO3104	13.293		-1.07	
1059	ISO3104	13.32		-0.32	
1080	ISO3104	13.36		0.78	
1094	D445	13.3103		-0.59	
1106		-----		-----	
1113		-----		-----	
1128		-----		-----	
1132	D445	13.29		-1.15	
1146	D445	13.378		1.28	
1162	D445	13.222		-3.03	
1173		-----		-----	
1189	D445	13.1230		-5.77	
1201	D445	13.43		2.72	
1203	ISO3104	13.41		2.16	
1213	D445	13.36		0.78	
1231	D445	13.54		5.76	
1243	D445	13.50		4.65	
1293	ISO3104	12.88	G(0.01)	-12.48	
1295	ISO3104	13.485		4.24	
1316	D445	13.34		0.23	
1323	inh-265	13.35		0.50	
1324	inh-265	13.37		1.06	
1325	inh-265	13.37		1.06	
1326	D445	13.36		0.78	
1327	D445	13.42		2.44	
1328	inh-265	13.36		0.78	
1329	inh-265	13.35		0.50	
1330	inh-265	13.37		1.06	
1331	D445	13.37		1.06	
1332	inh265	13.31		-0.60	
1333	inh-265	13.38		1.33	
1334	inh-265	13.37		1.06	
1335	D445	13.330		-0.05	
1402	D445	13.29		-1.15	

1406	D445	13.36		0.78
1407	ISO3104	13.42		2.44
1428	ISO3104	13.39		1.61
1431	D7042	13.43		2.72
1435	D7042	13.6	DG(0.05)	7.41
1526		-----		-----
1535	ISO3104	13.322		-0.27
1540	D445	13.341		0.26
1543		-----		-----
1613	D445	13.356		0.67
1620	D445	13.31		-0.60
1650	D445	13.165		-4.61
1652	D445	13.227		-2.89
1658		-----		-----
1660	D445	13.451		3.30
1708	D445	13.370		1.06
1720	D445	13.07		-7.23
1722		-----		-----
1800		-----		-----
1825	D445	13.38		1.33
1827		-----		-----
1833	D445	13.355		0.64
1842	IP71	13.27		-1.71
1850	ISO3104	13.23		-2.81
1903	inh-08	13.2669		-1.79
2122	in house	13.65	DG(0.05)	8.80

normality	OK	
n	78	
outliers	4	
mean (n)	13.3317	
st.dev. (n)	0.08848	
R(calc.)	0.2478	
R(D445:09)	0.1013	
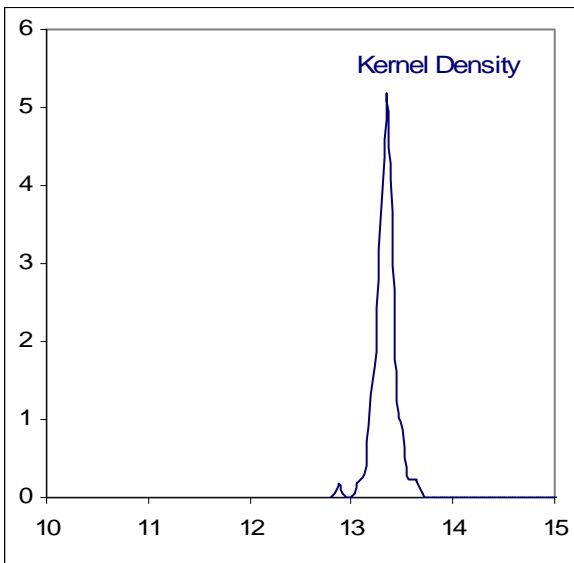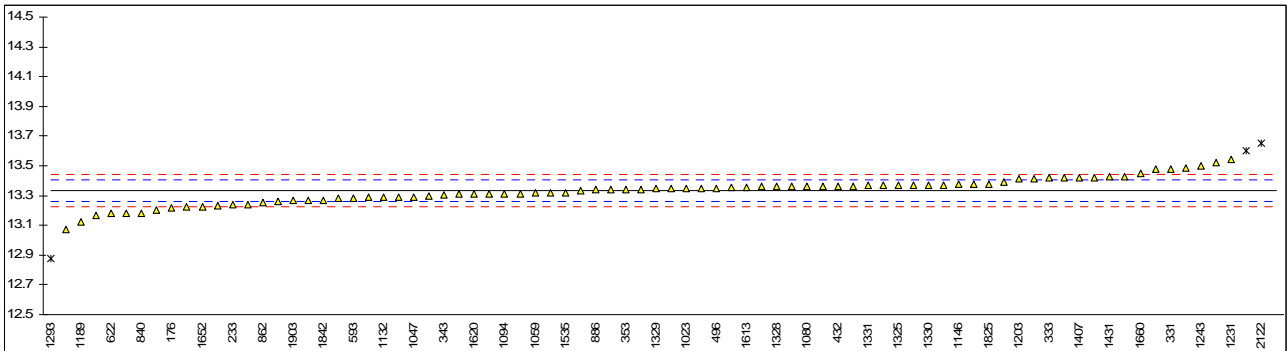
Determination of Viscosity Stabinger @ 40 °C on sample #1041; results in mm^2/s

lab	method	value	mark	z(targ)	remarks
176	D7042	86.56		-6.86	
233		-----		-----	
237		-----		-----	
252		-----		-----	
254		-----		-----	
255		-----		-----	
311	D7042	88.97		7.39	
315		-----		-----	
318		-----		-----	
331		-----		-----	
333		-----		-----	
340		-----		-----	
343		-----		-----	
353		-----		-----	
360		-----		-----	
432		-----		-----	
445		-----		-----	
446		-----		-----	
450		-----		-----	
451		-----		-----	
473		-----		-----	
496		-----		-----	
593		-----		-----	
609	D7042	87.753		0.20	
614		-----		-----	
622		-----		-----	
657		-----		-----	
663		-----		-----	
704		-----		-----	
840		-----		-----	
850		-----		-----	
862		-----		-----	
875		-----		-----	
886		-----		-----	
912		-----		-----	
963	D7042	86.817		-5.34	
994	D7042	87.31		-2.42	
1013		-----		-----	
1017		-----		-----	
1023		-----		-----	
1047		-----		-----	
1059		-----		-----	
1080	D7042	88.14		2.48	
1094		-----		-----	
1106		-----		-----	
1113		-----		-----	
1128		-----		-----	
1132		-----		-----	
1146		-----		-----	
1162		-----		-----	
1173		-----		-----	
1189		-----		-----	
1201	D7042	88.2		2.84	
1203		-----		-----	
1213		-----		-----	
1231		-----		-----	
1243		-----		-----	
1293		-----		-----	
1295		-----		-----	
1316		-----		-----	
1323		-----		-----	
1324		-----		-----	
1325		-----		-----	
1326		-----		-----	
1327		-----		-----	
1328		-----		-----	
1329		-----		-----	
1330		-----		-----	
1331		-----		-----	
1332		-----		-----	
1333		-----		-----	
1334		-----		-----	
1335		-----		-----	
1402		-----		-----	

1406		-----	-----
1407		-----	-----
1428		-----	-----
1431	D7042	88.01	1.71
1435		-----	-----
1526		-----	-----
1535		-----	-----
1540		-----	-----
1543		-----	-----
1613		-----	-----
1620		-----	-----
1650		-----	-----
1652		-----	-----
1658		-----	-----
1660		-----	-----
1708	D7042	88.03	1.83
1720	D7042	87.41	-1.83
1722		-----	-----
1800		-----	-----
1825		-----	-----
1827		-----	-----
1833		-----	-----
1842		-----	-----
1850		-----	-----
1903		-----	-----
2122		-----	-----

normality	OK
n	10
outliers	0
mean (n)	87.720
st.dev. (n)	0.7130
R(calc.)	1.997
R(D7042:04)	0.474
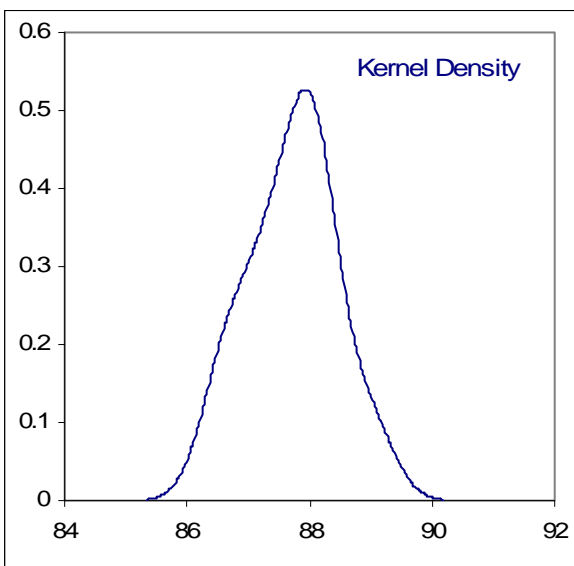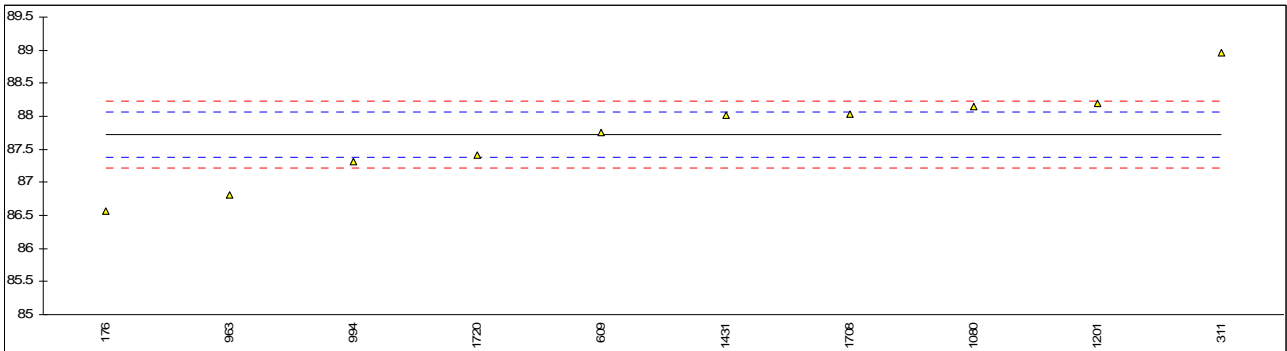
Determination of Nitrogen on sample #1041; results in mg/kg

lab	method	value	mark	z(targ)	remarks
176	D3228	848		-0.50	
233		-----		-----	
237		-----		-----	
252		-----		-----	
254		-----		-----	
255		-----		-----	
311	D5762	1212	G(0.05)	4.60	
315		-----		-----	
318		-----		-----	
331		-----		-----	
333		-----		-----	
340		-----		-----	
343		-----		-----	
353		-----		-----	
360		-----		-----	
432		-----		-----	
445	D5762	761		-1.72	
446		-----		-----	
450		-----		-----	
451		-----		-----	
473		-----		-----	
496		-----		-----	
593		-----		-----	
609		-----		-----	
614		-----		-----	
622		-----		-----	
657	D3228	1005.2		1.70	
663		-----		-----	
704	D3228	1054.3		2.39	
840		-----		-----	
850		-----		-----	
862	D4629	809.2		-1.04	
875	D5762	905		0.30	
886		-----		-----	
912		-----		-----	
963		-----		-----	
994		-----		-----	
1013		-----		-----	
1017		-----		-----	
1023		-----		-----	
1047		-----		-----	
1059		-----		-----	
1080	D4629	923		0.55	
1094		-----		-----	
1106		-----		-----	
1113		-----		-----	
1128		-----		-----	
1132		-----		-----	
1146		-----		-----	
1162		-----		-----	
1173		-----		-----	
1189		-----		-----	
1201		-----		-----	
1203	D3228	684	C	-2.80	First reported 581
1213	D3228	1030		2.05	
1231		-----		-----	
1243		-----		-----	
1293		-----		-----	
1295		-----		-----	
1316		-----		-----	
1323		-----		-----	
1324		-----		-----	
1325		-----		-----	
1326	D5762	939		0.77	
1327		-----		-----	
1328		-----		-----	
1329		-----		-----	
1330		-----		-----	
1331		-----		-----	
1332		-----		-----	
1333		-----		-----	
1334		-----		-----	
1335		-----		-----	
1402		-----		-----	

1406		-----	-----
1407		-----	-----
1428		-----	-----
1431		-----	-----
1435		-----	-----
1526		-----	-----
1535		-----	-----
1540		-----	-----
1543		-----	-----
1613		-----	-----
1620	D4629	760	-1.73
1650		-----	-----
1652		-----	-----
1658		-----	-----
1660		-----	-----
1708		-----	-----
1720		-----	-----
1722		-----	-----
1800		-----	-----
1825		-----	-----
1827		-----	-----
1833	D3228	723	-2.25
1842	D5762	1046	2.27
1850		-----	-----
1903		-----	-----
2122		-----	-----

normality	OK
n	13
outliers	1
mean (n)	883.7
st.dev. (n)	128.96
R(calc.)	361.1
R(D3228:08)	200.0
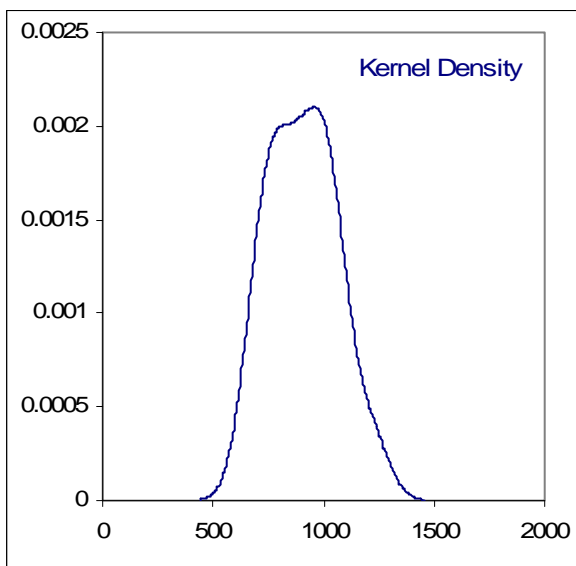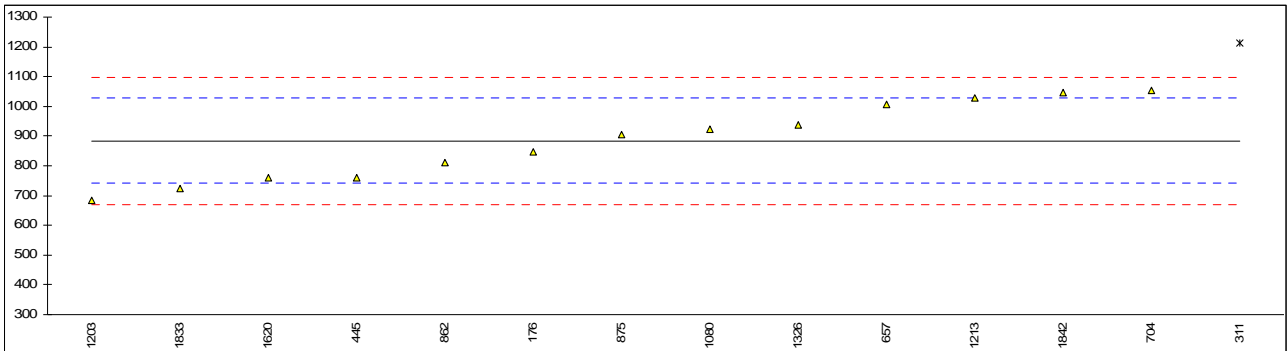
Determination of Pour Point (Manual) on sample #1041; results in °C

lab	method	value	mark	z(targ)	remarks
176	D97	-36		-0.55	
233		-----		-----	
237	D97	<-24.0		-----	
252	D97	-33.0		0.39	
254	D97	<-6		-----	
255		-----		-----	
311		-----		-----	
315		-----		-----	
318		-----		-----	
331		-----		-----	
333		-----		-----	
340		-----		-----	
343	D97	-36		-0.55	
353		-----		-----	
360	D97	-33		0.39	
432	D97	-36		-0.55	
445	D97	-33		0.39	
446		-----		-----	
450		-----		-----	
451		-----		-----	
473		-----		-----	
496	D97	-36		-0.55	
593		-----		-----	
609	D97	-30		1.32	
614	D97	-27		2.25	
622	D97	-33		0.39	
657	D97	<-18		-----	
663		-----		-----	
704	D97	-33		0.39	
840	D97	-33		0.39	
850	D97	-30		1.32	
862	D97	-36		-0.55	
875	D97	-33		0.39	
886		-----		-----	
912	D97	-33		0.39	
963	D97	-33		0.39	
994	D97	-30		1.32	
1013	D97	-36		-0.55	
1017		-----		-----	
1023	D97	-30		1.32	
1047		-----		-----	
1059		-----		-----	
1080		-----		-----	
1094		-----		-----	
1106		-----		-----	
1113		-----		-----	
1128		-----		-----	
1132		-----		-----	
1146		-----		-----	
1162	D97	-33.0		0.39	
1173		-----		-----	
1189		-----		-----	
1201		-----		-----	
1203	ISO3016	-34		0.08	
1213	D97	<-27		-----	
1231		-----		-----	
1243		-----		-----	
1293		-----		-----	
1295	inh-170	-30		1.32	
1316		-----		-----	
1323	inh-535	-36		-0.55	
1324	inh-535	-36		-0.55	
1325	inh-535	-36		-0.55	
1326	D97	-36		-0.55	
1327	D97	-36.0		-0.55	
1328	inh-535	-36		-0.55	
1329	inh-535	-36		-0.55	
1330		-----		-----	
1331	inh-535	-36		-0.55	
1332	D97	-35.6		-0.42	
1333	inh-535	-36		-0.55	
1334	inh-535	-36		-0.55	
1335		-----		-----	
1402	D97	-36		-0.55	

1406	ISO3016	-35	-0.24
1407	ISO3016	-33	0.39
1428	ISO3016	-36	-0.55
1431		-----	-----
1435	D97	-33	0.39
1526		-----	-----
1535		-----	-----
1540	D97	-39	-1.48
1543		-----	-----
1613	D97	-34	0.08
1620	D97	-33	0.39
1650		-----	-----
1652	ISO3016	-33	0.39
1658		-----	-----
1660	D97	-36	-0.55
1708	D97	-36	-0.55
1720	D97	-36	-0.55
1722		-----	-----
1800		-----	-----
1825		-----	-----
1827		-----	-----
1833	D97	-37	-0.86
1842		-----	-----
1850	ISO3016	-34	0.08
1903		-----	-----
2122		-----	-----

|	
normality	not OK
n	48
outliers	0
mean (n)	-34.24
st.dev. (n)	2.360
R(calc.)	6.61
R(D97:09)	9.00

Kernel Density
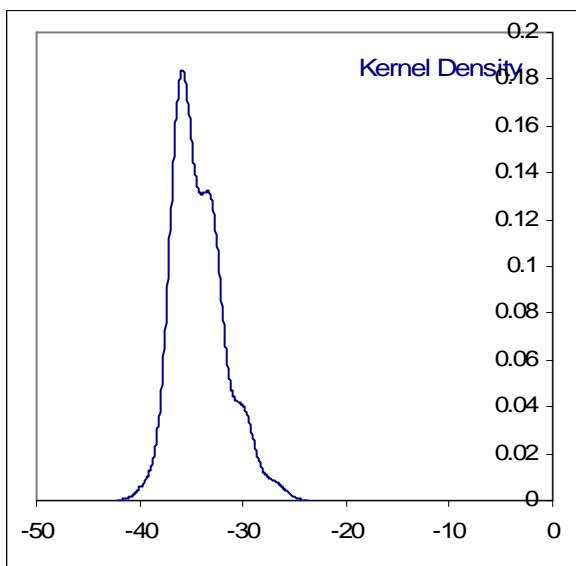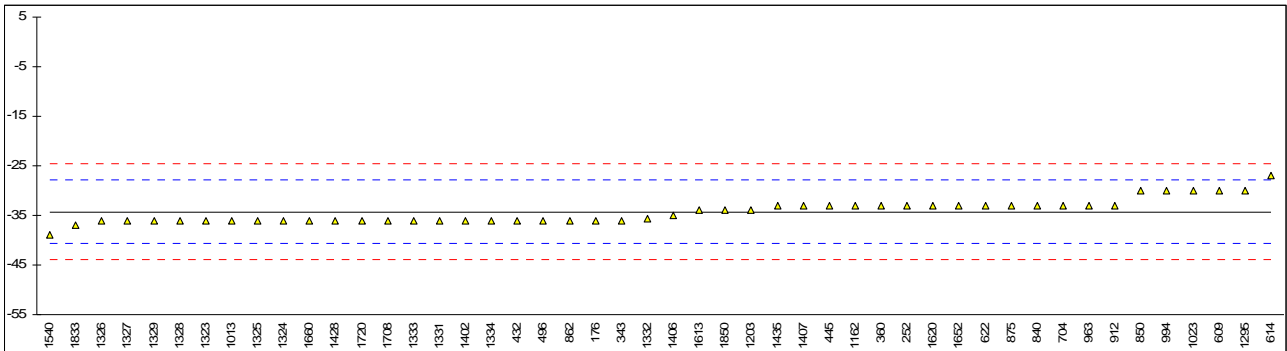
Determination of Pour Point (Automated, 1°C interval) on sample #1041; results in °C

lab	method	value	mark	z(targ)	remarks
176		-----		-----	
233		-----		-----	
237		-----		-----	
252		-----		-----	
254		-----		-----	
255		-----		-----	
311	D5950 (3°)	-36		0.46	
315		-----		-----	
318		-----		-----	
331		-----		-----	
333		-----		-----	
340		-----		-----	
343		-----		-----	
353		-----		-----	
360		-----		-----	
432	D5950	-39		-1.41	
445	D5950	-38		-0.79	
446		-----		-----	
450		-----		-----	
451		-----		-----	
473		-----		-----	
496		-----		-----	
593		-----		-----	
609		-----		-----	
614		-----		-----	
622		-----		-----	
657		-----		-----	
663		-----		-----	
704		-----		-----	
840		-----		-----	
850		-----		-----	
862		-----		-----	
875		-----		-----	
886	D5950	-36		0.46	
912		-----		-----	
963		-----		-----	
994		-----		-----	
1013		-----		-----	
1017	D5950	-36		0.46	
1023		-----		-----	
1047		-----		-----	
1059	ISO3016	-36		0.46	
1080	ISO3016	-38		-0.79	
1094		-----		-----	
1106		-----		-----	
1113		-----		-----	
1128		-----		-----	
1132	D5950	-36.0		0.46	
1146		-----		-----	
1162		-----		-----	
1173		-----		-----	
1189		-----		-----	
1201	D5950	-39		-1.41	
1203		-----		-----	
1213		-----		-----	
1231	D5950	-35		1.08	
1243	D5950	-36		0.46	
1293		-----		-----	
1295		-----		-----	
1316	D5950	-36		0.46	
1323		-----		-----	
1324		-----		-----	
1325		-----		-----	
1326		-----		-----	
1327		-----		-----	
1328		-----		-----	
1329		-----		-----	
1330	D97	-36		0.46	
1331		-----		-----	
1332		-----		-----	
1333		-----		-----	
1334		-----		-----	
1335	D5950	-37.0		-0.16	
1402		-----		-----	

1406		-----	-----
1407		-----	-----
1428	D5950	-36	0.46
1431		-----	-----
1435		-----	-----
1526		-----	-----
1535		-----	-----
1540		-----	-----
1543		-----	-----
1613		-----	-----
1620		-----	-----
1650	D5950	-40	-2.03
1652		-----	-----
1658		-----	-----
1660		-----	-----
1708		-----	-----
1720		-----	-----
1722		-----	-----
1800		-----	-----
1825		-----	-----
1827		-----	-----
1833	D5950	-37	-0.16
1842	D5950	-36	0.46
1850	D5950	-35	1.08
1903		-----	-----
2122		-----	-----

normality	not OK
n	19
outliers	0
mean (n)	-36.74
st.dev. (n)	1.408
R(calc.)	3.94
R(D5950:07)	4.50
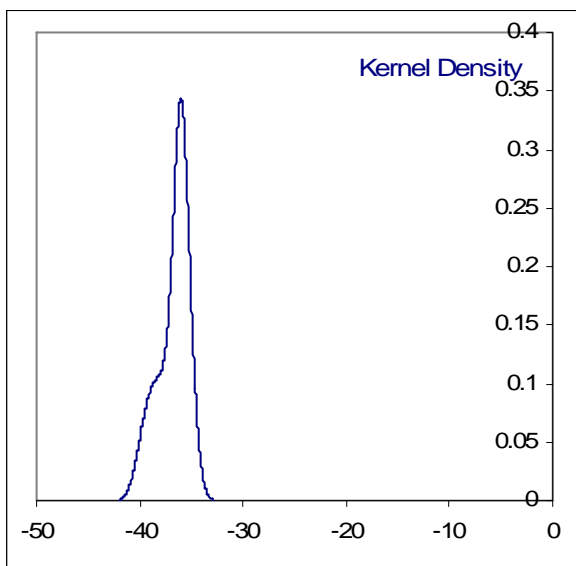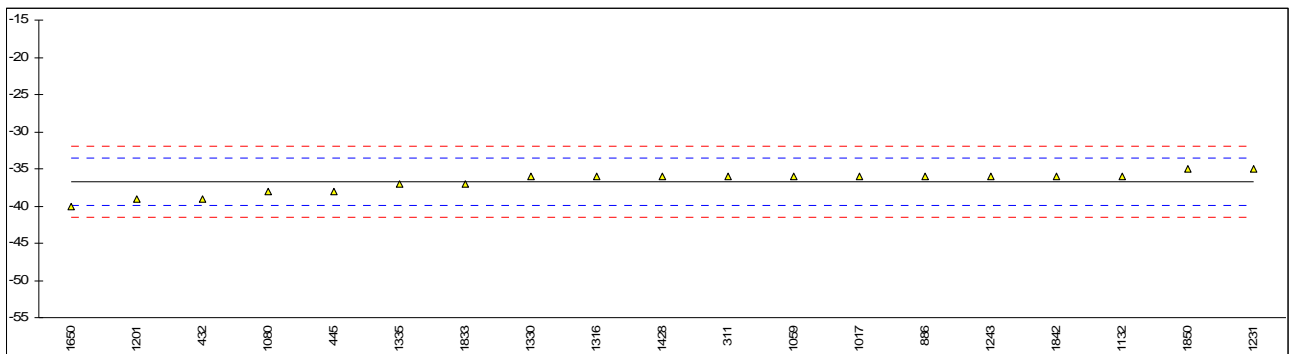
Determination of Sulphated Ash on sample #1041; results in %M/M

lab	method	value	mark	z(targ)	remarks
176	D874	2.045		0.78	
233		-----		-----	
237	D874	1.917		-0.29	
252		-----		-----	
254		-----		-----	
255		-----		-----	
311	D874	1.88		-0.60	
315		-----		-----	
318		-----		-----	
331		-----		-----	
333		-----		-----	
340	D874	1.693	G(0.05)	-2.17	
343	D874	1.81		-1.19	
353		-----		-----	
360	D874	1.830		-1.02	
432		-----		-----	
445	D874	1.90		-0.43	
446		-----		-----	
450		-----		-----	
451		-----		-----	
473		-----		-----	
496	D874	2.066		0.96	
593	D874	2.040		0.74	
609	D874	2.0465		0.80	
614		-----		-----	
622	D874	2.06		0.91	
657	D874	1.84		-0.94	
663	D874	1.979		0.23	
704	D874	1.944		-0.06	
840	D874	1.913		-0.32	
850		-----		-----	
862	D874	1.988		0.31	
875		-----		-----	
886		-----		-----	
912		-----		-----	
963		-----		-----	
994		-----		-----	
1013		-----		-----	
1017		-----		-----	
1023		-----		-----	
1047	ISO3987	1.86		-0.77	
1059	ISO3987	1.98		0.24	
1080	ISO3987	1.851		-0.84	
1094		-----		-----	
1106		-----		-----	
1113		-----		-----	
1128		-----		-----	
1132	D874	2.01		0.49	
1146		-----		-----	
1162	D874	1.936		-0.13	
1173		-----		-----	
1189		-----		-----	
1201	D874	2.03		0.66	
1203	D874	1.943		-0.07	
1213	D874	1.88		-0.60	
1231		-----		-----	
1243		-----		-----	
1293		-----		-----	
1295		-----		-----	
1316		-----		-----	
1323	inh-433	2.014		0.52	
1324	inh-433	2.024		0.61	
1325		-----		-----	
1326	D874	1.993		0.35	
1327	D874	2.011		0.50	
1328	inh-433	1.98		0.24	
1329	inh-433	1.983		0.26	
1330	inh-433	1.99		0.32	
1331	inh-433	2.00		0.41	
1332	D874	2.0122		0.51	
1333	inh-433	1.992		0.34	
1334	inh-433	2.01		0.49	
1335		-----		-----	
1402	D874	1.77		-1.52	

1406	D874	1.915	-0.31
1407		-----	-----
1428	ISO3987	1.89	-0.52
1431	D874	1.79	-1.36
1435		-----	-----
1526		-----	-----
1535	ISO3987	1.888	-0.53
1540		-----	-----
1543		-----	-----
1613	D874	1.974	0.19
1620	D874	2.04	0.74
1650	D874	1.998	0.39
1652		-----	-----
1658		-----	-----
1660		-----	-----
1708	D874	1.994	0.36
1720		-----	-----
1722		-----	-----
1800		-----	-----
1825		-----	-----
1827		-----	-----
1833		-----	-----
1842	IP163	1.841	-0.93
1850	ISO3987	1.96	0.07
1903		-----	-----
2122		-----	-----

normality	not OK
n	45
outliers	1
mean (n)	1.952
st.dev. (n)	0.0778
R(calc.)	0.218
R(D874:07)	0.334

Kernel Density
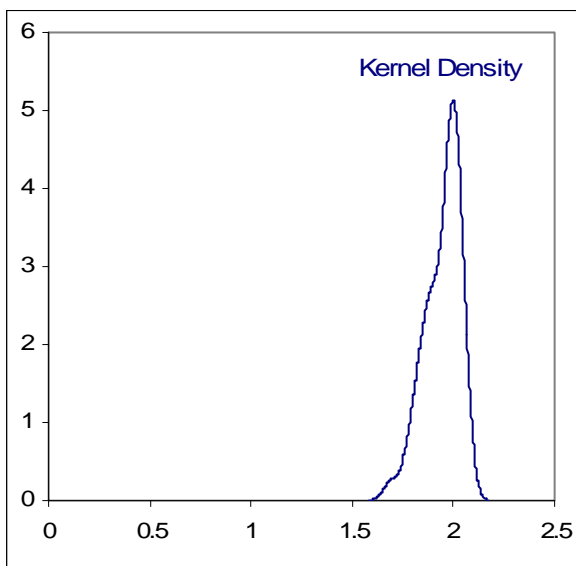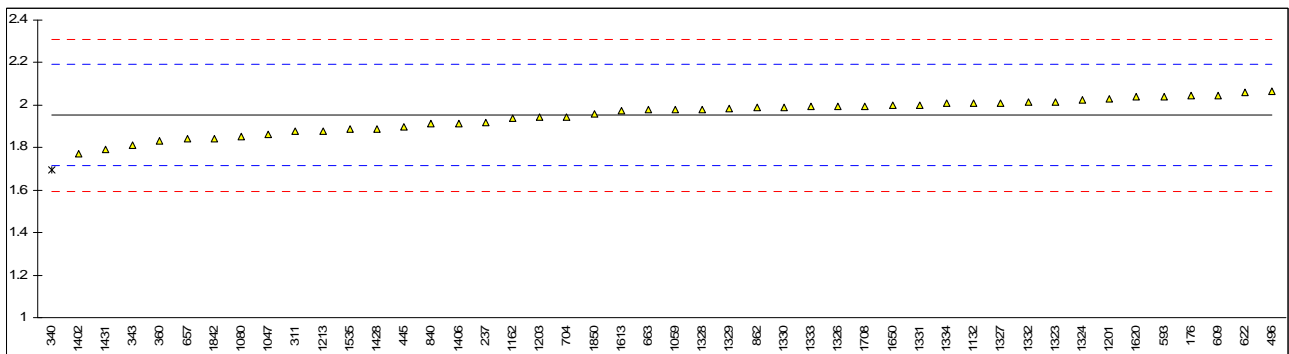
Determination of Sulphur on sample #1041; results in %M/M

lab	method	value	mark	z(targ)	remarks
176	D2622	0.347		0.92	
233		-----		-----	
237		-----		-----	
252		-----		-----	
254		-----		-----	
255		-----		-----	
311	D2622	0.319		-1.80	
315		-----		-----	
318	inh-2	0.34		0.24	
331		-----		-----	
333	D2622	0.329		-0.83	
340		-----		-----	
343	IP336	0.409	DG(0.01)	6.96	First reported 0.452
353		-----		-----	
360	D2622	0.323		-1.41	
432		-----		-----	
445		-----		-----	
446		-----		-----	
450		-----		-----	
451		-----		-----	
473		-----		-----	
496	D2622	0.3197		-1.74	
593		-----		-----	
609	D2622	0.308		-2.88	
614		-----		-----	
622	D4294	0.372		3.36	
657		-----		-----	
663		-----		-----	
704		-----		-----	
840	D4294	0.4411	CG(0.05)	10.09	First reported 0.4711
850	D2622	0.3307		-0.66	
862	D2622	0.3360		-0.15	
875		-----		-----	
886	D2622	0.3377		0.02	
912		-----		-----	
963		-----		-----	
994		-----		-----	
1013		-----		-----	
1017		-----		-----	
1023	IP3	0.203	DG(0.05)	-13.10	
1047		-----		-----	
1059	ISO14596	0.31		-2.68	
1080	D4294	0.413	DG(0.01)	7.35	
1094	in house	0.3701		3.17	
1106		-----		-----	
1113		-----		-----	
1128	D2622	0.3541		1.61	
1132		-----		-----	
1146		-----		-----	
1162		-----		-----	
1173		-----		-----	
1189		-----		-----	
1201	D2622	0.185	DG(0.05)	-14.85	
1203	ISO14596	0.33		-0.73	
1213		-----		-----	
1231		-----		-----	
1243		-----		-----	
1293		-----		-----	
1295		-----		-----	
1316		-----		-----	
1323		-----		-----	
1324	D7039	0.320	C	-1.71	First reported 0.251
1325		-----		-----	
1326	D4294	0.3408		0.32	
1327	D5453	0.3401	C	0.25	First reported 0.357
1328		-----		-----	
1329		-----		-----	
1330		-----		-----	
1331	inh-387	0.334		-0.34	
1332		-----		-----	
1333		-----		-----	
1334		-----		-----	
1335		-----		-----	
1402		-----		-----	

1406	ISO8754	0.3457		0.80	
1407	In house	0.326		-1.12	
1428	ISO8754	0.34	C	0.24	First reported 0.19
1431	D4294	0.34		0.24	
1435	D2622	0.2645	G(0.05)	-7.11	
1526	D5185	0.259	G(0.05)	-7.65	
1535		-----		-----	
1540	D6481	0.327		-1.03	
1543		-----		-----	
1613		-----		-----	
1620	D4294	0.262	CG(0.05)	-7.36	First reported 0.242
1650		-----		-----	
1652		-----		-----	
1658		-----		-----	
1660		-----		-----	
1708		-----		-----	
1720	D4952	0.272	G(0.05)	-6.38	
1722		-----		-----	
1800		-----		-----	
1825		-----		-----	
1827		-----		-----	
1833	D2622	0.38		4.14	
1842	D2622Mod	0.3593		2.12	
1850	ISO8754	0.334		-0.34	
1903		-----		-----	
2122		-----		-----	

			Only ASTM D2622 data:
normality	OK		OK
n	27		12
outliers	9		2
mean (n)	0.3375		0.3370
st.dev. (n)	0.01781		0.02024
R(calc.)	0.0499		0.0567
R(D2622:10)	0.0288		0.0288
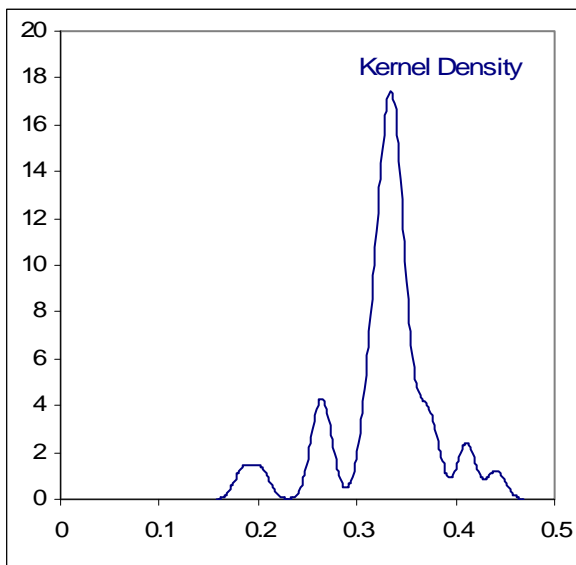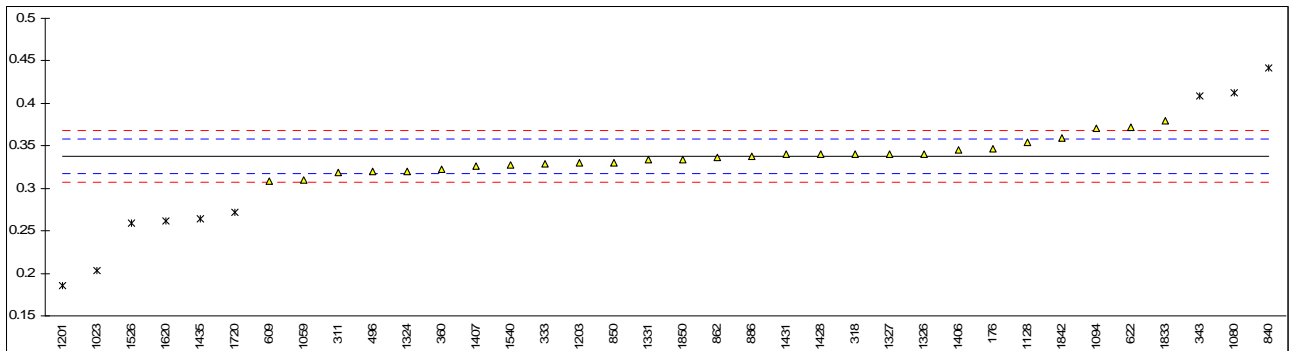
Determination of Water on sample #1041; results in mg/kg

lab	method	value	mark	z(targ)	remarks
176	D6304-C	131		-0.62	
233	in house	0.00	ex	-1.46	Result excluded, not a real result
237	D95	<500		-----	
252		-----		-----	
254		-----		-----	
255		-----		-----	
311		-----		-----	
315		-----		-----	
318	inh-2	3300	ex	19.54	First reported 3.3, method used not suitable for lube oil
331	D6304	54		-1.11	
333		-----		-----	
340		-----		-----	
343	E203	2450	ex	14.13	method used not suitable for lube oil
353	IP439	2300	ex	13.18	method used not suitable for lube oil
360		-----		-----	
432		-----		-----	
445	D6304-A	860	ex	4.02	method used not suitable for lube oil
446	D6304-A	2364	ex	13.59	method used not suitable for lube oil
450		-----		-----	
451	D6304-C	105		-0.79	
473	D6304Mod	234.3		0.03	
496	D6304-C	53.0		-1.12	
593		-----		-----	
609		-----		-----	
614	D6304-C	275.6		0.30	
622		-----		-----	
657	D6304-A	1026.6	ex	5.08	method used not suitable for lube oil
663		-----		-----	
704	D6304	2218.4	ex	12.66	method used not suitable for lube oil
840	D6304-C	1970	G(0.01)	11.08	
850	D6304-A	2113	ex	11.99	First reported 2744.2, method used not suitable for lube oil
862	D6304-C	178.8		-0.32	
875		-----		-----	
886	D6304-A	1017	ex	5.02	method used not suitable for lube oil
912	D6304	252		0.15	
963	D6304-A	2476	ex	14.30	method used not suitable for lube oil
994		-----		-----	
1013		-----		-----	
1017		-----		-----	
1023	D6304	129		-0.64	
1047	D95	2788	ex	16.29	method used not suitable for lube oil
1059	in house	120		-0.69	
1080		-----		-----	
1094		-----		-----	
1106		-----		-----	
1113		-----		-----	
1128		-----		-----	
1132		-----		-----	
1146	D6304-C	344		0.73	
1162	D6304	2494.5	ex	14.42	method used not suitable for lube oil
1173	In house	1840	ex	10.25	method used not suitable for lube oil
1189		-----		-----	
1201	D6304	3000	ex	17.63	method used not suitable for lube oil
1203	ISO12937	391		1.03	
1213	D6304	2200	ex	12.54	method used not suitable for lube oil
1231		-----		-----	
1243	D6304	1350	ex	7.13	method used not suitable for lube oil
1293	ISO12937	2066	ex	11.69	method used not suitable for lube oil
1295		-----		-----	
1316	D6304	330		0.64	
1323		-----		-----	
1324		-----		-----	
1325		-----		-----	
1326		-----		-----	
1327		-----		-----	
1328		-----		-----	
1329		-----		-----	
1330		-----		-----	
1331		-----		-----	
1332		-----		-----	
1333		-----		-----	
1334	D6304-C	232		0.02	
1335		-----		-----	
1402	D6304	313		0.54	

1406	D1744	1050	ex	5.23	method used not suitable for lube oil
1407		-----		-----	
1428		-----		-----	
1431		-----		-----	
1435	D6304	2321	ex	13.31	method used not suitable for lube oil
1526	D4377	<5000	ex	-----	method used not suitable for lube oil
1535		-----		-----	
1540	E203	311.2		0.52	First reported 3112
1543		-----		-----	
1613		-----		-----	
1620	D6304	250		0.13	
1650	D6304	2205.6	ex	12.58	method used not suitable for lube oil
1652		-----		-----	
1658		-----		-----	
1660	IEC 60814	195		-0.22	
1708	D6304	450		1.41	
1720		-----		-----	
1722		-----		-----	
1800		-----		-----	
1825		-----		-----	
1827	D6304	1533.5	ex	8.30	method used not suitable for lube oil
1833	D6304	4433	ex	26.75	method used not suitable for lube oil
1842	D6304	2415	ex	13.91	method used not suitable for lube oil
1850	ISO12937	3377	ex	20.03	First reported 0.3377, method used not suitable for lube oil
1903		-----		-----	
2122	IP396	1320	ex	6.94	method used not suitable for lube oil

normality	OK	
n	19	
outliers	1	
mean (n)	228.9	
st.dev. (n)	112.46	
R(calc.)	314.9	
R(D6304:07)	440.0	

Kernel Density
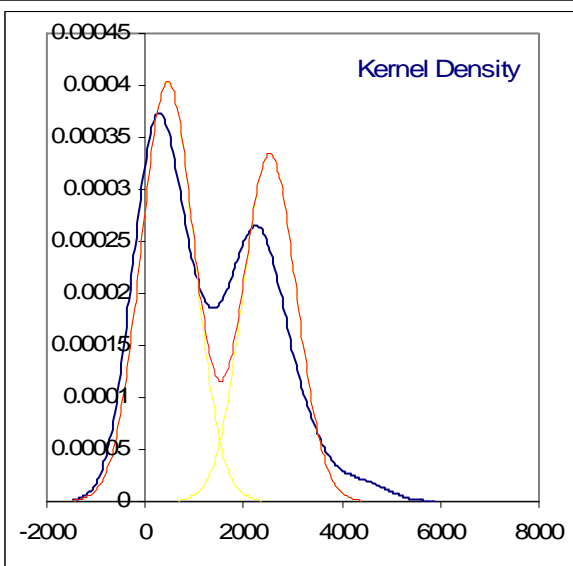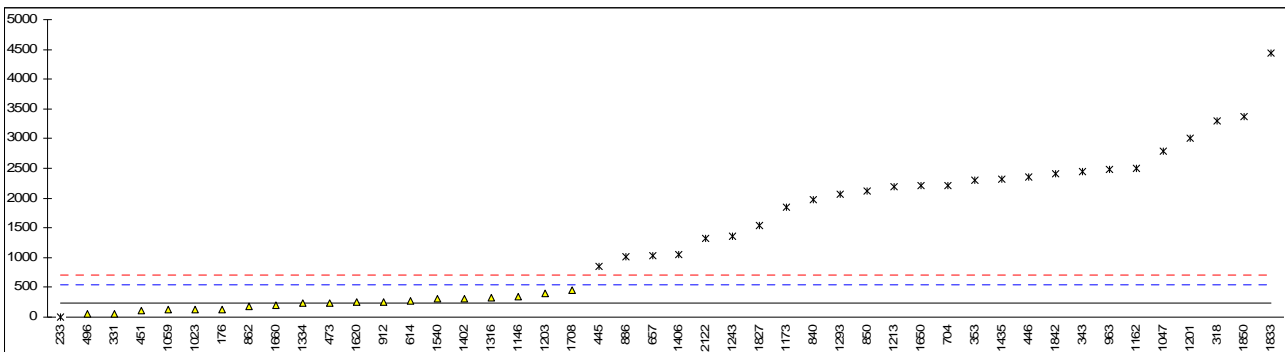
Determination of Calcium (Ca) on sample #1041; results in mg/kg

lab	method	value	mark	z(targ)	remarks
176	D5185	6518	G(0.01)	5.16	
233	in house	4742		-0.24	
237		-----		-----	
252		-----		-----	
254		-----		-----	
255		-----		-----	
311	D5185	4780		-0.13	
315		-----		-----	
318		-----		-----	
331	D5185	4800.44		-0.07	
333	D5185	5030		0.63	
340	D5185	4498		-0.99	
343	D5185	5200		1.15	
353		-----		-----	
360	D5185	4585		-0.72	
432		-----		-----	
445	D5185	4920		0.30	
446		-----		-----	
450		-----		-----	
451	D5185	5312		1.49	
473	D5185Mod	5521.78		2.13	
496	D5185	4906		0.26	
593		-----		-----	
609	D5185	4340		-1.47	
614	D5185	5522		2.13	
622	D5185	4879.12		0.17	
657	D5185	4520		-0.92	
663		-----		-----	
704		-----		-----	
840		-----		-----	
850		-----		-----	
862	D5185	4804		-0.05	
875		-----		-----	
886		-----		-----	
912	D5185	4543		-0.85	
963	D5185	4835		0.04	
994	D5185	4937.9		0.35	
1013		-----		-----	
1017	D5185	4788		-0.10	
1023	D5185	4496		-0.99	
1047		-----		-----	
1059	in house	4884		0.19	
1080		-----	W	-----	First reported 6930, malfunction of the equipment
1094	D5185	4781		-0.12	
1106		-----		-----	
1113		-----		-----	
1128	In house	4434.33		-1.18	
1132		-----		-----	
1146	D5185	4076		-2.27	
1162		-----		-----	
1173	In house	4941.5		0.36	
1189		-----		-----	
1201	D5185	3800	G(0.05)	-3.11	
1203	D5185	5462		1.95	
1213	D5185	4770		-0.16	
1231	D4951	5090		0.81	
1243	D5185	4580		-0.74	
1293	D6595	5066.9		0.74	
1295		-----		-----	
1316	D5185	4040		-2.38	
1323	inh-270	4717		-0.32	
1324		-----		-----	
1325		-----		-----	
1326	D5185	5210		1.18	
1327	D5185	5296		1.44	
1328	D5185	4832		0.03	
1329	inh-270	4930		0.33	
1330		-----		-----	
1331	inh-270	4930		0.33	
1332	inh-270	4913		0.28	
1333	inh-228	4681.0		-0.43	
1334	inh-270	4950		0.39	
1335		-----		-----	
1402	D5185	4900		0.24	

1406	D4628	4820		-0.01
1407		-----		-----
1428	D5185	4935		0.34
1431	in house	5185		1.10
1435	D5185	4206		-1.87
1526		-----		-----
1535		-----		-----
1540	D6481	4340		-1.47
1543		-----		-----
1613		-----		-----
1620	D5185	4890		0.21
1650		-----		-----
1652		-----		-----
1658		-----		-----
1660	D5185	790	G(0.01)	-12.26
1708	D5185	4993		0.52
1720		-----		-----
1722		-----		-----
1800	In house	4779		-0.13
1825		-----		-----
1827		-----		-----
1833	D5185	4279		-1.65
1842	in house	4910		0.27
1850	in house	5205		1.16
1903		-----		-----
2122	D5185	4406		-1.26

normality	not OK
n	54
outliers	3
mean (n)	4822.1
st.dev. (n)	334.60
R(calc.)	936.9
R(D5185:09)	921.1
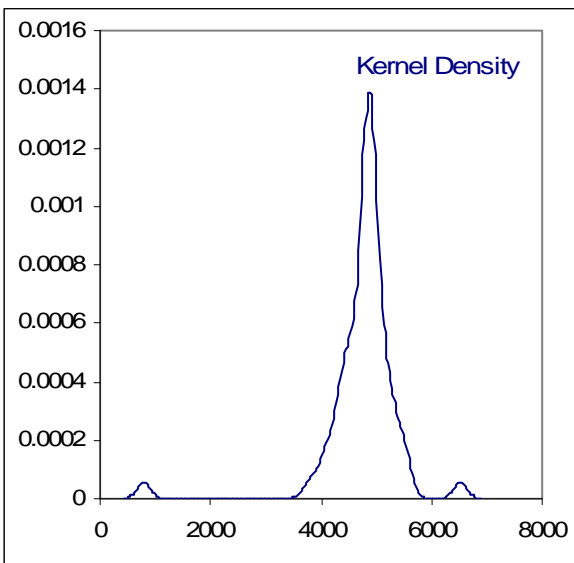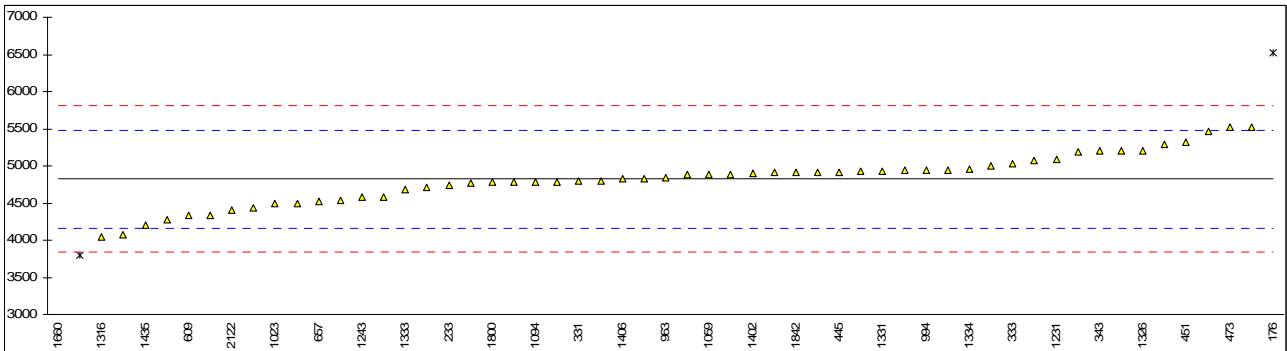
Determination of Phosphorus (P) on sample #1041; results in mg/kg

lab	method	value	mark	z(targ)	remarks
176	D5185	1457	DG(0.05)	5.01	
233	In house	1093		-1.85	
237		-----		-----	
252		-----		-----	
254		-----		-----	
255		-----		-----	
311	D5185	1170		-0.40	
315		-----		-----	
318		-----		-----	
331	D5185	1133.22		-1.09	
333	D5185	1128		-1.19	
340	D5185	1151		-0.76	
343	D5185	1216		0.47	
353		-----		-----	
360	D5185	1090		-1.91	
432		-----		-----	
445	D5185	1230		0.73	
446		-----		-----	
450		-----		-----	
451	D5185	1249		1.09	
473	D5185Mod	1747.89	G(0.01)	10.50	
496	D5185	1138		-1.00	
593		-----		-----	
609	D5185	1200		0.17	
614	D5185	1230		0.73	
622	D5185	1245.50		1.02	
657	D5185	1230		0.73	
663		-----		-----	
704		-----		-----	
840		-----		-----	
850		-----		-----	
862	D5185	1183		-0.15	
875		-----		-----	
886		-----		-----	
912	D5185	1187		-0.08	
963	D5185	1104		-1.65	
994	D5185	1226.6		0.67	
1013		-----		-----	
1017	D5185	1199		0.15	
1023	D5185	1240		0.92	
1047		-----		-----	
1059	in house	1218		0.51	
1080	D5185	1336		2.73	
1094	D5185	1235		0.83	
1106		-----		-----	
1113		-----		-----	
1128	In house	1262.83		1.35	
1132		-----		-----	
1146	D5185	1110		-1.53	
1162		-----		-----	
1173	In house	1197.7		0.12	
1189		-----		-----	
1201	D5185	950	DG(0.01)	-4.55	
1203	D5185	1181		-0.19	
1213	D5185	1240		0.92	
1231	D4951	1250		1.11	
1243	D5185	1065		-2.38	
1293	D6595	1443.45	DG(0.05)	4.76	
1295		-----		-----	
1316	D5185	940	DG(0.01)	-4.74	
1323	inh-296	1187		-0.08	
1324		-----		-----	
1325		-----		-----	
1326	D5185	1300		2.05	
1327	D5185	1278		1.64	
1328	D5185	1197		0.11	
1329	inh-296	1244		1.00	
1330		-----		-----	
1331	inh-296	1210		0.35	
1332	inh-296	1230		0.73	
1333	inh-296	1220.0		0.54	
1334	inh-296	1210		0.35	
1335		-----		-----	
1402	D5185	1281		1.69	

1406		-----		-----	
1407		-----		-----	
1428	D5185	1121	C	-1.32	First reported 1374
1431	in house	1261		1.32	
1435	D5185	1066		-2.36	
1526		-----		-----	
1535		-----		-----	
1540	D6481	1100		-1.72	
1543		-----		-----	
1613		-----		-----	
1620	D5185	1090		-1.91	
1650		-----		-----	
1652		-----		-----	
1658		-----		-----	
1660	D5185	1205		0.26	
1708	D5185	1174		-0.32	
1720		-----		-----	
1722		-----		-----	
1800	In house	1249		1.09	
1825		-----		-----	
1827		-----		-----	
1833	D5185	1032		-3.00	
1842	in house	1220		0.54	
1850		-----		-----	
1903		-----		-----	
2122	D5185	1137.5		-1.01	

normality	OK
n	51
outliers	5
mean (n)	1191.2
st.dev. (n)	66.71
R(calc.)	186.8
R(D5185:09)	148.4
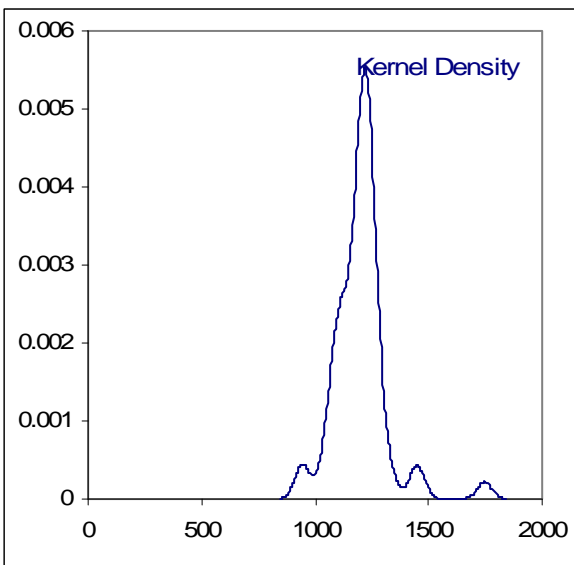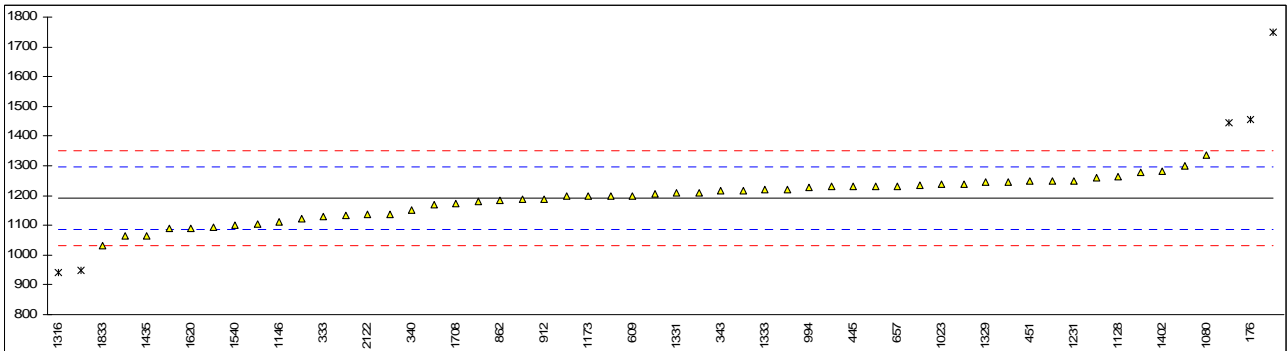
Determination of Zinc (Zn) on sample #1041; results in mg/kg

lab	method	value	mark	z(targ)	remarks
176	D5185	1329		-0.28	
233	In house	1539		2.27	
237		-----		-----	
252		-----		-----	
254	IP308	1542.7		2.31	
255		-----		-----	
311	D5185	1340		-0.14	
315		-----		-----	
318		-----		-----	
331	D5185	1272.33		-0.97	
333	D5185	1367		0.18	
340	D5185	1254		-1.19	
343	D5185	1474		1.48	
353		-----		-----	
360	D5185	1186		-2.01	
432		-----		-----	
445	D5185	1340		-0.14	
446		-----		-----	
450		-----		-----	
451	D5185	1396		0.53	
473	D5185Mod	2392.65	G(0.01)	12.63	
496	D5185	1294		-0.70	
593		-----		-----	
609	D5185	1280		-0.87	
614	D5185	1400		0.58	
622	D5185	1257.02		-1.15	
657	D5185	1320		-0.39	
663		-----		-----	
704		-----		-----	
840		-----		-----	
850		-----		-----	
862	D5185	1344		-0.10	
875		-----		-----	
886		-----		-----	
912	D5185	1319		-0.40	
963	D5185	1216		-1.65	
994	D5185	1138.9		-2.59	
1013	D5185	1383		0.38	
1017	D5185	1355		0.04	
1023	D5185	1300		-0.63	
1047		-----		-----	
1059	in house	1311		-0.50	
1080	D5185	1304		-0.58	
1094	D5185	1293		-0.72	
1106		-----		-----	
1113		-----		-----	
1128	In house	1375.33		0.28	
1132		-----		-----	
1146	D5185	1220		-1.60	
1162		-----		-----	
1173	In house	1381.2		0.36	
1189		-----		-----	
1201	D5185	950	G(0.05)	-4.88	
1203	D5185	1463		1.35	
1213	D5185	1330		-0.27	
1231	D4951	1410		0.70	
1243	D5185	1250		-1.24	
1293	D6595	1499.3		1.79	
1295		-----		-----	
1316	D5185	1120		-2.81	
1323	inh-226	1406		0.66	
1324		-----		-----	
1325		-----		-----	
1326	D5185	1470		1.43	
1327	D5185	1488		1.65	
1328	D5185	1359		0.09	
1329	inh-226	1490		1.68	
1330		-----		-----	
1331	inh-226	1360		0.10	
1332	inh-226	1465		1.37	
1333	inh-228	1436.0		1.02	
1334	inh-226	1360		0.10	
1335		-----		-----	
1402	D5185	1438		1.04	

1406	D4628	1340	-0.14
1407		-----	-----
1428	D5185	1402	0.61
1431	in house	1538	2.26
1435	D5185	1029	-3.92
1526	D5185	1266	-1.04
1535		-----	-----
1540	D6481	1420	0.83
1543		-----	-----
1613		-----	-----
1620	D5185	1333	-0.23
1650		-----	-----
1652		-----	-----
1658		-----	-----
1660	D5185	1523	2.08
1708	D5185	1337	-0.18
1720		-----	-----
1722		-----	-----
1800	In house	1350	-0.02
1825		-----	-----
1827		-----	-----
1833	D5185	1290	-0.75
1842	in house	1320	-0.39
1850	in house	1481	1.57
1903		-----	-----
2122	D5185	1259	-1.13

normality	OK
n	59
outliers	2
mean (n)	1351.9
st.dev. (n)	105.54
R(calc.)	295.5
R(D5185:09)	230.7

Kernel Density
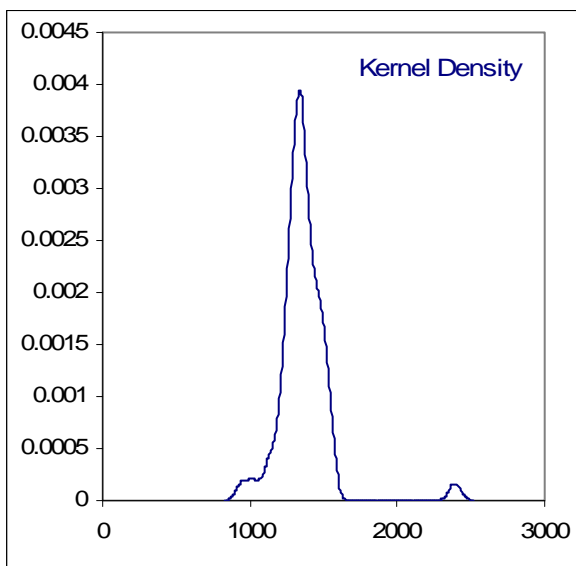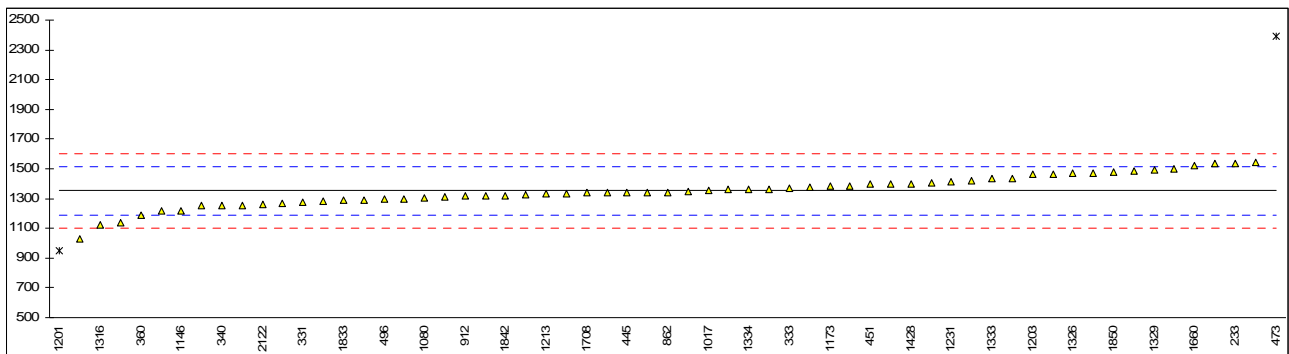
APPENDIX 2

Number of participants per country

```
 1 laboratory in   AUSTRALIA
 1 laboratory in   AUSTRIA
 1 laboratory in   AZERBAIJAN
 2 laboratories in BELGIUM
 1 laboratory in   BULGARIA
 1 laboratory in   CROATIA
 1 laboratory in   ECUADOR
 3 laboratories in FRANCE
 1 laboratory in   GABON
 2 laboratories in GERMANY
 1 laboratory in   GHANA
 3 laboratories in GREECE
 1 laboratory in   HONG KONG
 2 laboratories in HUNGARY
 1 laboratory in   INDIA
 1 laboratory in   INDONESIA
 1 laboratory in   IRELAND
 1 laboratory in   ITALY
 1 laboratory in   JORDAN
 2 laboratories in KENYA
 1 laboratory in   LATVIA
 2 laboratories in MALAYSIA
 1 laboratory in   NEGARA BRUNEI DARUSSALAM
 1 laboratory in   NIGERIA
 2 laboratories in NORWAY
16 laboratories in P.R. of CHINA
 4 laboratories in POLAND
 1 laboratory in   PORTUGAL
 2 laboratories in REPUBLIC OF MACEDONIA
 1 laboratory in   ROMANIA
 1 laboratory in   RUSSIA
 1 laboratory in   SAUDI ARABIA
 1 laboratory in   SERBIA
 1 laboratory in   SINGAPORE
 1 laboratory in   SLOVENIA
 2 laboratories in SPAIN
 1 laboratory in   SUDAN
 1 laboratory in   SWEDEN
 1 laboratory in   TAIWAN R.O.C.
 1 laboratory in   TANZANIA
 4 laboratories in THAILAND
 6 laboratories in THE NETHERLANDS
 4 laboratories in TURKEY
 1 laboratory in   U.S.A.
 1 laboratory in   UKRAINE
10 laboratories in UNITED KINGDOM
 2 laboratories in VIETNAM
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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
ex   = excluded from calculations
U   = reported indifferent unit
W   = results withdrawn on request of the participants
fr.   = first reported
S   = scope of the reported method is not applicable
n.a.   = not applicable
D.U.   = reported a different unit
SDS   = Material Safety Data Sheet

Literature:

1   i.i.s. Interlaboratory Studies, Protocol for the Organization, Statistics and Evaluation, January
            2010 (version 3.2)
2   ASTM E178-89
3   ASTM E1301-89
4   ISO 5725-86
5   ISO 5725, parts 1-6, 1994
6   ISO13528-05
7   M. Thompson and R. Wood, J. AOAC Int, <u>76</u>, 926, (1993)
8   W.J. Youden and E.H. Steiner, Statistical Manual of the AOAC, (1975)
9   IP 367/84
10   DIN 38402 T41/42
11   P.L. Davies, First reported Z. Anal. Chem, <u>331</u>, 513, (1988)
12   J.N. Miller, Analyst, <u>118</u>, 455, (1993)
13   Analytical Methods Committee Technical brief, No4 January 2001.
14   The Royal Society of Chemistry 2002, Analyst 2002, 127 pages 1359-1364, P.J. Lowthian and M.
            Thompson (see http://www.rsc.org/suppdata/an/b2/b205600n/).