Results of Proficiency Test
Gasoil (premium)
April 2021

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Report: **iis21G02 == revised ==**

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SUMMARY OF CHANGES

This revised report replaces the original report iis21G02 of July 2021.

It was discovered that there was a copy error in the table of the parameter Distillation. The methods mentioned were of Density instead of Distillation.
This has no effect of the reported test results and the evaluation.

The following pages in this report has been revised:

- Appendix 1: page 24 and 27 (page 23 and 26 in the original report)

CONTENTS

Appendices:

1   INTRODUCTION

Over the past years, more and more diesel fuels are marketed with higher cetane numbers and additional cleaning agents and some synthetic content. These fuels are called premium diesel. The demand for these premium diesel fuels is increasing. Therefore, the Institute for Interlaboratory Studies (iis) decided to start with a proficiency test for Gasoil premium grade in 2020. During the annual proficiency testing program of 2020/2021 it was decided to continue the round robin for the analysis of Gasoil premium in accordance with EN590.

In this interlaboratory study registered for participation:
- 27 laboratories in 22 countries on Gasoil (premium)   iis21G02,
- 14 laboratories in 11 countries for CN & DCN in Gasoil (premium)   iis21G02CN,
- 14 laboratories in 14 countries for TC in Gasoil (premium)   iis21G02TC.

In total 30 laboratories in 22 different countries registered for participation. See appendix 2 for the number of participants per country. In this report the results of this Gasoil (premium) proficiency tests are presented and discussed. This report is also electronically available through the iis website www.iisnl.com.

2   SET UP

The Institute for Interlaboratory Studies (iis) in Spijkenisse, the Netherlands, was the organizer of this proficiency test (PT). Sample analyzes for fit-for-use and homogeneity testing were subcontracted to an ISO/IEC17025 accredited laboratory. In this proficiency test the participants received, depending on the registration, from one to three different samples of premium Gasoil.

Sample	Quantity	Purpose
#21045	1 x 1L + 1x 0.5L	Regular analyzes
#21046	4 x 1L	Cetane Number & DCN
#21047	1 x 1L	Total Contamination

Table 1: samples used in Gasoil (premium) proficiency tests iis21G02

Participants were requested to report rounded and unrounded test results. The unrounded test results were preferably used for statistical evaluation.

2.1 ACCREDITATION

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

2.2 PROTOCOL

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

2.3 CONFIDENTIALITY STATEMENT

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

2.4 SAMPLES

For the preparation of the sample for the regular PT of approximately 200 liters of premium Gasoil was obtained from the local market. After homogenisation 54 amber glass bottles of 1L and 54 amber glass bottles of 500 mL were filled and labelled #21045.
The homogeneity of the subsamples was checked by the determination of Density at 15°C in accordance with ISO12185 on 8 stratified randomly selected subsamples.

	Density at 15°C in kg/m^3
sample #21045-1	835.33
sample #21045-2	835.33
sample #21045-3	835.30
sample #21045-4	835.33
sample #21045-5	835.30
sample #21045-6	835.32
sample #21045-7	835.31
sample #21045-8	835.31

Table 2: homogeneity test results of subsamples #21045

From the above test results the repeatability was calculated and compared with 0.3 times the reproducibility of the reference test method in agreement with the procedure of ISO13528, Annex B2 in the next table.

	Density at 15°C in kg/m^3
r (observed)	0.04
reference test method	ISO12185:96
0.3 x R (reference test method)	0.15

Table 3: evaluation of the repeatability of subsamples #21045

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

For the preparation of the sample for the PT on Cetane Number a batch of approximately 100 liters of Gasoil (premium) was obtained from the local market. After homogenization 90 amber glass bottles of 1L were filled and labelled #21046.
The homogeneity of the subsamples was checked by the determination of Density at 15°C in accordance with ISO12185 on 8 stratified randomly selected subsamples.

	Density at 15°C in kg/m^3
sample #21046-1	835.33
sample #21046-2	835.32
sample #21046-3	835.33
sample #21046-4	835.33
sample #21046-5	835.33
sample #21046-6	835.32
sample #21046-7	835.33
sample #21046-8	835.33

Table 4: homogeneity test results of subsamples #21046

From the above test results the repeatability was calculated and compared with 0.3 times the reproducibility of the reference test method in agreement with the procedure of ISO13528, Annex B2 in the next table.

	Density at 15°C in kg/m^3
r (observed)	0.01
reference test method	ISO12185:96
0.3 x R (reference test method)	0.15

Table 5: evaluation of the repeatability of subsamples #21046

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

For the PT on Total Contamination the remaining amount of the same batch as used for the regular PT was selected. A defined volume of freshly prepared and well shaken dust suspension of Arizona Dust material in an oil was added to an 1L empty bottle by means of a calibrated pipette. The addition was checked by weighing the bottle before and after the addition. In total 30 bottles were prepared and subsequently filled up to 1L with premium Gasoil. Finally, the subsamples were labelled #21047.

Depending on the registration of the participant the appropriate set of PT samples was sent on March 17, 2021. An SDS was added to the sample package.

2.5   STABILITY OF THE SAMPLES

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

2.6   ANALYZES

The participants were requested to determine on sample #21045: Total Acid Number (TAN), Ash content, Calculated Cetane Index (four variables), Cloud Point, Cold Filter Plugging Point (CFPP), Carbon Residue (micro method) on 10% residue, Copper Corrosion 3hrs at 50°C, Density at 15°C, Distillation at 760 mmHg (IBP, 10%, 50%, 90%, 95% recovered, FBP and Volume at 250°C and 350°C), FAME, Flash Point PMcc, Kinematic Viscosity at 40°C, Lubricity by HFRR at 60°C, Manganese as Mn, Nitrogen, Polycyclic, Mono, Di, Tri+ and Total Aromatic Hydrocarbons, Pour Point (Manual and Automated), Sulfur and Water.
On sample #21046 was requested to determine: Cetane Number and Derived Cetane Number (EN15195 and EN16715).
On sample #21047 was requested to determine: Total Contamination.

It was explicitly requested to treat the samples as if they were routine samples and to report the test results using the indicated units on the report form and not to round the test results but report as much significant figures as possible. It was also requested not to report 'less than' test results, which are above the detection limit, because such test results cannot be used for meaningful statistical evaluations.

To get comparable test results a detailed report form and a letter of instructions are prepared. On the report form the reporting units are given as well as the reference test methods (when applicable) that will be used during the evaluation. The detailed report form and the letter of instructions are both made available on the data entry portal www.kpmd.co.uk/sgs-iis/. The participating laboratories are also requested to confirm the sample receipt on this data entry portal. The letter of instructions can also be downloaded from the iis website www.iisnl.com.

3   RESULTS

During five weeks after sample dispatch, the test results of the individual laboratories were gathered via the data entry portal www.kpmd.co.uk/sgs-iis/. The reported test results are tabulated per determination in appendix 1 of this report. The laboratories are presented by their code numbers.

Directly after the deadline, a reminder was sent to those laboratories that had not reported test results at that moment. Shortly after the deadline, the available test results were screened for suspect data. A test result was called suspect in case the Huber Elimination Rule (a robust outlier test) found it to be an outlier. The laboratories that produced these suspect data were asked to check the reported test results (no reanalyzes). Additional or corrected test results are used for data analysis and the original test results are placed under 'Remarks' in the test result tables in appendix 1. Test results that came in after the deadline were not taken into account in this screening for suspect data and thus these participants were not requested for checks.

3.1 STATISTICS

The protocol followed in the organization of this proficiency test was the one as described for proficiency testing in the report 'iis Interlaboratory Studies: Protocol for the Organisation, Statistics and Evaluation' of June 2018 (iis-protocol, version 3.5).

For the statistical evaluation the *unrounded* (when available) figures were used instead of the rounded test results. Test results reported as '<…' or '>…' were not used in the statistical evaluation.

First, the normality of the distribution of the various data sets per determination was checked by means of the Lilliefors-test, a variant of the Kolmogorov-Smirnov test and by the calculation of skewness and kurtosis. Evaluation of the three normality indicators in combination with the visual evaluation of the graphic Kernel density plot, lead to judgement of the normality being either 'unknown', 'OK', 'suspect' or 'not OK'. After removal of outliers, this check was repeated. If a data set does not have a normal distribution, the (results of the) statistical evaluation should be used with due care.

The assigned value is determined by consensus based on the test results of the group of participants after rejection of the statistical outliers and/or suspect data.

According to ISO13528 all (original received or corrected) results per determination were submitted to outlier tests. In the iis procedure for proficiency tests, outliers are detected prior to calculation of the mean, standard deviation and reproducibility. For small data sets, Dixon (up to 20 test results) or Grubbs (up to 40 test results) outlier tests can be used. For larger data sets (above 20 test results) Rosner's outlier test can be used. Outliers are marked by D(0.01) for the Dixon's test, by G(0.01) or DG(0.01) for the Grubbs' test and by R(0.01) for the Rosner's test. Stragglers are marked by D(0.05) for the Dixon's test, by G(0.05) or DG(0.05) for the Grubbs' test and by R(0.05) for the Rosner's test. Both outliers and stragglers were not included in the calculations of averages and standard deviations.

For each assigned value the uncertainty was determined in accordance with ISO13528. Subsequently the calculated uncertainty was evaluated against the respective requirement based on the target reproducibility in accordance with ISO13528. In this PT, the criterion of ISO13528, paragraph 9.2.1. was met for all evaluated tests, therefore, the uncertainty of all assigned values may be negligible and need not be included in the PT report.

Finally, the reproducibilities were calculated from the standard deviations by multiplying them with a factor of 2.8.

3.2 GRAPHICS

In order to visualize the data against the reproducibilities from literature, Gauss plots were made, using the sorted data for one determination (see appendix 1). On the Y-axis the reported test results are plotted. The corresponding laboratory numbers are on the X-axis. The straight horizontal line presents the consensus value (a trimmed mean). The four striped lines, parallel to the consensus value line, are the +3s, +2s, -2s and -3s target reproducibility limits of the selected reference test method. Outliers and other data, which were excluded from the calculations, are represented as a cross. Accepted data are represented as a triangle.

Furthermore, Kernel Density Graphs were made. This is a method for producing a smooth density approximation to a set of data that avoids some problems associated with histograms. Also, a normal Gauss curve (dotted line) was projected over the Kernel Density Graph (smooth line) for reference. The Gauss curve is calculated from the consensus value and the corresponding standard deviation.

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. ISO, ASTM reproducibilities, the z-scores were calculated using a target standard deviation. This results in an evaluation independent of the variation in this interlaboratory study.

The target standard deviation was calculated from the literature reproducibility by division with 2.8. In case no literature reproducibility was available, other target values were used, like Horwitz or an estimated reproducibility based on former iis proficiency tests.

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

The z-scores were calculated according to:

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

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

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

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

4   EVALUATION

In this proficiency test some problems were encountered with the dispatch of the samples due to COVID-19 pandemic. Therefore, the reporting time on the data entry portal was extended with another week. For the regular premium Gasoil PT one participant did not report any test results at all and all participants report test results for the PT on Cetane Number in prepium Gasoil. For the PT on Total Contamination in premium Gasoil one participant did not report any test results at all.
In total 29 participants reported 553 numerical test results. Observed were 21 outlying test results, which is 3.8% of the numerical test results.
In proficiency studies, outlier percentages of 3%-7.5% are quite normal.

Not all original data sets proved to have a normal Gaussian distribution. These are referred to as "not OK" or "suspect". The statistical evaluation of these data sets should be used with due care.

4.1 EVALUATION PER SAMPLE AND PER TEST

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

In the iis PT reports ASTM test methods are referred to with a number (e.g. D4737) and an added designation for the year that the test method was adopted or revised (e.g. D4737:10). If applicable, a designation in parentheses is added to designate the year of reapproval (e.g. D4737:10(2016)). In the results tables of appendix 1 only the test method number and year of adoption or revision e.g. D4737:10 will be used.

Sample #21045

Total Acid Number: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of ASTM D974:14e2.

Ash content: This determination may not be problematic. The consensus value was below the application range of ISO6245:01 and many participants reported a lower than test value. Therefore, no z-scores were calculated.

Calculated Cetane Index, four variables: Regretfully, no reproducibility is mentioned in procedure A of ASTM D4737:10(2016) nor in the equivalent test methods ISO4264 and IP380. Therefore, iis has estimated a reproducibility for Calculated Cetane Index by Four Variable Equation based from previous iis Gasoil PTs. This work done in 2019 has been reported in iis memo 1904 available on www.iisnl.com.
This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the reproducibility of iis memo 1904. No calculation errors were observed.

Cloud Point: This determination was not problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is in agreement with the requirements of ISO3015:19.

CFPP: This determination was problematic. Two statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is not in agreement with the requirements of EN116:15.

Carbon Residue on 10% residue: This determination was problematic. No statistical outliers were observed. However, the calculated reproducibility is not in agreement with the requirements of ISO10370:14.

Copper Corrosion: This determination was not problematic. All reporting laboratories agreed on a result of 1 (1a).

Density at 15°C: This determination was not problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is in agreement with the requirements of ISO12185:96.

Distillation: This determination was problematic for the determination for Initial Boiling Point. Most likely sample #21045 contained traces of light product. This affected the IBP and Flash Point PMcc. Therefore, it was decided to calculate no z-scores for the Initial Boiling Point.
The determination was not problematic for all other Distillation parameters. Six statistical outliers were observed over eight parameters. All calculated reproducibilities (except IBP) after rejection of the statistical outliers are in agreement with the requirements of ISO3405:19 for automated mode as well as for manual mode.

FAME: This determination was not problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is in agreement with the requirements of mode B of EN14078:14.

Flash Point PMcc: This determination was problematic. It appeared that the consensus value was below the application range of ISO2719A:16. Therefore, no z-scores were calculated. Most likely sample #21045 contained traces of light product. This had also affected the IBP in the Distillation Determination.

Kinematic Viscosity at 40°C: This determination was problematic. No statistical outliers were observed. The calculated reproducibility is not in agreement with the requirements of ISO3104:20.

Lubricity: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of modes A or B of ISO12156-1:18.

Manganese: This determination may not be problematic. The consensus value was below the application range of EN16576:14. Therefore, no z-scores were calculated.

Nitrogen: This determination was not problematic. Three statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is in agreement with the requirements of ASTM D4629:17.

Polycyclic Aromatic Hydrocarbons: This determination was not problematic. No statistical outlies were observed. The calculated reproducibility is in agreement with the requirements of EN12916:16.

Mono Aromatic Hydrocarbons: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of EN12916:16.

Di Aromatic Hydrocarbons: This determination was not problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is in agreement with the requirements of EN12916:16.

Tri+ Aromatic Hydrocarbons: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of EN12916:16.

Total Aromatic Hydrocarbons: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of EN12916:16.

Pour Point Manual: This determination was not problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is in agreement with the requirements of ISO3016:19.

Pour Point Automated: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements ASTM D5950:14(2020)

Sulfur: This determination was not problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is in agreement with the requirements of ISO20846:19.

Water: This determination was not problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is in agreement with the requirements of ISO12937:00.

Sample #21046
Cetane Number: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of ISO5165:20.

DCN - EN17155: For DCN and Ignition Delay only one test result was reported, therefore no z-scores were calculated.

DCN - EN16715: This determination was problematic for Derived Cetane Number and Combustion Delay but not problematic for Ignition Delay. No statistical outliers were observed. The calculated reproducibilities of Derived Cetane Number and Combustion Delay are not in agreement with the requirements of EN16715:15. The calculated reproducibility of Ignition Delay is in agreement with the requirements of EN16715:15.

Sample #21047

Total Contamination: This determination was problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is not in agreement with the requirements of EN12662:14.

4.2 PERFORMANCE EVALUATION FOR THE GROUP OF LABORATORIES

A comparison has been made between the reproducibility as declared by the reference test method and the reproducibility as found for the group of participating laboratories. The number of significant test results, the average, the calculated reproducibility (2.8 * standard deviation) and the target reproducibility derived from literature reference test methods (in casu ASTM, EN, ISO test methods) or previous proficiency tests are presented in the next tables.

Parameter	unit	n	average	2.8 * sd	R(lit)
Total Acid Number (TAN)	mg KOH/g	12	0.035	0.028	0.04
Ash content	%M/M	10	<0.001	n.e.	n.e.
Calc. Cetane Index four variables		23	53.19	0.70	0.91
Cloud Point	°C	20	-7.0	1.5	4
Cold Filter Plugging Point	°C	20	-25.3	5.4	4.5
Carbon Residue on 10% residue	%M/M	10	0.019	0.041	0.018
Copper Corrosion, 3hrs at 50°C		19	1 (1a)	n.a.	n.a.
Density at 15°C	kg/m^3	24	835.4	0.3	0.5
Initial Boiling Point	°C	23	153.6	15.4	(8.5)
Temp at 10% recovery	°C	25	205.2	4.0	4.5
Temp at 50% recovery	°C	24	274.3	2.5	3.0
Temp at 90% recovery	°C	25	343.5	3.7	5.2
Temp at 95% recovery	°C	25	356.7	7.1	8.9
Final Boiling Point	°C	24	363.6	4.0	7.1
Volume at 250°C	%V/V	23	36.0	1.7	2.7
Volume at 350°C	%V/V	23	92.9	1.9	2.7
FAME	%V/V	14	6.77	0.37	0.50
Flash Point PMcc	°C	21	<40	n.e.	n.e.
Kinematic Viscosity at 40°C	mm^2/s	20	2.811	0.051	0.031
Lubricity by HFRR	µm	14	182	49	80
Manganese as Mn	mg/L	7	<0.5	n.e.	n.e.
Nitrogen	mg/kg	8	20.2	2.2	3.8
Polycyclic Aromatic Hydrocarbons	%M/M	12	1.57	0.73	0.76
Mono Aromatic Hydrocarbons	%M/M	10	15.3	1.5	1.9
Di Aromatic Hydrocarbons	%M/M	10	1.48	0.40	0.45
Tri$^+$ Aromatic Hydrocarbons	%M/M	11	0.09	0.11	0.51
Total Aromatic Hydrocarbons	%M/M	10	16.9	1.7	1.8
Pour Point Manual	°C	17	-32.1	4.9	9
Pour Point Automated	°C	8	-31.1	4.4	6.1

Parameter	unit	n	average	2.8 * sd	R(lit)
Sulfur	mg/kg	23	7.5	1.9	2.0
Water	mg/kg	20	55.3	29.9	51.1

Table 6: reproducibilities of tests on sample #21045

Parameter	unit	n	average	2.8 * sd	R(lit)
Cetane Number		9	52.6	1.8	4.4
DCN (EN17155)		1	n.e.	n.e.	n.e.
Ignition Delay (EN17155)	ms	1	n.e.	n.e.	n.e.
DCN (EN16715)		5	53.4	2.6	1.5
Ignition Delay (EN16715)	ms	5	3.0	0.08	0.16
Combustion Delay (EN16715)	ms	5	4.5	0.19	0.13
Total Contamination	mg/kg	12	19.5	13.4	7.5

Table 7: reproducibilities of tests on samples #21046 and #21047

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

4.3   COMPARISON OF THE PROFICIENCY TEST OF APRIL 2021 WITH PREVIOUS PT

	April 2021	April 2020
Number of reporting laboratories	29	30
Number of test results	553	618
Number of statistical outliers	21	15
Percentage of statistical outliers	3.8%	2.4%

Table 8: comparison with previous proficiency test

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

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

Parameter	April 2021	April 2020
Total Acid Number (TAN)	+	+
Ash content	n.e.	++
Calc. Cetane Index four variables	+	+
Cloud Point	++	+
Cold Filter Plugging Point	-	-
Carbon Residue on 10% residue	--	+/-
Density at 15°C	++	++
Distillation at 760 mmHg	-	+
FAME	+	+/-

Parameter	April 2021	April 2020
Flash Point PMcc	n.e.	+
Kinematic Viscosity at 40°C	-	+/-
Lubricity by HFRR	+	+
Manganese as Mn	n.e.	n.e.
Nitrogen	+	-
Polycyclic Aromatic Hydrocarbons	+/-	+
Mono, Di and Tri$^+$ Aromatic HCs	+	+
Total Aromatic Hydrocarbons	+	++
Pour Point	+	+
Sulfur	+/-	+
Water	+	++
Cetane Number	+	+
DCN (EN17155)	n.e.	-
DCN (EN16715)	-	-

Table 9: comparison determinations against the reference test method

The following performance categories were used:

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

APPENDIX 1

Determination of Total Acid Number (TAN) on sample #21045; result in mg KOH/g

lab	method	value	mark	z(targ)	remarks
171	D974	0.04		0.35	
492		-----		-----	
496	D974	0.0275		-0.53	
541	D974	<0.05		-----	
824	D974	0.03		-0.35	
962		-----		-----	
963	D974	0.02		-1.05	
1121	D664-A	0.044		0.63	
1126		-----		-----	
1141		-----		-----	
1259	D664-A	0.023		-0.84	
1320		-----		-----	
1556	D664-A	0.054		1.33	
1720	D974	0.03		-0.35	
1753		-----		-----	
1776	D664-A	<0.1		-----	
1806		-----		-----	
1854	D664-A	0.03		-0.35	
1857	D974	0.047		0.84	
1980		-----		-----	
6018		-----		-----	
6028		-----		-----	
6075		-----		-----	
6201	D664-A	0.04		0.35	
6274		-----		-----	
6366	D974	0.035		0.00	
6378		-----		-----	

normality	OK
n	12
outliers	0
mean (n)	0.03504
st.dev. (n)	0.010163
R(calc.)	0.02846
st.dev.(D974:14e2)	0.014286
R(D974:14e2)	0.04
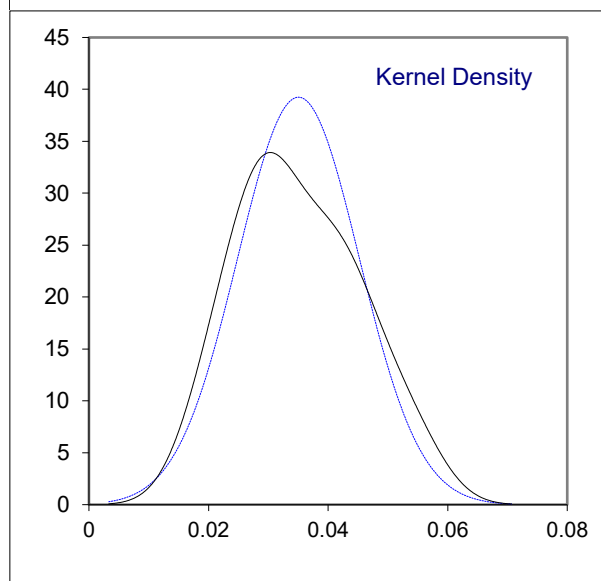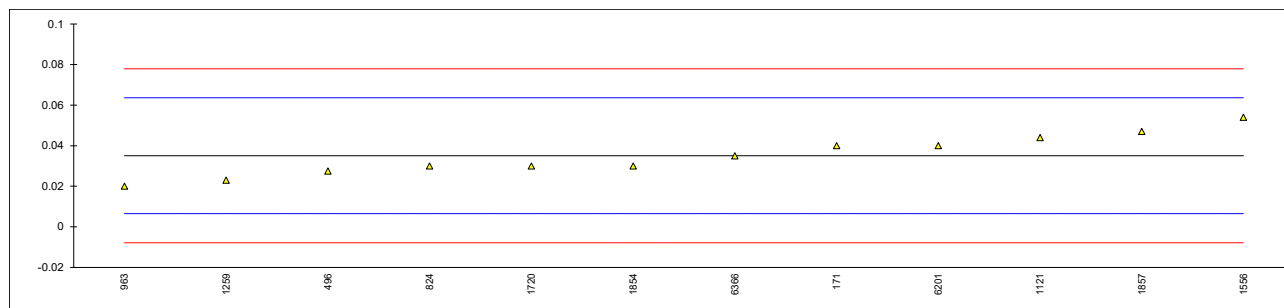
Determination of Ash content on sample #21045; result in %M/M

lab	method	value	mark	z(targ)	remarks
171	D482	<0.010		-----	
492		-----		-----	
496		-----		-----	
541	ISO6245	<0.001		-----	
824	ISO6245	<0.01		-----	
962	D482	0.0003		-----	
963	ISO6245	<0.001		-----	
1121	ISO6245	0.00048		-----	
1126		-----		-----	
1141		-----		-----	
1259		-----		-----	
1320		-----		-----	
1556	ISO6245	0.0004		-----	
1720		-----		-----	
1753	ISO6245	0.0006		-----	
1776		-----		-----	
1806		-----		-----	
1854	ISO6245	0.0009		-----	
1857	ISO6245	0.0029		-----	
1980	ISO6245	0.0013		-----	
6018		-----		-----	
6028		-----		-----	
6075	ISO6245	<0.001		-----	
6201	ISO6245	0.0012		-----	
6274	ISO6245	<0.001		-----	
6366	D482	< 0.001		-----	
6378		-----		-----	
	n	10			
	mean (n)	<0.001			

Determination of Calculated Cetane Index, four variables on sample #21045

lab	method	value	mark	z(targ)	remarks
171	D4737-A	53.1		-0.28	
492		-----		-----	
496	ISO4264	53.2		0.03	
541	D4737-A	53.47		0.86	
824	ISO4264	53.2		0.03	
962	D4737-A	53.3		0.34	
963	ISO4264	53.6		1.26	
1121	ISO4264	52.85		-1.05	
1126		-----		-----	
1141	ISO4264	53.0		-0.59	
1259	ISO4264	53.1		-0.28	
1320		-----		-----	
1556	ISO4264	53.2		0.03	
1720	D4737-A	53.4		0.65	
1753	ISO4264	52.99		-0.62	
1776	ISO4264	53.0		-0.59	
1806	ISO4264	52.88		-0.96	
1854	D4737-A	53.0		-0.59	
1857	ISO4264	53.8		1.88	
1980	ISO4264	53.3		0.34	
6018	ISO4264	53.6	C	1.26	first reported 53.9
6028	ISO4264	53.2		0.03	
6075	ISO4264	53.15		-0.13	
6201	ISO4264	53.1		-0.28	
6274	ISO4264	53.1		-0.28	
6366	D4737-A	52.85		-1.05	
6378		-----		-----	

normality	OK	
n	23	
outliers	0	
mean (n)	53.191	
st.dev. (n)	0.2491	
R(calc.)	0.697	
st.dev.(iis memo 1904)	0.3239	
R(iis memo 1904)	0.907	

Kernel Density
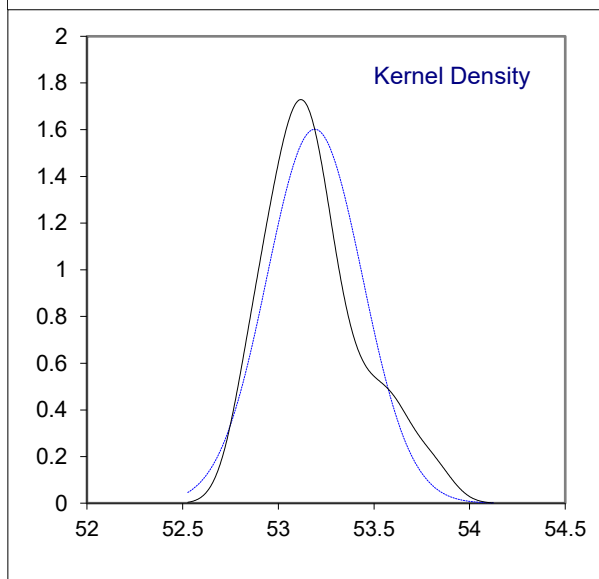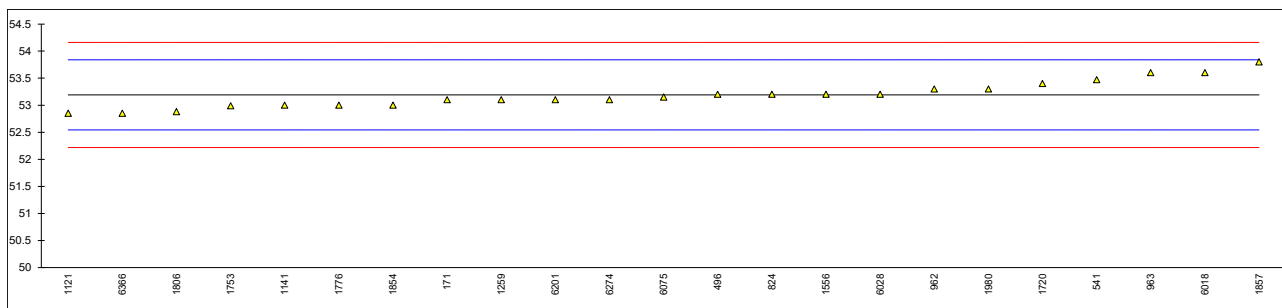
Determination of Cloud Point on sample #21045; result in °C

lab	method	value	mark	z(targ)	remarks
171	D2500	-7		0.03	
492		-----		-----	
496	ISO22995	-8		-0.67	
541	D5771	-6.9		0.10	
824	ISO3015	-7		0.03	
962	D2500	-6		0.73	
963	ISO3015	-7		0.03	
1121	ISO3015	-4.8	G(0.05)	1.57	
1126		-----		-----	
1141	ISO3015	-7		0.03	
1259	EN23015	-7		0.03	
1320		-----		-----	
1556	ISO3015	-7.7		-0.46	
1720	D5773	-6.5		0.38	
1753	ISO3015	-7		0.03	
1776	ISO3015	-7		0.03	
1806	D2500	-7		0.03	
1854		-----		-----	
1857	ISO3015	-7		0.03	
1980	ISO3015	-6.8		0.17	
6018	ISO3015	-8		-0.67	
6028	D2500	-8		-0.67	
6075	EN23015	-7		0.03	
6201	ISO3015	-7		0.03	
6274		-----		-----	
6366	D2500	-6		0.73	
6378		-----		-----	

normality	OK
n	20
outliers	1
mean (n)	-7.04
st.dev. (n)	0.550
R(calc.)	1.54
st.dev.(ISO3015:19)	1.429
R(ISO3015:19)	4
compare	
R(ISO22995:19)	2.5

Kernel Density
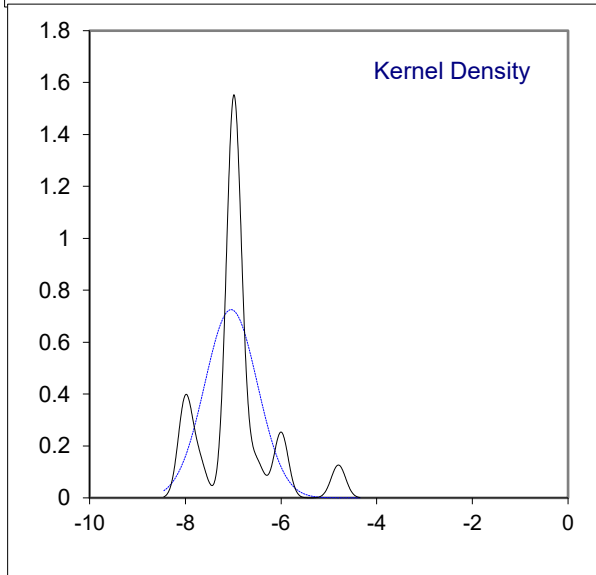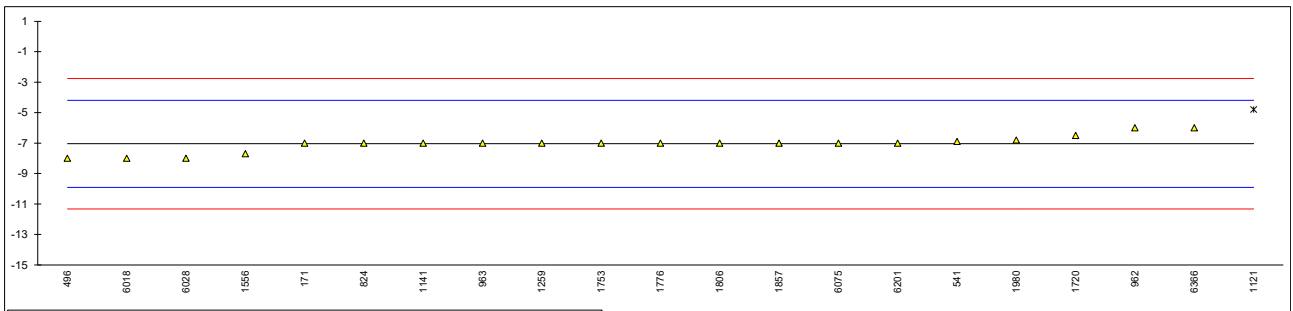
Determination of Cold Filter Plugging Point (CFPP) on sample #21045; result in °C

lab	method	value	mark	z(targ)	remarks
171	D6371	-21		2.66	
492		-----		-----	
496	EN116	-27.5		-1.37	
541	EN116	-28		-1.68	
824	EN116	-23		1.42	
962	D6371	-26		-0.44	
963	EN116	-25		0.18	
1121	IP309	-22.7		1.60	
1126		-----		-----	
1141	EN116	-30	G(0.05)	-2.92	
1259	EN116	-25		0.18	
1320	EN116	-27		-1.06	
1556	EN116	-25		0.18	
1720		-----		-----	
1753	EN116	-26		-0.44	
1776	EN116	-28		-1.68	
1806	EN116	-25		0.18	
1854	EN116	-23		1.42	
1857	EN116	-24.5		0.49	
1980	EN116	-24.0		0.80	
6018	EN116	-25		0.18	
6028	EN116	-26		-0.44	
6075		-----		-----	
6201	EN116	-26		-0.44	
6274	EN116	-28		-1.68	
6366	D6371	-19	G(0.05)	3.90	
6378		-----		-----	

normality	OK
n	20
outliers	2
mean (n)	-25.29
st.dev. (n)	1.922
R(calc.)	5.38
st.dev.(EN116:15)	1.613
R(EN116:15)	4.52

Kernel Density
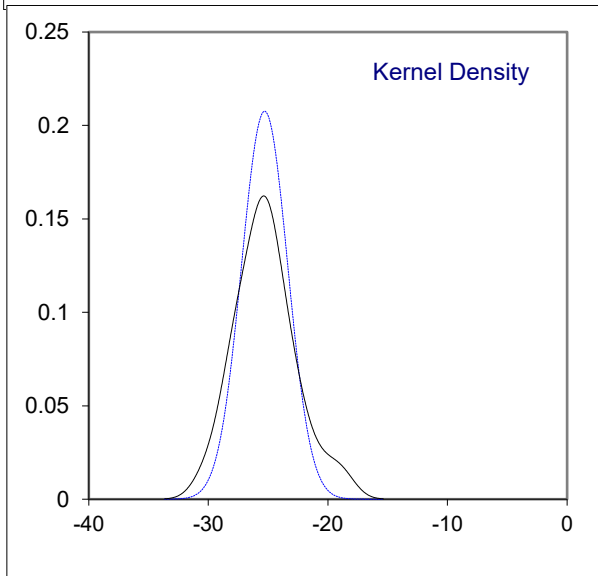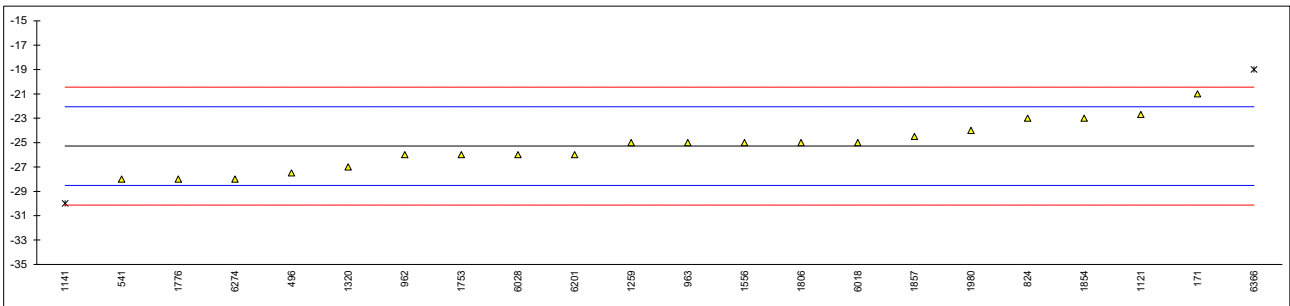
Determination of Carbon Residue (Micro method) on 10% residue on sample #21045; result in %M/M

lab	method	value	mark	z(targ)	remarks
171		-----		-----	
492		-----		-----	
496	ISO10370	0.026		1.02	
541	ISO10370	<0.10		-----	
824	ISO10370	0.030		1.63	
962	D4530	0.0060		-2.01	
963	ISO10370	<0.1		-----	
1121	ISO10370	0.048		4.35	
1126		-----		-----	
1141		-----		-----	
1259		-----		-----	
1320		-----		-----	
1556	ISO10370	0.0015		-2.69	
1720		-----		-----	
1753		-----		-----	
1776		-----		-----	
1806		-----		-----	
1854	ISO10370	0.03		1.63	
1857	ISO10370	0.006		-2.01	
1980	ISO10370	0.007		-1.85	
6018		-----		-----	
6028	ISO10370	0.02		0.11	
6075	ISO10370	0.018		-0.19	
6201	ISO10370	<0,10		-----	
6274	ISO10370	<0.1		-----	
6366	D4530	<0.10		-----	
6378		-----		-----	

normality	OK
n	10
outliers	0
mean (n)	0.01925
st.dev. (n)	0.014612
R(calc.)	0.04091
st.dev.(ISO10370:14)	0.006604
R(ISO10370:14)	0.01849

Kernel Density
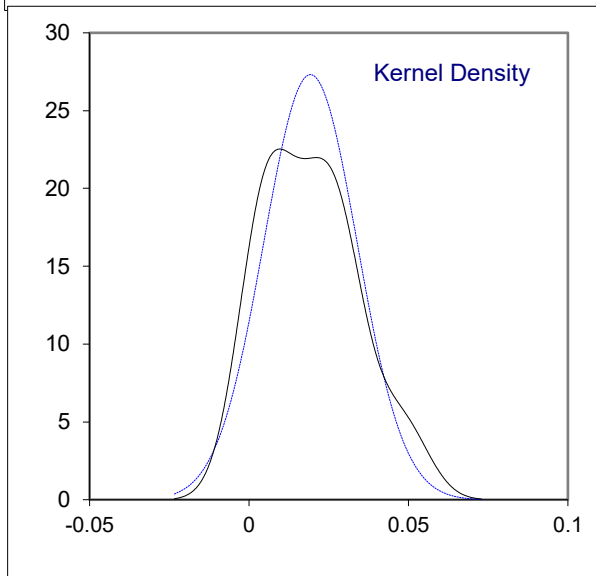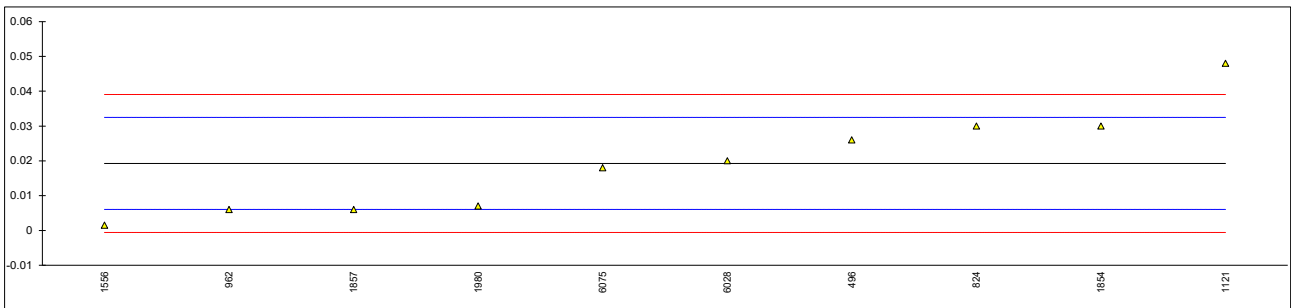
Determination of Copper Corrosion, 3hrs at 50°C on sample #21045

lab	method	value	mark	z(targ)	remarks
171		-----		-----	
492		-----		-----	
496		-----		-----	
541	D130	1a		-----	
824	D130	1a		-----	
962	D130	1A		-----	
963	D130	1a		-----	
1121	IP154	1a		-----	
1126		-----		-----	
1141	ISO2160	class 1		-----	
1259		-----		-----	
1320	D130	1a		-----	
1556	ISO2160	class 1		-----	
1720	D130	1a		-----	
1753	ISO2160	1a		-----	
1776		-----		-----	
1806		-----		-----	
1854	D130	1A		-----	
1857	D130	1a		-----	
1980	ISO2160	1		-----	
6018	ISO2160	1a		-----	
6028	ISO2160	1a		-----	
6075	ISO2160	1a		-----	
6201	D130	1a		-----	
6274	D130	1A		-----	
6366	D130	1A		-----	
6378		-----		-----	

n	19	
mean (n)	1 (1a)	

Determination of Density at 15°C on sample #21045; result in kg/m³

lab	method	value	mark	z(targ)	remarks
171	D4052	835.4		0.05	
492		-----		-----	
496	D4052	835.26		-0.73	
541	ISO12185	835.35		-0.23	
824	ISO12185	835.4		0.05	
962	D4052	835.3		-0.51	
963	ISO12185	835.3		-0.51	
1121	ISO12185	835.4		0.05	
1126	ISO12185	835.35		-0.23	
1141	ISO12185	835.4		0.05	
1259	ISO12185	835.3		-0.51	
1320		-----		-----	
1556	ISO12185	835.58		1.06	
1720	D4052	835.375		-0.09	
1753	ISO12185	835.5		0.61	
1776	ISO12185	835.4		0.05	
1806	ISO3675	835.6		1.17	
1854	ISO12185	835.35		-0.23	
1857	ISO12185	835.4		0.05	
1980	ISO12185	835.45		0.33	
6018	ISO12185	835.3		-0.51	
6028	ISO12185	835.2		-1.07	
6075	ISO12185	835.49		0.55	
6201	D4052	835.43		0.22	
6274	ISO12185	835.5		0.61	
6366	D4052	835.35		-0.23	
6378	D1298	834.7	C,R(0.01)	-3.87	first reported 836

|		
normality	OK	
n	24	
outliers	1	
mean (n)	835.391	
st.dev. (n)	0.0961	
R(calc.)	0.269	
st.dev.(ISO12185:96)	0.1786	
R(ISO12185:96)	0.5	

Kernel Density
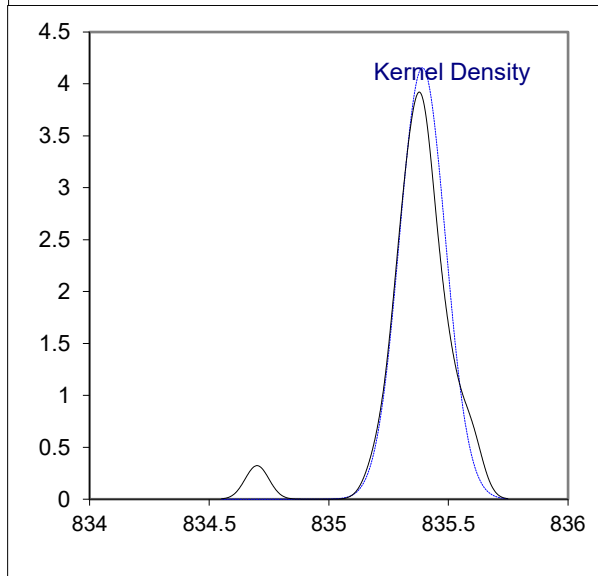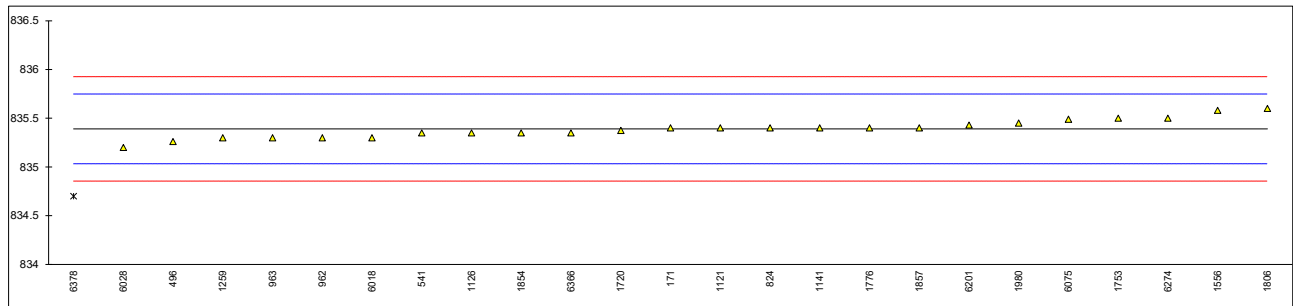
Determination of Distillation at 760 mmHg on sample #21045; result in °C

lab	method	IBP	10%rec	50%rec	90%rec	95%rec	FBP
171	D86-automated	153.3	205.6	273.8	343.4	358.3	362.2
492		-----	-----	-----	-----	-----	-----
496	D86-automated	152.3	204.9	274.6	343.2	357.2	364.0
541	D86-automated	153.84	206.38	275.37	344.17	357.86	365.39
824	ISO3405-automated	153.9	205.1	274.6	343.9	356.7	364.4
962	D86-automated	151.8	207.0	274.0	344.2	357.7	362.0
963	ISO3405-automated	153.3	206.9	275.6	345.4	361.1	364.7
1121	ISO3405-automated	162.7	205.7	272.3	341.9	354.0	364.8
1126	ISO3405-automated	80.7 R(1)	206.1	274.4	343.0	355.5	364.3
1141	ISO3405-automated	145.2	204.8	273.4	341.8	356.2	361.0
1259	D86-automated	161.4	206.1	273.0	340.7	351.5	358.4 R(5)
1320		-----	-----	-----	-----	-----	-----
1556	ISO3405-automated	157.2	206.2	274.6	343.0	355.9	364.7
1720	D86-automated	155.3	206.9	274.9	345.7	360.4	364.7
1753	ISO3405-manual	157	202	275	344	357	362
1776	ISO3405-automated	145.1	204.4	273.6	342.0	354.7	360.1
1806	ISO3405-manual	158	202	275	344	357	362
1854	D86-automated	158.5	202.8	274.2	343.4	356.9	362.9
1857	ISO3405-automated	145.1	205.6	277.8 R(5)	346	362.1	363.2
1980	ISO3405-automated	149.1	204.0	275.6	344.4	358.7	363.4
6018	ISO3405-automated	161.2	207.2	275.6	344.7	358.2	365.5
6028	ISO3405-automated	156.0	205.7	273.0	341.1	352.7	364.7
6075	ISO3405-automated	142.3	205.4	274.4	344.4	358.7	363.4
6201	D86-automated	150.4	205.3	273.7	343.2	355.2	363.9
6274	D86-automated	154	205.2	274.3	342.6	354.9	364.8
6366	D86-automated	53.0 R(1)	203.7	275.1	344.0	356.8	363.7
6378	D86-manual	156.0	205.5 C	273.3 C	343.1 C	352.7 C	364.3 C
	normality	OK	OK	OK	OK	OK	OK
	n	23	25	24	25	25	24
	outliers	2	0	1	0	0	1
	mean (n)	153.61	205.22	274.31	343.49	356.72	363.59
	st.dev. (n)	5.487	1.426	0.906	1.332	2.549	1.411
	R(calc.)	15.36	3.99	2.54	3.73	7.14	3.95
	st.dev.(ISO3405-A:19)	(3.017)	1.612	1.071	1.840	3.177	2.536
	R(ISO3405-A:19)	(8.45)	4.51	3.00	5.15	8.90	7.10
	compare						
	R(ISO3405-M:19)	(7.60)	5.01	4.10	4.24	4.47	3.68

Lab 6378 first reported 153.0; 208.8; 281.6; 355.4; 368.1; 376.5 respectively

50% recovered

90% recovered

95% recovered

Final Boiling Point
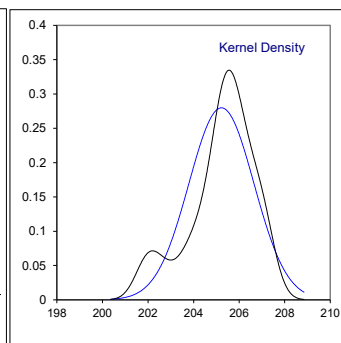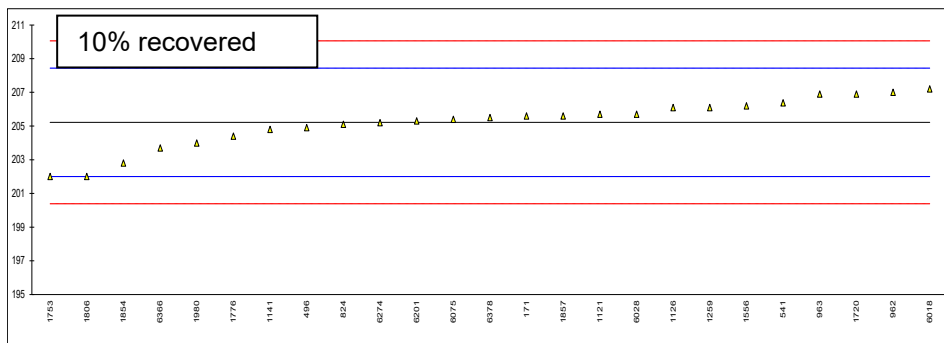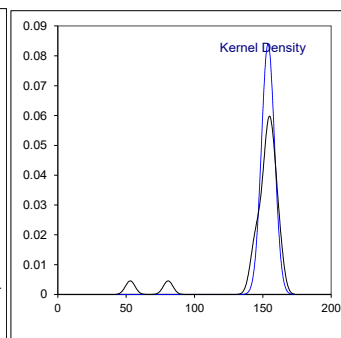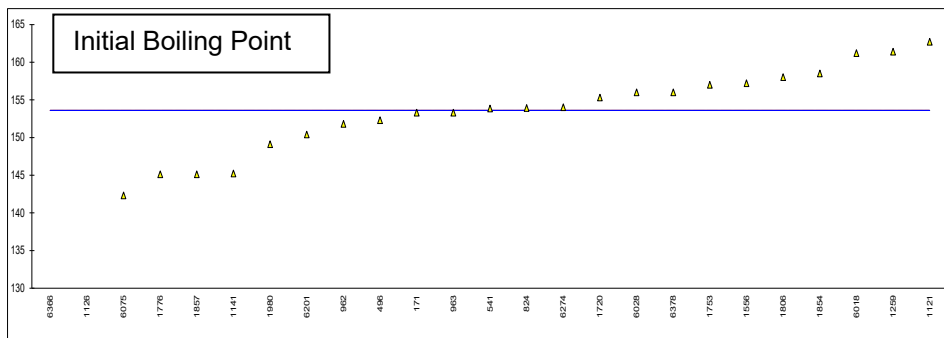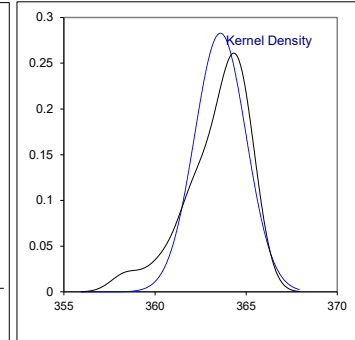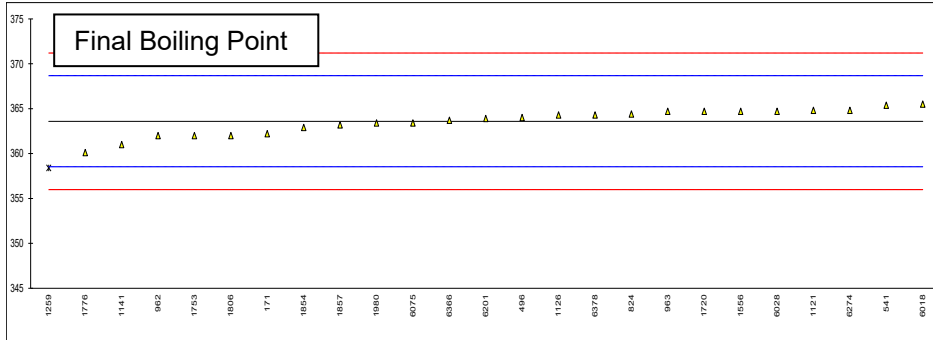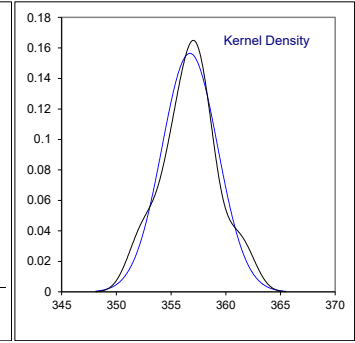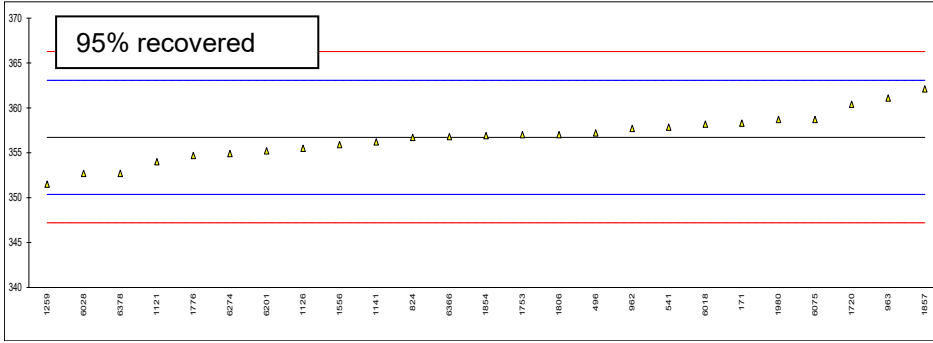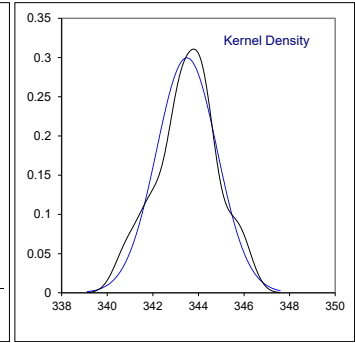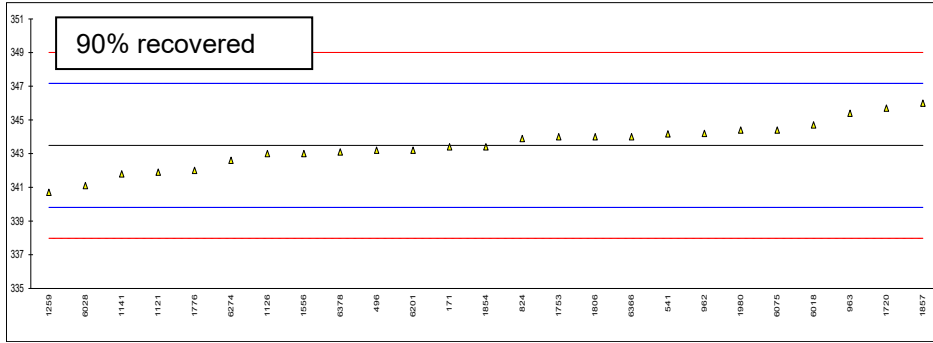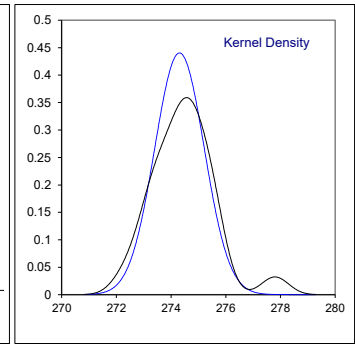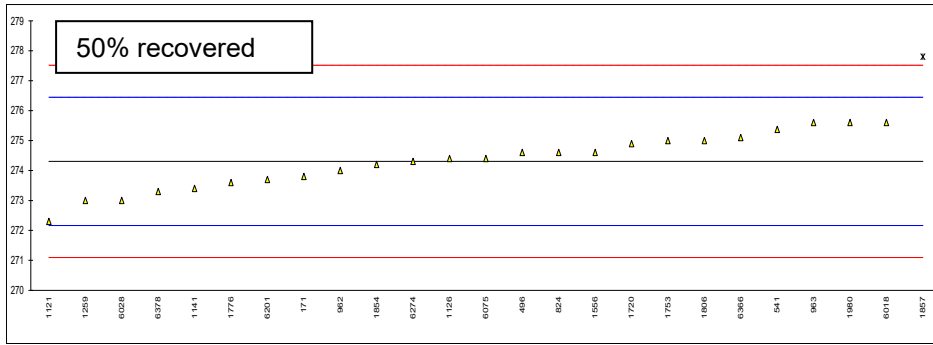
z-scores Distillation on sample #21045

lab	IBP	10%rec	50%rec	90%rec	95%rec	FBP
171	-----	0.24	-0.47	-0.05	0.50	-0.55
492	-----	-----	-----	-----	-----	-----
496	-----	-0.20	0.27	-0.16	0.15	0.16
541	-----	0.72	0.99	0.37	0.36	0.71
824	-----	-0.07	0.27	0.22	-0.01	0.32
962	-----	1.10	-0.29	0.39	0.31	-0.63
963	-----	1.04	1.21	1.04	1.38	0.44
1121	-----	0.30	-1.87	-0.86	-0.86	0.48
1126	-----	0.55	0.09	-0.27	-0.38	0.28
1141	-----	-0.26	-0.85	-0.92	-0.16	-1.02
1259	-----	0.55	-1.22	-1.52	-1.64	-2.05
1320	-----	-----	-----	-----	-----	-----
1556	-----	0.61	0.27	-0.27	-0.26	0.44
1720	-----	1.04	0.55	1.20	1.16	0.44
1753	-----	-2.00	0.65	0.28	0.09	-0.63
1776	-----	-0.51	-0.66	-0.81	-0.64	-1.38
1806	-----	-2.00	0.65	0.28	0.09	-0.63
1854	-----	-1.50	-0.10	-0.05	0.06	-0.27
1857	-----	0.24	3.26	1.36	1.69	-0.15
1980	-----	-0.76	1.21	0.49	0.62	-0.07
6018	-----	1.23	1.21	0.66	0.47	0.75
6028	-----	0.30	-1.22	-1.30	-1.26	0.44
6075	-----	0.11	0.09	0.49	0.62	-0.07
6201	-----	0.05	-0.57	-0.16	-0.48	0.12
6274	-----	-0.01	-0.01	-0.48	-0.57	0.48
6366	-----	-0.94	0.74	0.28	0.03	0.04
6378	-----	0.17	-0.94	-0.21	-1.26	0.28

Determination of Distillation on sample #21045; result in %V/V

lab	method	Vol.250°C	mark	z(targ)	Vol.350°C	mark	z(targ)	remarks
171		-----		-----	-----		-----	
492		-----		-----	-----		-----	
496	D86-automated	36.1		0.09	92.9		0.05	
541	D86-automated	35.69		-0.33	92.11		-0.77	
824	ISO3405-automated	36.3		0.30	92.7		-0.16	
962	D86-automated	36.4		0.40	92.5		-0.37	
963	ISO3405-automated	35.8		-0.22	91.9		-0.99	
1121	ISO3405-automated	37.3		1.34	93.6		0.78	
1126	ISO3405-automated	35.3		-0.74	93.2		0.36	
1141	ISO3405-automated	35.9		-0.12	93.2		0.36	
1259	D86-automated	36.1		0.09	94.4		1.60	
1320		-----		-----	-----		-----	
1556	ISO3405-automated	36.2		0.19	93.1		0.26	
1720	D86-automated	36.4		0.40	91.9		-0.99	
1753	ISO3405-manual	35		-1.05	93		0.15	
1776	ISO3405-automated	36.7		0.71	93.5		0.67	
1806	ISO3405-manual	35		-1.05	93		0.15	
1854	D86-automated	36.4		0.40	92.6		-0.26	
1857	ISO3405-automated	35		-1.05	91.7		-1.20	
1980	ISO3405-automated	35.7		-0.32	92.4		-0.47	
6018	ISO3405-automated	35.7		-0.32	92.3		-0.57	
6028	ISO3405-automated	37.1		1.13	94.1		1.29	
6075	ISO3405-automated	36.3		0.30	92.3		-0.57	
6201	D86-automated	36.4		0.40	93.2		0.36	
6274	D86-automated	36.1		0.09	93.3		0.46	
6366	D86-automated	35.4		-0.64	92.7		-0.16	
6378	D86-manual	39.5	C,R(0.01)	3.62	96.0	C,R(0.01)	3.26	fr. 37.5; 90.5
	normality	OK			OK			
	n	23			23			
	outliers	1			1			
	mean (n)	36.01			92.85			
	st.dev. (n)	0.620			0.686			
	R(calc.)	1.74			1.92			
	st.dev.(ISO3405-A:19)	0.964			0.964			
	R(ISO3405-A:19)	2.7			2.7			
	compare							
	R(ISO3405-M:19)	2.53			2.17			

Volume at 250°C

Volume at 350°C
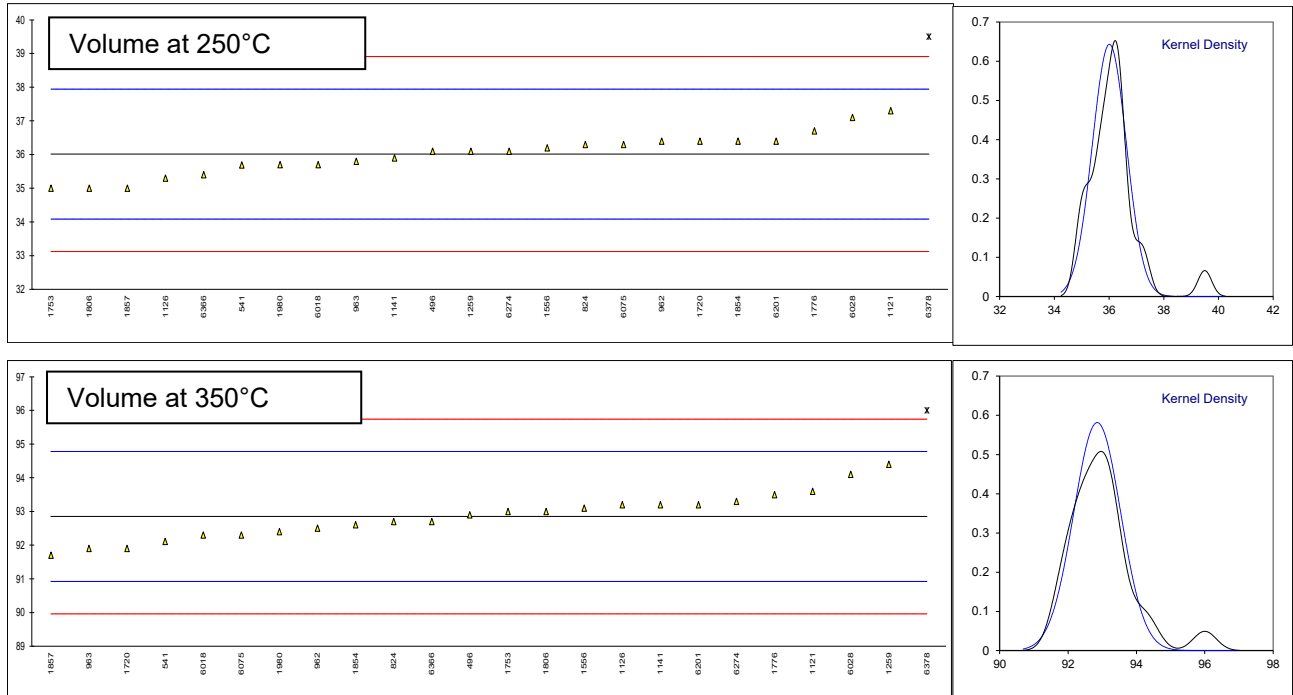
Determination of FAME on sample #21045; result in %V/V

lab	method	value	mark	z(targ)	remarks
171	D7371	7.63	G(0.01)	4.86	
492		-----		-----	
496	EN14078-B	6.87		0.56	
541		-----		-----	
824		-----		-----	
962		-----		-----	
963	EN14078-A	6.85	C	0.45	first reported 6.2
1121		-----		-----	
1126	EN14078-A	6.7		-0.40	
1141		-----		-----	
1259	EN14078-A	6.8		0.17	
1320		-----		-----	
1556	EN14078-A	6.6829		-0.49	
1720		-----		-----	
1753		-----		-----	
1776	EN14078-A	6.71		-0.34	
1806		-----		-----	
1854	EN14078-B	6.75		-0.11	
1857	EN14078	6.95		1.02	
1980	EN14078-B	6.82		0.28	
6018	EN14078-B	6.6258		-0.82	
6028	EN14078-B	6.9		0.73	
6075		-----		-----	
6201	EN14078-A	6.52		-1.41	
6274	EN14078-B	6.96		1.07	
6366	EN14078-A	6.644		-0.71	
6378		-----		-----	

normality	OK			
n	14			
outliers	1			
mean (n)	6.770			
st.dev. (n)	0.1303			
R(calc.)	0.365			
st.dev.(EN14078-B:14)	0.1770			
R(EN14078-B:14)	0.496		application range: 3-20 %V/V	
compare				
R(EN14078-A:14)	0.361		application range: 0.05-3 %V/V	

Kernel Density
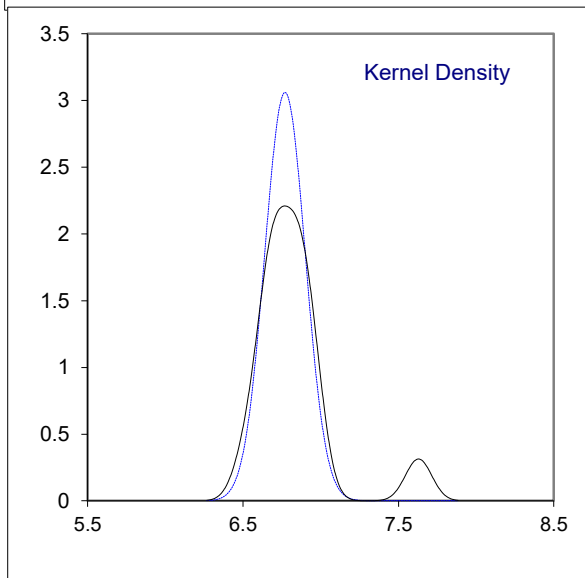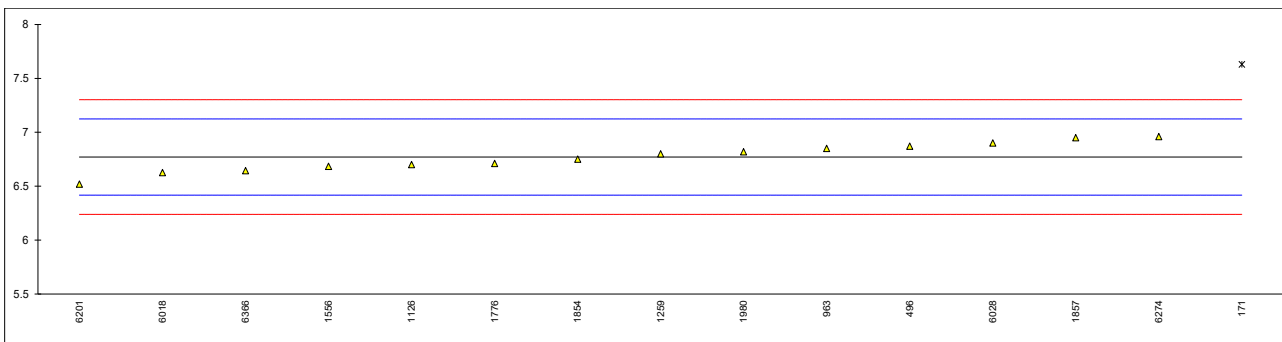
Determination of Flash Point PMcc on sample #21045; result in °C

lab	method	value	mark	z(targ)	remarks
171	D93-A	<40		-----	
492		-----		-----	
496	ISO2719-A	<40		-----	
541	ISO2719-A	<40.0		-----	
824	ISO2719-A	<40.0		-----	
962	D93-A	<40.0		-----	
963	ISO2719-A	<40.0		-----	
1121	ISO2719-A	<40		-----	
1126		-----		-----	
1141	ISO2719-A	< 40		-----	
1259	D93-A	30.0		-----	
1320		-----		-----	
1556	ISO2719-A	<40		-----	
1720		-----		-----	
1753	ISO2719-A	21.5		-----	
1776	ISO2719-A	<40		-----	
1806	ISO2719-A	22		-----	
1854	D93-A	LT 40		-----	
1857	ISO2719	24		-----	
1980	ISO2719-B	<40,0		-----	
6018	ISO2719-A	<40,0 [37,0]		-----	
6028	ISO2719-A	28.0		-----	
6075		-----		-----	
6201	D93-A	22.0		-----	
6274	D93-A	21		-----	
6366	D93-A	<40.0		-----	
6378		-----		-----	
	n	21			
	mean (n)	<40			

Determination of Kinematic Viscosity at 40°C on sample #21045; result in mm^2/s

lab	method	value	mark	z(targ)	remarks
171	D445	2.822		1.00	
492		-----		-----	
496		-----		-----	
541	ISO3104	2.7918		-1.70	
824	ISO3104	2.811		0.02	
962	D445	2.815	C	0.38	first reported 2.75
963	ISO3104	2.817		0.56	
1121	ISO3104	2.8074		-0.30	
1126		-----		-----	
1141		-----		-----	
1259	ISO3104	2.788		-2.04	
1320		-----		-----	
1556	ISO3104	2.8059		-0.44	
1720	D7042	2.817		0.56	
1753	ISO3104	2.8046		-0.56	
1776	D7042	2.786		-2.22	
1806	ISO3104	2.8029		-0.71	
1854		-----		-----	
1857	ISO3104	2.8088		-0.18	
1980	ISO3104	2.8221		1.01	
6018	ISO3104	2.8503		3.54	
6028	ISO3104	2.827		1.45	
6075	ISO3104	2.772		-3.48	
6201	ISO3104	2.812		0.11	
6274	D445	2.843		2.89	
6366	D445	2.8122		0.13	
6378		-----		-----	

normality	OK
n	20
outliers	0
mean (n)	2.8108
st.dev. (n)	0.01828
R(calc.)	0.0512
st.dev.(ISO3104:20)	0.01116
R(ISO3104:20)	0.0312
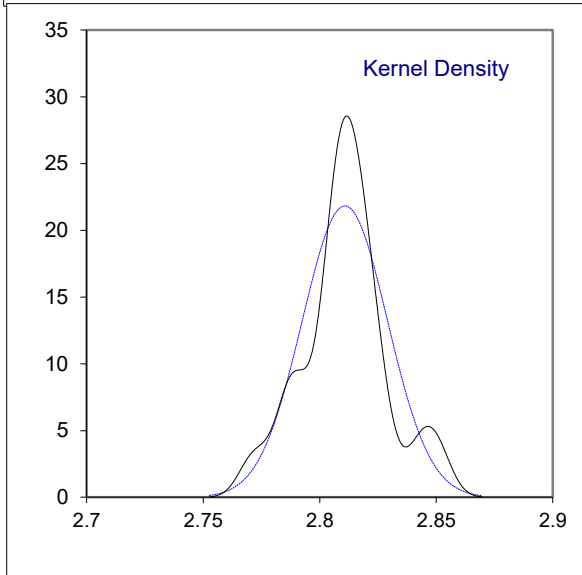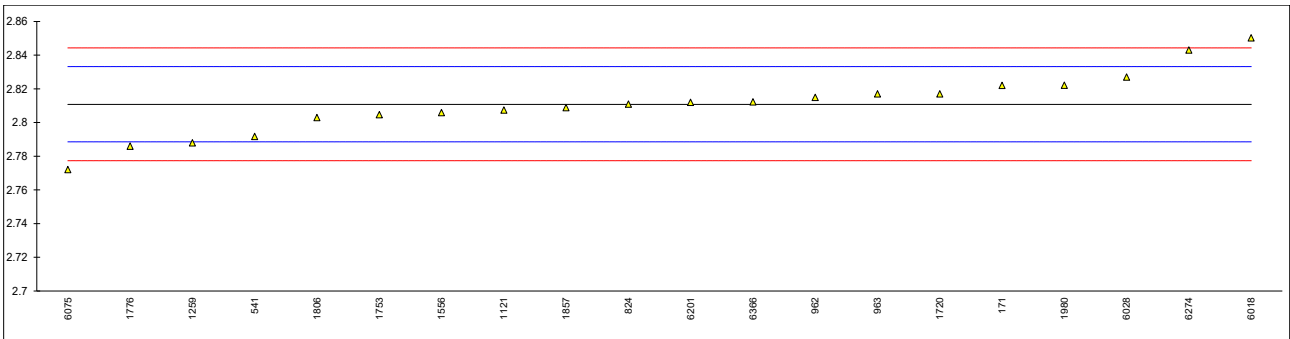
Determination of Lubricity by HFRR at 60°C on sample #21045; result in µm

lab	method	value	mark	z(targ)	Corrected	remarks
171	D6079	202		0.68	-----	
492		-----		-----	-----	
496	ISO12156-1-A	187		0.16	No	
541		-----		-----	-----	
824	ISO12156-1-A	173		-0.33	Yes	
962		-----		-----	-----	
963	ISO12156-1 (2006)	185		0.09	Yes	
1121		-----		-----	-----	
1126		-----		-----	-----	
1141		-----		-----	-----	
1259	ISO12156-1-A	180		-0.09	-----	
1320	ISO12156-1-A	190		0.26	No	
1556	ISO12156-1-A	159		-0.82	No	
1720		-----		-----	-----	
1753		-----		-----	-----	
1776		-----		-----	-----	
1806		-----		-----	-----	
1854	ISO12156-1-A	183		0.02	Yes	
1857	ISO12156-1-B	177		-0.19	No	
1980		-----		-----	-----	
6018		-----		-----	-----	
6028	ISO12156-1-A	175		-0.26	-----	
6075	ISO12156-1-A	211		1.00	No	
6201	ISO12156-1-A	160	C	-0.79	No	first reported 260
6274	ISO12156-1-A	160		-0.79	Yes	
6366	ISO12156-1-A	212.8		1.06	Yes	
6378		-----		-----	-----	

	normality	OK		
	n	14		
	outliers	0		
	mean (n)	182.486		
	st.dev. (n)	17.4121		
	R(calc.)	48.754		
	st.dev.(ISO12156-1-A:18)	28.5714		
	R(ISO12156-1-A:18)	80	(digital camera)	
	compare			
	R(ISO12156-1-B:18)	90	(visual)	
	R(D6079:18)	80		

Kernel Density
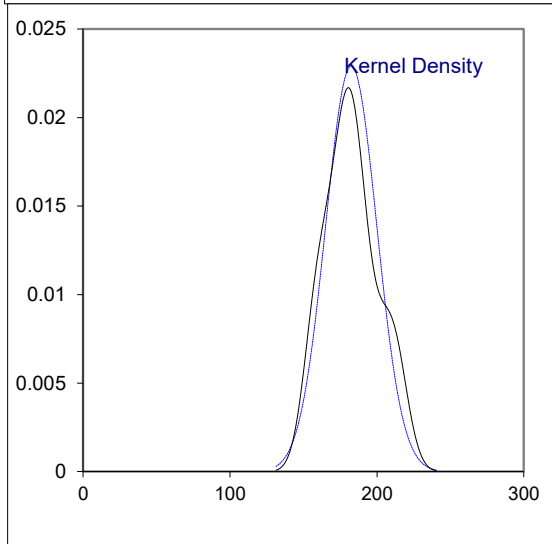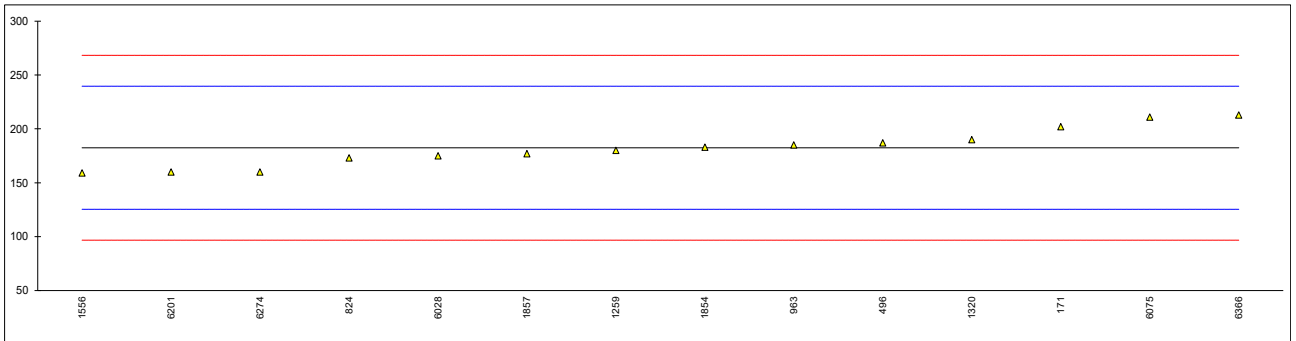
Determination of Manganese as Mn on sample #21045; result in mg/L

lab	method	value	mark	z(targ)	remarks
171	D3831	<0.25		-----	
492		-----		-----	
496	EN16576	<0.5		-----	
541		-----		-----	
824		-----		-----	
962		-----		-----	
963		-----		-----	
1121		-----		-----	
1126		-----		-----	
1141		-----		-----	
1259		-----		-----	
1320		-----		-----	
1556		-----		-----	
1720		-----		-----	
1753		-----		-----	
1776		-----		-----	
1806		-----		-----	
1854		-----		-----	
1857	EN16576	0.01		-----	
1980	EN16576	<0,50		-----	
6018		-----		-----	
6028	EN16576	0.15		-----	
6075		-----		-----	
6201	EN16576	0.01		-----	
6274	EN16576	<0.5		-----	
6366		-----		-----	
6378		-----		-----	
	n	7			
	mean (n)	<0.5			application range: 0.5 - 7 mg//L

Determination of Nitrogen on sample #21045; result in mg/kg

lab	method	value	mark	z(targ)	remarks
171	D4629	14	G(0.05)	-4.54	
492		-----		-----	
496		----		-----	
541		-----		-----	
824	D4629	20.6		0.32	
962	D4629	20.8		0.47	
963	D4629	21.3		0.83	
1121		-----		-----	
1126		-----		-----	
1141		-----		-----	
1259		-----		-----	
1320	D4629	19.9		-0.20	
1556	D4629	18.72		-1.07	
1720	D4629	20.12		-0.03	
1753		-----		-----	
1776	D4629	19.6		-0.42	
1806		-----		-----	
1854		-----		-----	
1857	D4629	20.3		0.10	
1980		-----		-----	
6018		-----		-----	
6028		-----		-----	
6075		-----		-----	
6201	D4629	23.12	DG(0.05)	2.17	
6274		-----		-----	
6366	D4629	24.2	DG(0.05)	2.97	
6378		-----		-----	

normality	OK
n	8
outliers	3
mean (n)	20.17
st.dev. (n)	0.791
R(calc.)	2.21
st.dev.(D4629:17)	1.358
R(D4629:17)	3.80
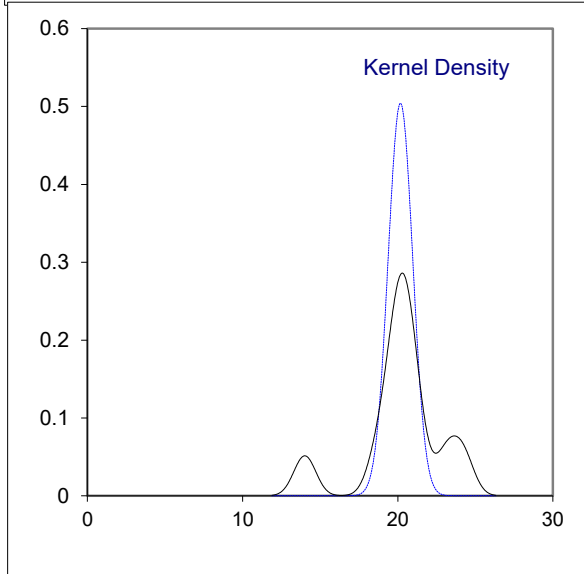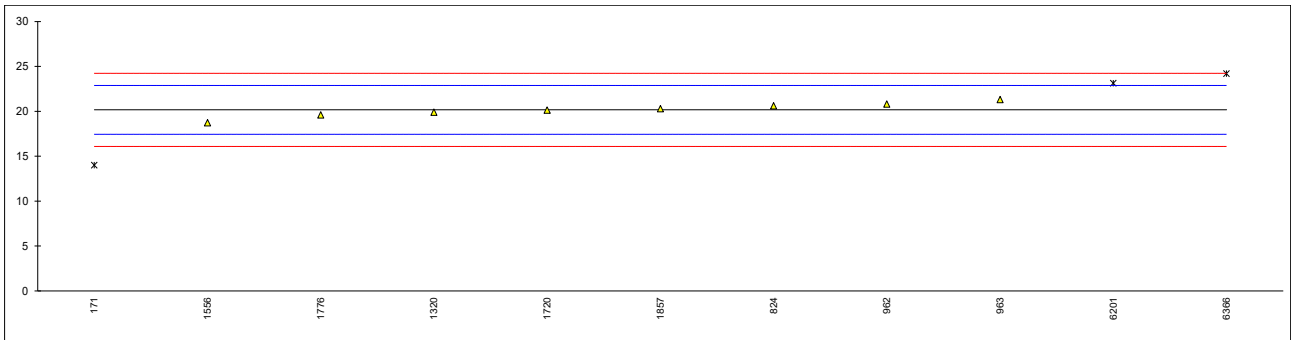
Determination of Polycyclic Aromatic Hydrocarbons [1] on sample #21045; result in %M/M

lab	method	value	mark	z(targ)	remarks
171		-----		-----	
492		-----		-----	
496	EN12916	1.52		-0.18	
541		-----		-----	
824	EN12916	1.63		0.23	
962		-----		-----	
963		-----		-----	
1121		-----		-----	
1126	EN12916	1.7		0.49	
1141		-----		-----	
1259	EN12916	1.6	C	0.12	first reported 2.0
1320	EN12916	1.50		-0.25	
1556	EN12916	1.44		-0.47	
1720		-----		-----	
1753		-----		-----	
1776	EN12916	1.333		-0.87	
1806		-----		-----	
1854		-----		-----	
1857	EN12916	1.85		1.05	
1980		-----		-----	
6018		-----		-----	
6028	EN12916	1.05		-1.92	
6075		-----		-----	
6201	EN12916	1.5		-0.25	
6274	EN12916	2.1		1.98	
6366	EN12916	1.585		0.07	
6378		-----		-----	

normality	suspect
n	12
outliers	0
mean (n)	1.567
st.dev. (n)	0.2588
R(calc.)	0.725
st.dev.(EN12916:16)	0.2696
R(EN12916:16)	0.755

[1] Definition from EN12916: %Polycyclic Aromatic Hydrocarbons = sum of %di and %tri+ Aromatic Hydrocarbons
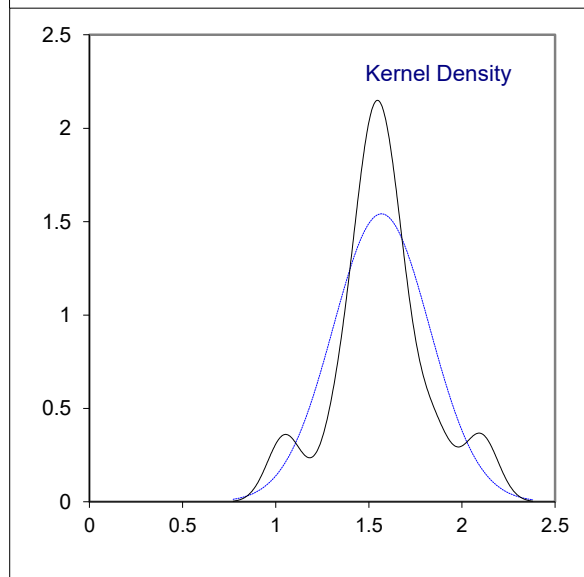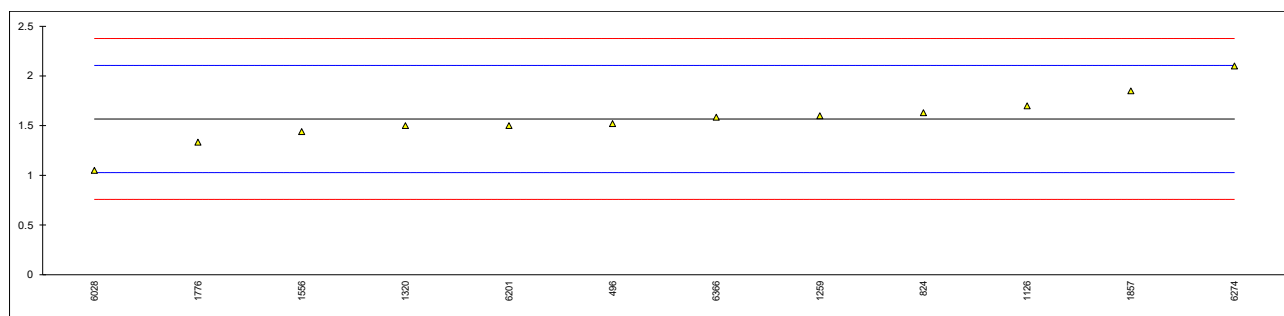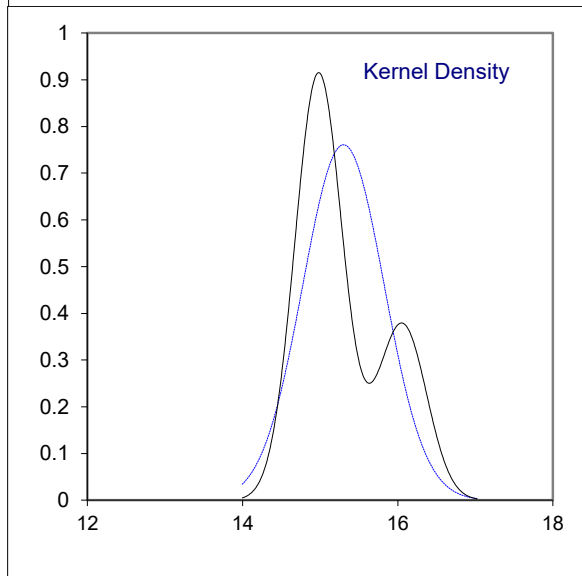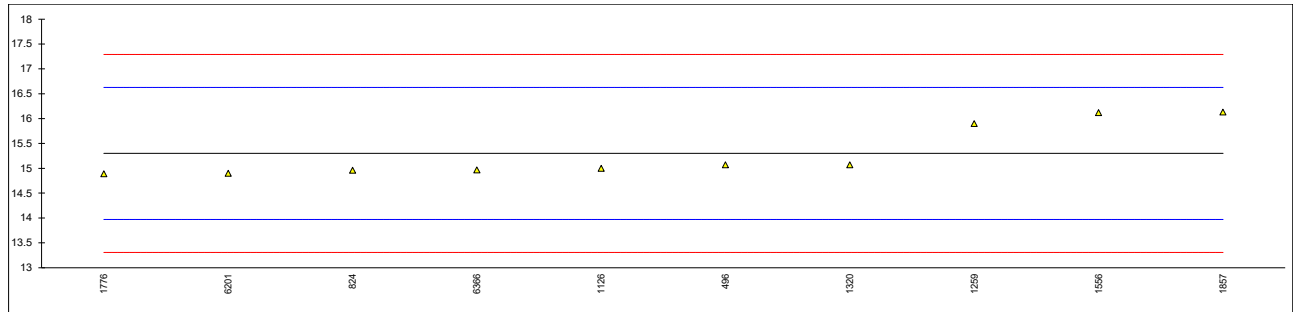

Kernel Density

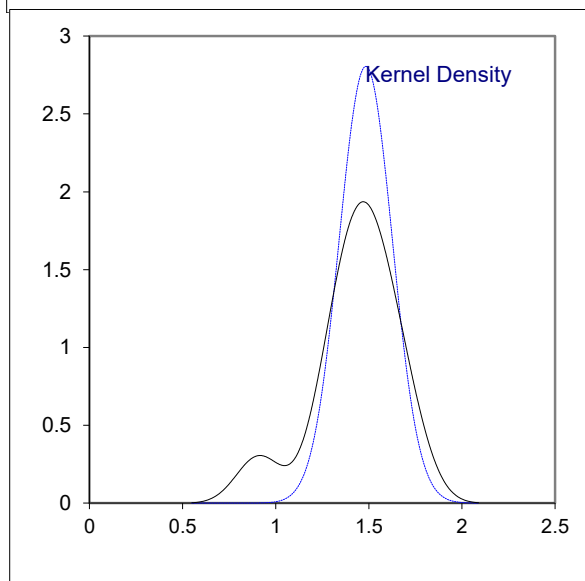## Determination of Mono Aromatic Hydrocarbons on sample #21045; result in %M/M

lab	method	value	mark	z(targ)	remarks
171		-----		-----	
492		-----		-----	
496	EN12916	15.07		-0.35	
541		-----		-----	
824	EN12916	14.96		-0.51	
962		-----		-----	
963		-----		-----	
1121		-----		-----	
1126	EN12916	15.0		-0.45	
1141		-----		-----	
1259	EN12916	15.9	C	0.90	first reported 17.7
1320	EN12916	15.07		-0.35	
1556	EN12916	16.120		1.23	
1720		-----		-----	
1753		-----		-----	
1776	EN12916	14.88824		-0.62	
1806		-----		-----	
1854		-----		-----	
1857	EN12916	16.13		1.25	
1980		-----		-----	
6018		-----		-----	
6028		-----		-----	
6075		-----		-----	
6201	EN12916	14.9		-0.60	
6274	EN12916	-----		-----	
6366	EN12916	14.965		-0.50	
6378		-----		-----	

normality	suspect
n	10
outliers	0
mean (n)	15.300
st.dev. (n)	0.5243
R(calc.)	1.468
st.dev.(EN12916:16)	0.6640
R(EN12916:16)	1.859

Kernel Density

Determination of Di Aromatic Hydrocarbons on sample #21045; result in %M/M

lab	method	value	mark	z(targ)	remarks
171		-----		-----	
492		-----		-----	
496	EN12916	1.46		-0.15	
541		-----		-----	
824	EN12916	1.63		0.90	
962		-----		-----	
963		-----		-----	
1121		-----		-----	
1126	EN12916	1.6		0.72	
1141		-----		-----	
1259	EN12916	1.5	C	0.10	first reported 1.8
1320	EN12916	1.42		-0.40	
1556	EN12916	1.3115		-1.07	
1720		-----		-----	
1753		-----		-----	
1776	EN12916	1.27401		-1.30	
1806		-----		-----	
1854		-----		-----	
1857	EN12916	1.73		1.52	
1980		-----		-----	
6018		-----		-----	
6028	EN12916	0.91	G(0.05)	-3.56	
6075		-----		-----	
6201	EN12916	1.4		-0.52	
6274		-----		-----	
6366	EN12916	1.515		0.19	
6378		-----		-----	

normality	OK
n	10
outliers	1
mean (n)	1.484
st.dev. (n)	0.1422
R(calc.)	0.398
st.dev.(EN12916:16)	0.1613
R(EN12916:16)	0.452

Kernel Density
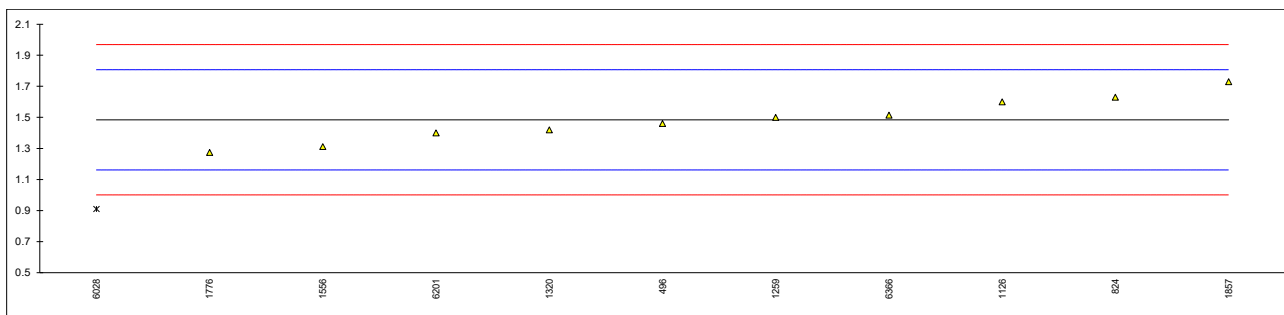
Determination of Tri⁺ Aromatic Hydrocarbons on sample #21045; result in %M/M

lab	method	value	mark	z(targ)	remarks
171		-----		-----	
492		-----		-----	
496	EN12916	0.06		-0.15	
541		-----		-----	
824	EN12916	0		-0.48	
962		-----		-----	
963		-----		-----	
1121		-----		-----	
1126	EN12916	0.1		0.07	
1141		-----		-----	
1259	EN12916	0.1	C	0.07	first reported 0.2
1320	EN12916	0.08		-0.04	
1556	EN12916	0.1302		0.24	
1720		-----		-----	
1753		-----		-----	
1776	EN12916	0.0589923		-0.16	
1806		-----		-----	
1854		-----		-----	
1857	EN12916	0.12		0.18	
1980		-----		-----	
6018		-----		-----	
6028	EN12916	0.14		0.29	
6075		-----		-----	
6201	EN12916	0.1		0.07	
6274		-----		-----	
6366	EN12916	0.07		-0.09	
6378		-----		-----	

normality	suspect
n	11
outliers	0
mean (n)	0.087
st.dev. (n)	0.0396
R(calc.)	0.111
st.dev.(EN12916:16)	0.1820
R(EN12916:16)	0.510

Kernel Density
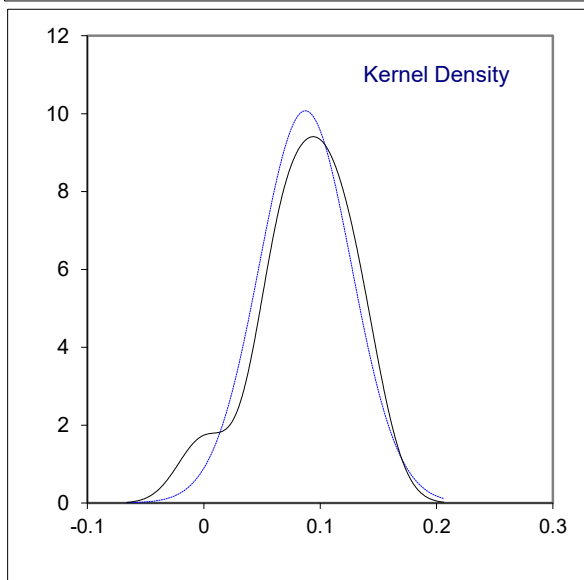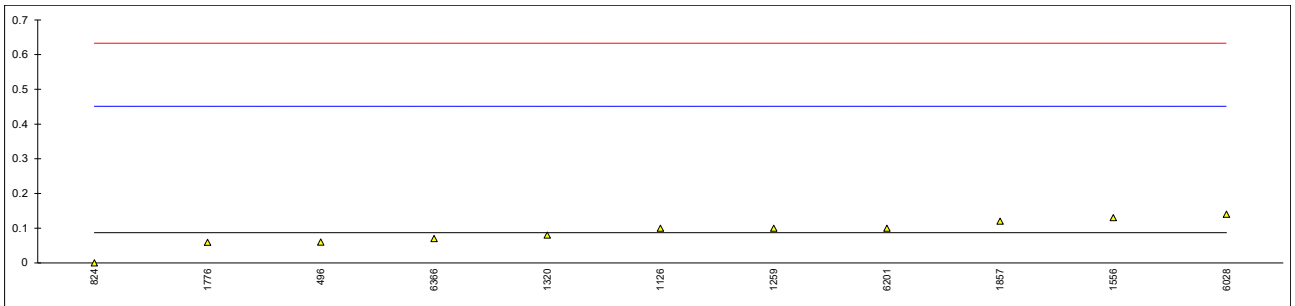
Determination of Total Aromatic Hydrocarbons on sample #21045; result in %M/M

lab	method	value	mark	z(targ)	remarks
171		-----		-----	
492		-----		-----	
496	EN12916	16.59		-0.43	
541		-----		-----	
824	EN12916	16.59		-0.43	
962		-----		-----	
963		-----		-----	
1121		-----		-----	
1126	EN12916	16.7		-0.26	
1141		-----		-----	
1259	EN12916	17.5	C	0.98	first reported 19.5
1320	EN12916	16.57		-0.46	
1556	EN12916	17.562		1.08	
1720		-----		-----	
1753		-----		-----	
1776	EN12916	16.22124		-1.00	
1806		-----		-----	
1854		-----		-----	
1857	EN12916	17.98		1.73	
1980		-----		-----	
6018		-----		-----	
6028		-----		-----	
6075		-----		-----	
6201	EN12916	16.4		-0.72	
6274	EN12916	-----		-----	
6366	EN12916	16.55		-0.49	
6378		-----		-----	

normality	suspect
n	10
outliers	0
mean (n)	16.866
st.dev. (n)	0.5895
R(calc.)	1.651
st.dev.(EN12916:16)	0.6454
R(EN12916:16)	1.807

Kernel Density
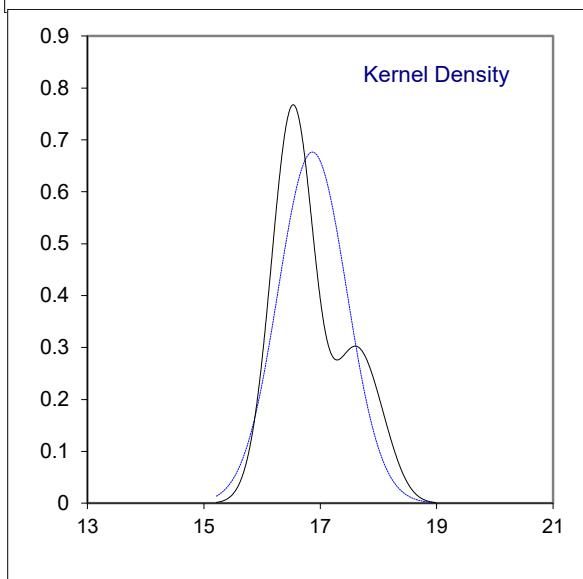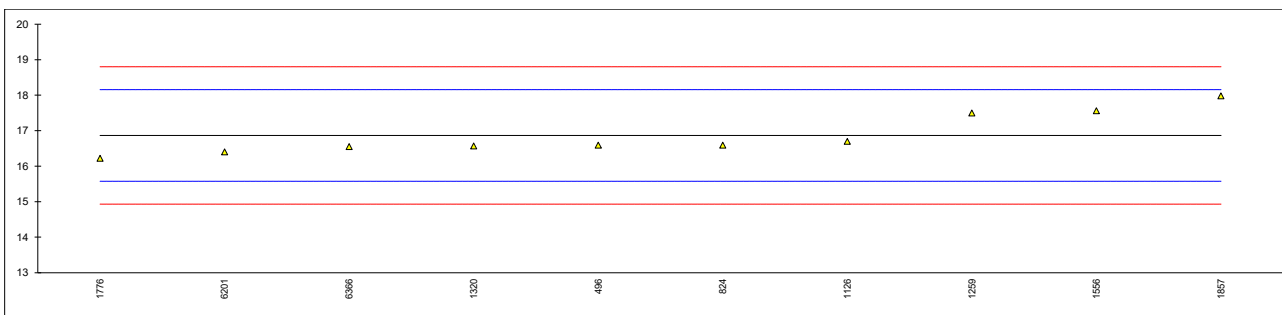
Determination of Pour Point Manual on sample #21045; result in °C

lab	method	value	mark	z(targ)	remarks
171	D97	-33		-0.27	
492		-----		-----	
496	ISO3016-automated	-33		-0.27	
541		-----		-----	
824	ISO3016-manual	-33		-0.27	
962	D97	-33		-0.27	
963	ISO3016-manual	-33		-0.27	
1121	ISO3016-manual	< -24		-----	
1126		-----		-----	
1141	ISO3016-manual	-33		-0.27	
1259	ISO3016-manual	-33		-0.27	
1320	ISO3016-manual	-30		0.66	
1556	ISO3016-automated	-30		0.66	
1720		-----		-----	
1753	D97	-30		0.66	
1776		-----		-----	
1806	D97	-30		0.66	
1854	ISO3016-manual	-33		-0.27	
1857	ISO3016-manual	-30		0.66	
1980	ISO3016-automated	-30		0.66	
6018	ISO3016-manual	-39	G(0.05)	-2.14	
6028		-----		-----	
6075		-----		-----	
6201	ISO3016-manual	-36		-1.21	
6274	ISO3016-automated	-33		-0.27	
6366	D97	-33		-0.27	
6378		-----		-----	

normality	OK	
n	17	
outliers	1	
mean (n)	-32.12	
st.dev. (n)	1.764	
R(calc.)	4.94	
st.dev.(ISO3016:19)	3.214	
R(ISO3016:19)	9	

Kernel Density
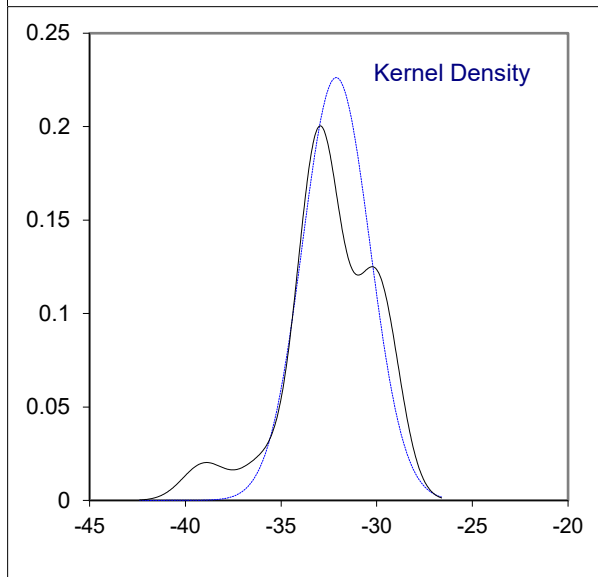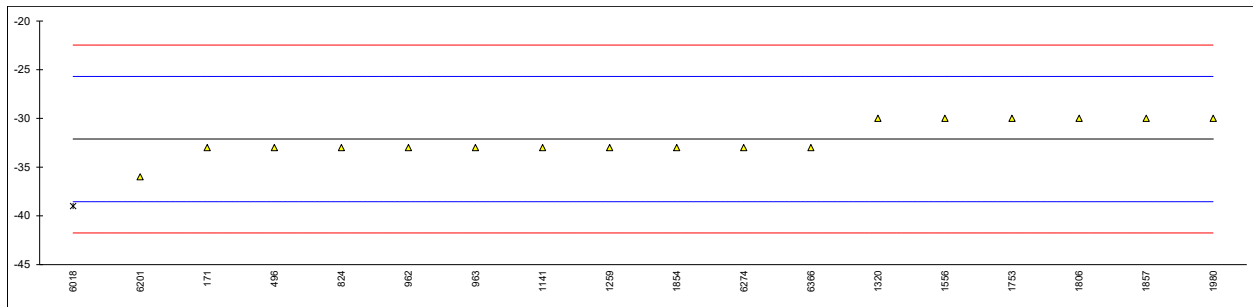
Determination of Pour Point Automated, 3°C interval on sample #21045; result in °C

lab	method	value	mark	z(targ)	remarks
171	D5950	-33		-0.86	
492		-----		-----	
496	D6892	-33		-0.86	
541	D5950	-30		0.52	
824		-----		-----	
962		-----		-----	
963	D5950	-33		-0.86	
1121		-----		-----	
1126		-----		-----	
1141		-----		-----	
1259		-----		-----	
1320		-----		-----	
1556		-----		-----	
1720		-----		-----	
1753		-----		-----	
1776	D5950	-30		0.52	
1806		-----		-----	
1854		-----		-----	
1857		-----		-----	
1980		-----		-----	
6018		-----		-----	
6028	D5950	-30		0.52	
6075	NF T60-105	-30		0.52	
6201	D5950	-30		0.52	
6274		-----		-----	
6366		-----		-----	
6378		-----		-----	

normality	unknown
n	8
outliers	0
mean (n)	-31.13
st.dev. (n)	1.553
R(calc.)	4.35
st.dev.(D5950:14)	2.179
R(D5950:14)	6.1

Kernel Density
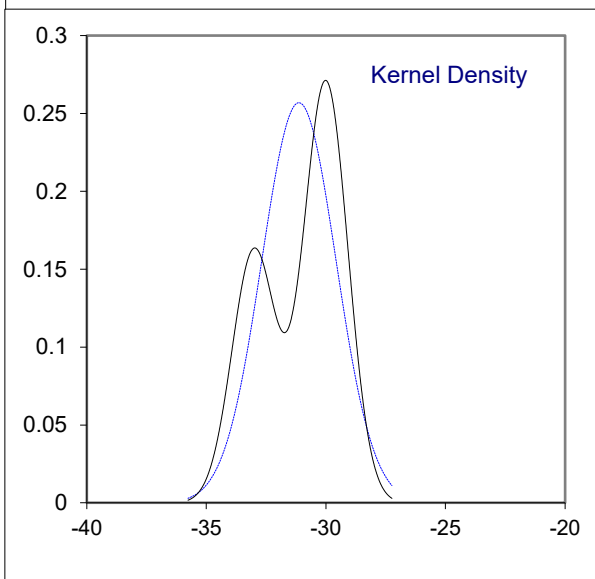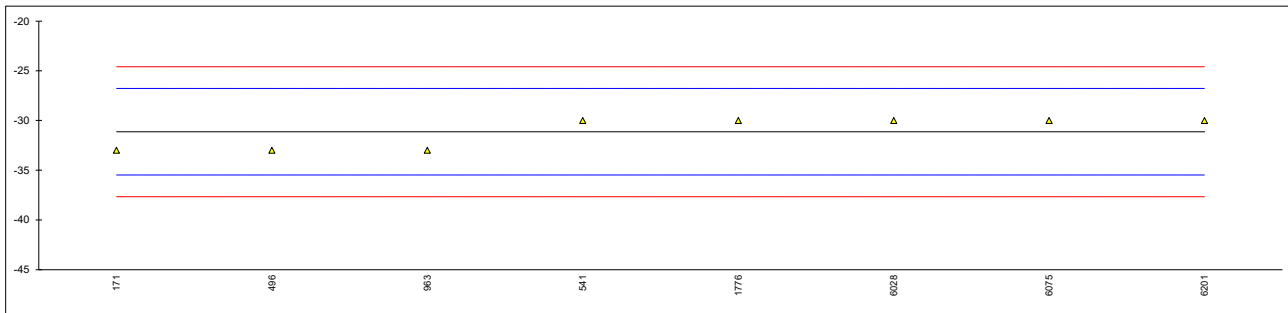
Determination of Sulfur on sample #21045; result in mg/kg

lab	method	value	mark	z(targ)	remarks
171	D5453	6.9		-0.83	
492		-----		-----	
496	ISO20846	7.2		-0.40	
541	ISO20846	7.50		0.03	
824	D5453	8.44		1.37	
962	D5453	8.21		1.05	
963	ISO20846	8.1		0.89	
1121	D5453	7.64		0.23	
1126	ISO20846	7.3		-0.26	
1141	ISO20846	7.28		-0.28	
1259	ISO20846	6.9		-0.83	
1320	ISO20846	7.97		0.70	
1556	ISO20884	7.4		-0.11	
1720	D5453	1.66	R(0.01)	-8.32	
1753	ISO20846	7.28		-0.28	
1776	ISO20846	7.4		-0.11	
1806		-----		-----	
1854	ISO20846	7.7		0.32	
1857	ISO20846	7.46		-0.03	
1980	ISO20884	6.90		-0.83	
6018	ISO20846	5.9		-2.26	
6028	ISO20846	8.42		1.35	
6075	ISO20846	6.04		-2.06	
6201	ISO20846	8		0.75	
6274	ISO20846	8.2		1.03	
6366	D5453	7.875		0.57	
6378		-----		-----	

normality	OK	
n	23	
outliers	1	
mean (n)	7.479	
st.dev. (n)	0.6662	
R(calc.)	1.865	
st.dev.(ISO20846:19)	0.6992	
R(ISO20846:19)	1.958	
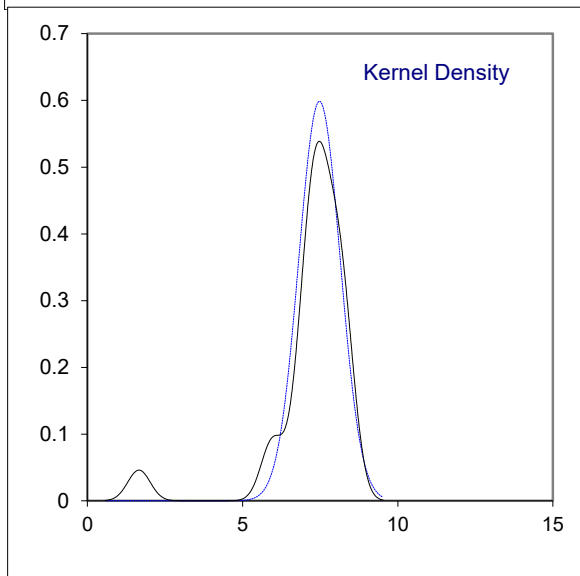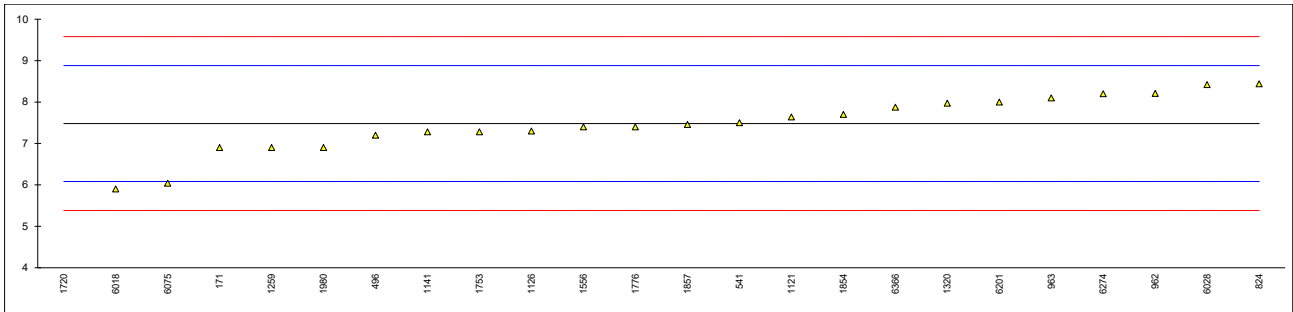
Determination of Water on sample #21045; result in mg/kg

lab	method	value	mark	z(targ)	remarks
171	D6304-A	66		0.59	
492		-----		-----	
496	ISO12937	49		-0.34	
541	ISO12937	60.5		0.29	
824	ISO12937	64.7		0.52	
962	D6304-A	63		0.42	
963	ISO12937	62.685		0.41	
1121	ISO12937	61.8		0.36	
1126		-----		-----	
1141	ISO12937	53.726		-0.08	
1259	ISO12937	70		0.81	
1320		-----		-----	
1556	ISO12937	39		-0.89	
1720		-----		-----	
1753	ISO12937	54.7		-0.03	
1776	ISO12937	35		-1.11	
1806		-----		-----	
1854	D6304-C	56		0.04	
1857	ISO12937	99.1	R(0.05)	2.40	
1980	ISO12937	52		-0.18	
6018	ISO12937	31.55		-1.30	
6028	ISO12937	59		0.20	
6075	ISO12937	49.1		-0.34	
6201	ISO12937	50		-0.29	
6274	ISO12937	59		0.20	
6366	D6304-A	68.55		0.73	
6378		-----		-----	

normality	OK	
n	20	
outliers	1	
mean (n)	55.27	
st.dev. (n)	10.680	
R(calc.)	29.90	
st.dev.(ISO12937:00)	18.259	
R(ISO12937:00)	51.12	

Kernel Density
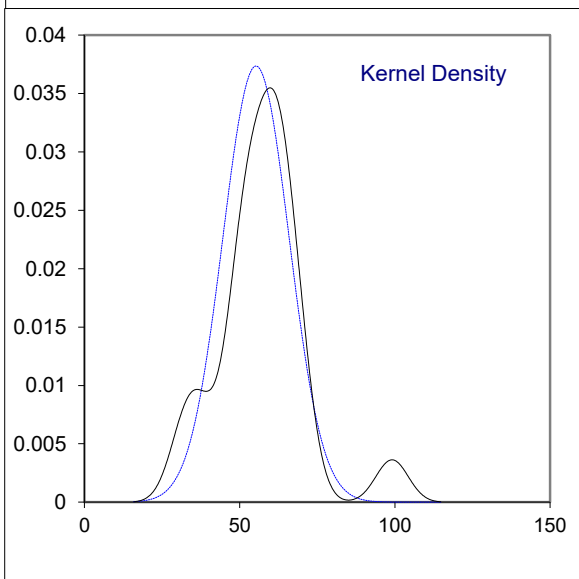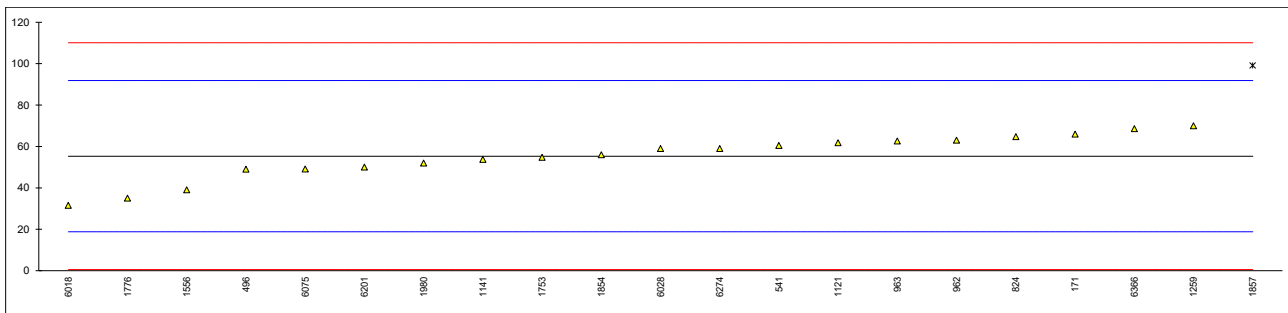
Determination of Cetane Number on sample #21046;

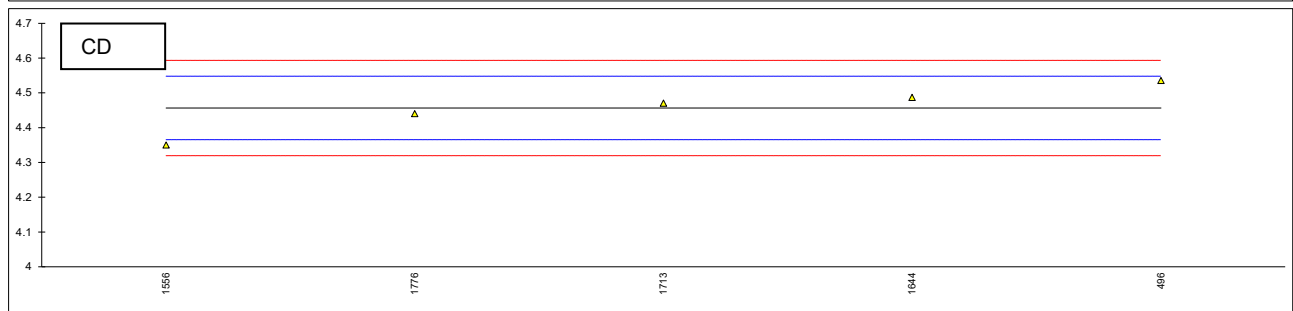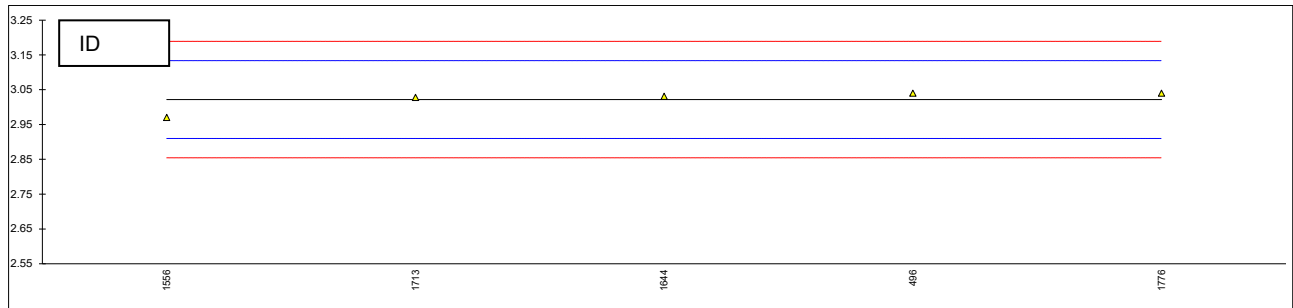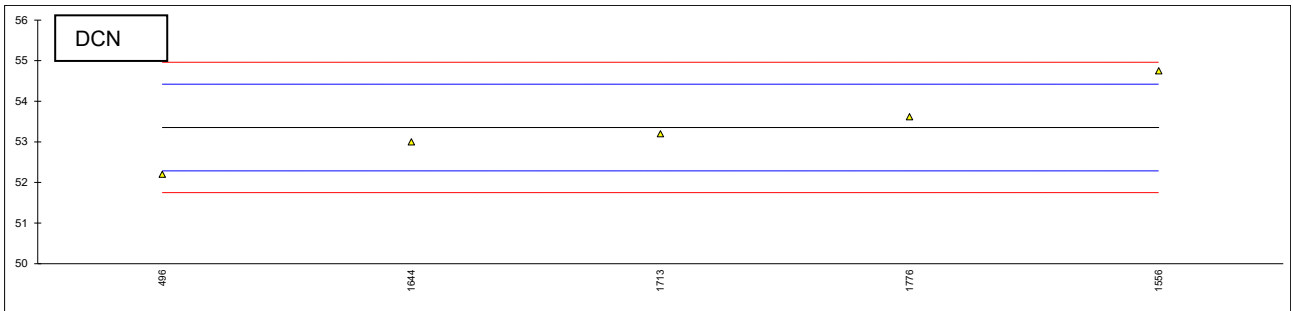| lab	method	value	mark	z(targ)	remarks
496	ISO5165	52.3		-0.18	
824	D613	51.6		-0.62	
963	ISO5165	53.5		0.59	
1259	ISO5165	53.2		0.40	
1320	ISO5165	52.2		-0.24	
1556		-----		-----	
1611	ISO5165	52.87		0.19	
1644		-----		-----	
1713		-----		-----	
1776		-----		-----	
1857	ISO5165	53.3		0.46	
6028	ISO5165	52.1		-0.30	
6075		-----		-----	
6274	ISO5165	52.1		-0.30	
	normality	OK			
	n	9			
	outliers	0			
	mean (n)	52.57			
	st.dev. (n)	0.659			
	R(calc.)	1.846			
	st.dev.(ISO5165:20)	1.56			
	R(ISO5165:20)	4.37			
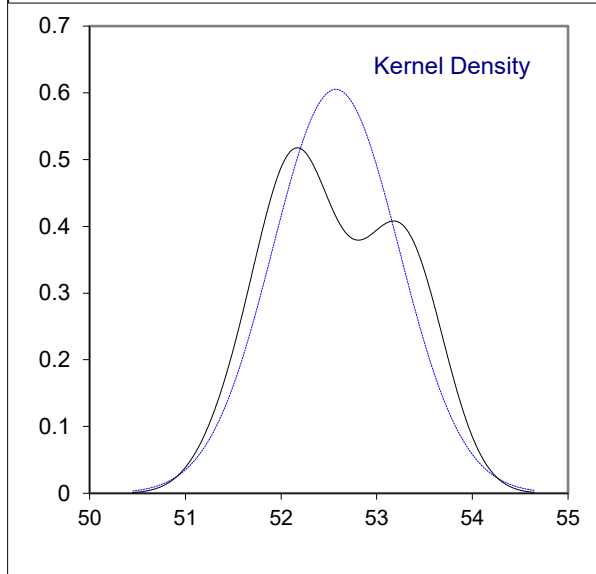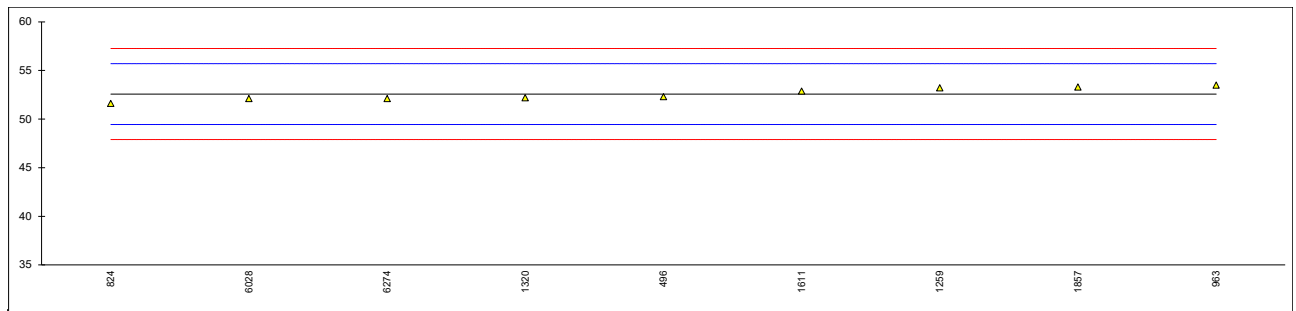
Determination of Derived Cetane Number (EN17155) on sample #21046;

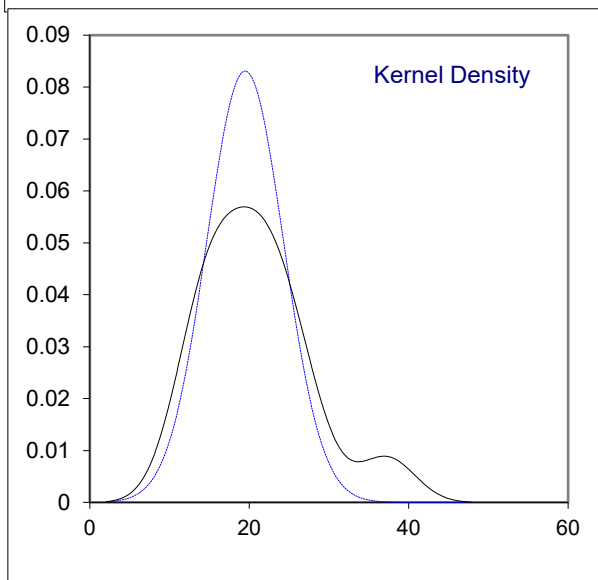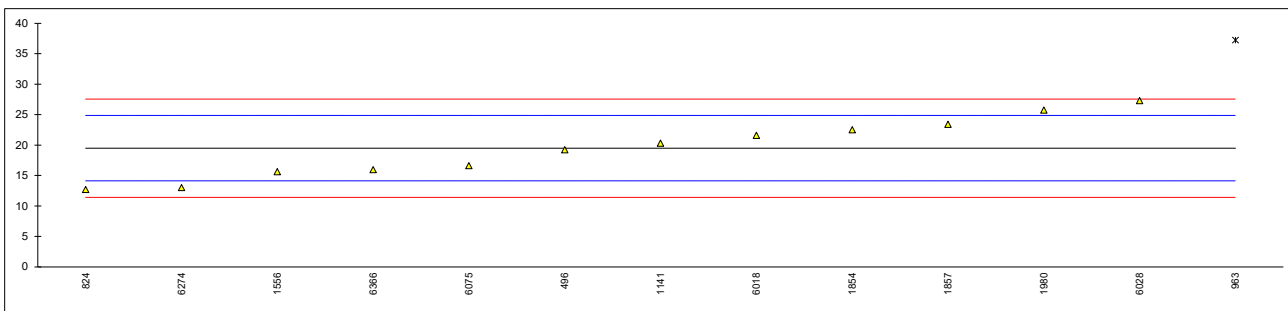| lab	method	DCN	mark	z(targ)	ID (ms)	mark	z(targ)	Air Temp. (°C)	mark
496		-----		-----	-----		-----	-----	
824		-----		-----	-----		-----	-----	
963		-----		-----	-----		-----	-----	
1259		-----		-----	-----		-----	-----	
1320		-----		-----	-----		-----	-----	
1556		-----		-----	-----		-----	-----	
1611		-----		-----	-----		-----	-----	
1644		-----		-----	-----		-----	-----	
1713		-----		-----	-----		-----	-----	
1776		-----		-----	-----		-----	-----	
1857		-----		-----	-----		-----	-----	
6028		-----		-----	-----		-----	-----	
6075	EN17155	52.28		-----	2.2847		-----	579.57	
6274		-----		-----	-----		-----	-----	

Determination of Derived Cetane Number (EN16715) on sample #21046;

lab	method	DCN	mark	z(targ)	ID (ms)	mark	z(targ)	CD (ms)	mark	z(targ)	W. T. (°C)
496	EN16715	52.2		-2.16	3.04		0.33	4.535		1.72	-----
824		-----		-----	-----		-----	-----		-----	-----
963		-----		-----	-----		-----	-----		-----	-----
1259		-----		-----	-----		-----	-----		-----	-----
1320		-----		-----	-----		-----	-----		-----	-----
1556	EN16715	54.75		2.61	2.97		-0.92	4.35		-2.33	583.21
1611		-----		-----	-----		-----	-----		-----	-----
1644	EN16715	53.00		-0.66	3.0309		0.16	4.4866		0.66	599.75
1713	EN16715	53.20		-0.29	3.0275		0.10	4.4701		0.30	586.77
1776	EN16715	53.62		0.50	3.04		0.33	4.44		-0.36	589.22
1857		-----		-----	-----		-----	-----		-----	-----
6028		-----		-----	-----		-----	-----		-----	-----
6075		-----		-----	-----		-----	-----		-----	-----
6274		-----		-----	-----		-----	-----		-----	-----
	normality	unknown			unknown			unknown			
	n	5			5			5			
	outliers	0			0			0			
	mean (n)	53.35			3.02			4.46			
	st.dev. (n)	0.935			0.029			0.069			
	R(calc.)	2.62			0.08			0.19			
	st.dev.(EN16715:15)	0.535			0.056			0.05			
	R(EN16715:15)	1.50			0.16			0.13			

Determination of Total Contamination on sample #21047; result in mg/kg

lab	method	Total C.	mark	z(targ)	incomplete	vol. filtered (mL)	stopped (min)	remarks
496	EN12662:2008	19.21		-0.11	Yes	-----	-----	
824	EN12662:2014	12.7		-2.52	-----	300	-----	
963	EN12662:2014	37.23	C,G(0.05)	6.59	Yes	300	5	first reported 4.14
1141	EN12662:2014	20.3		0.30	Yes	300	-----	
1320		-----		-----	-----	-----	-----	
1556	EN12662:2014	15.61		-1.44	Yes	300	1	
1854	EN12662:2014	22.5	C	1.12	No	300	-----	first reported 35.5
1857	EN12662	23.4		1.45	Yes	300	-----	
1980	EN12662:2014	25.74		2.32	Yes	251.2	-----	
6018	EN12662:2014	21.6		0.78	-----	-----	-----	
6028	EN12662:2014	27.3		2.90	-----	-----	-----	
6075	EN12662:2014	16.6		-1.07	Yes	-----	-----	
6274	EN12662:2014	13		-2.41	Yes	300	-----	
6366	EN12662:2014	15.96		-1.31	Yes	300	1	

normality	OK
n	12
outliers	1
mean (n)	19.493
st.dev. (n)	4.8023
R(calc.)	13.446
st.dev.(EN12662:14)	2.6929
R(EN12662:14)	7.540

Kernel Density

APPENDIX 2

Number of participants per country

1 lab in ARGENTINA

1 lab in CROATIA

2 labs in GERMANY

1 lab in GREECE

1 lab in MALYSIA

1 lab in MARTINIQUE

2 labs in NETHERLANDS

4 labs in POLAND

1 lab in POTRUGAL

2 labs in ROMANIA

1 lab in RUSSIAN FEDERATION

2 labs in SAUDI ARABIA

1 lab in SERBIA

1 lab in SLOVAKIA

1 lab in SOUTH KOREA

1 lab in SUDAN

2 labs in SWEDEN

1 lab in TUNISIA

1 lab in TURKEY

1 lab in UGANDA

1 lab in UNITED KINGDOM

1 lab in UNITED STATES OF AMERICA

APPENDIX 3

Abbreviations

C   = final test result after checking of first reported suspect test result
D(0.01)   = outlier in Dixon's outlier test
D(0.05)   = straggler in Dixon's outlier test
G(0.01)   = outlier in Grubbs' outlier test
G(0.05)   = straggler in Grubbs' outlier test
DG(0.01)   = outlier in Double Grubbs' outlier test
DG(0.05)   = straggler in Double Grubbs' outlier test
R(0.01)/R(1) = outlier in Rosner's outlier test
R(0.05)/R(5) = straggler in Rosner's outlier test
E   = calculation difference between reported test result and result calculated by iis
W   = test result withdrawn on request of participant
ex   = test result excluded from statistical evaluation
n.a.   = not applicable
n.e.   = not evaluated
n.d.   = not detected
fr.   = first reported
f+?   = possibly a false positive test result?
f-?   = possibly a false negative test result?
SDS   = Safety Data Sheet

Literature

1   iis Interlaboratory Studies, Protocol for the Organisation, Statistics & Evaluation, June 2018
2   ISO5725:86
3   ISO5725 parts 1-6:94
4   ISO13528:05
5   M. Thompson and R. Wood, J. AOAC Int, 76, 926, (1993)
6   W.J. Youden and E.H. Steiner, Statistical Manual of the AOAC, (1975)
7   P.L. Davies, Fr. Z. Anal. Chem, 331, 513, (1988)
8   J.N. Miller, Analyst, 118, 455, (1993)
9   Analytical Methods Committee, Technical Brief, No 4, January 2001
10   P.J. Lowthian and M. Thompson, The Royal Society of Chemistry, Analyst, 127, 1359-1364, (2002)
11   W. Horwitz and R. Albert, J. AOAC Int, 79, 3, 589-621, (1996)
12   Bernard Rosner, Percentage Points for a Generalized ESD Many-Outlier Procedure, Technometrics, 25(2), 165-172, (1983)