

Results of Proficiency Test
Benzene & Toluene
April 2012

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

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1 INTRODUCTION

Since 1999, the Institute for Interlaboratory Studies organizes proficiency tests for the analysis of Benzene and Toluene. In the annual proficiency testing program of 2011-2012, it was decided to continue the proficiency test for the analysis of Benzene and Toluene. In the interlaboratory study for Benzene 48 laboratories from 22 different countries have participated and for Toluene 43 participants in 20 countries have participated. See appendix 2 for the number of participants per country.

In this report, the results of the proficiency test Benzene and Toluene are presented and discussed.

2 SET UP

The Institute for Interlaboratory Studies (iis) in Spijkenisse, the Netherlands, was the organizer of this proficiency test. The analyses for fit-for-use and homogeneity determination were subcontracted to an accredited laboratory. The participants received depending on their registration: 1* 1 litre bottle with Benzene (sample #12051) and/or 1* 1 litre bottle with Toluene (sample #12052).

In order to collect sufficient data for a statistical evaluation, the participants were asked to send in rounded and unrounded results. The unrounded were preferred used for statistical evaluation.

2.1 ACCREDITATION

The Institute for Interlaboratory Studies in Spijkenisse, the Netherlands, is accredited in accordance with ISO guide 43 and ILAC-G13:2007, (R007), since January 2000, by the Dutch Accreditation Council (Raad voor Accreditatie), see www.rva.nl. This ensures 100% confidentiality of participant's data. Also, customer's satisfaction is measured on a regular basis by sending out questionnaires. The analysis did subcontract to an accredited laboratory.

2.2 PROTOCOL

The protocol followed in the organisation of this proficiency test was the one as described for proficiency testing in the report 'iis. Interlaboratory Studies: Protocol for the Organization, Statistics and Evaluation' (iis-protocol, version 3.2) of January 2010.

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

BENZENE

The necessary bulk material of Benzene was obtained from a local chemical supplier. The approximately 74 litre was spiked with 506.6 mg 1-Methyl-2-Pyrrolidinone (for the Nitrogen determination) and 373.6 mg o-Chlorotoluene (for the Organic Chlorine determination). The bulk sample was, after homogenisation, divided over 74 amber glass bottles of 1 litre, labelled #12051. The homogeneity of the subsamples #12051 was checked by determination of Organic Chlorine in accordance with ASTM D5808:09a, Density @ 20°C in accordance with ASTM D4052:11 and Toluene content according to ASTM D4492:10, on 8 stratified randomly selected samples.

Benzene	Organic Chlorine in mg/kg	Density at 20°C in kg/L	Toluene in mg/kg
sample #12051-1	1.3	0.87897	370
sample #12051-2	1.2	0.87898	363
sample #12051-3	1.3	0.87900	358
sample #12051-4	1.3	0.87900	360
sample #12051-5	1.3	0.87900	370
sample #12051-6	1.4	0.87901	385
sample #12051-7	1.3	0.87900	359
sample #12051-8	1.3	0.87898	346

table 1: homogeneity test results of Benzene sub samples #12051

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

	Organic Chlorine in mg/kg	Density at 20°C in kg/L	Toluene in mg/kg
r (sample #12051)	0.3	0.00004	32
target	ASTM D5808:09a	ASTM D4052:11	ASTM D4492:10
0.3*R (target)	0.4	0.00015	51

table 2: evaluation of repeatabilities of subsamples #12051

The calculated repeatabilities were in agreement with 0.3 times the corresponding target reproducibility. Therefore, homogeneity of the samples was assumed.

TOLUENE

The necessary bulk material of Toluene was purchased from a local chemical supplier. The approximately 60 litre was, after homogenisation, divided over 60 brown glass bottles of 1 litre, labelled #12052. The homogeneity of the subsamples #12052 was checked by determination of Purity, according to ASTM D2360:11 and Density @ 20°C according to ASTM D4052:11 on 8 stratified randomly selected samples.

Toluene	Purity in %M/M	Density at 20°C in kg/L
sample #12052-1	99.96	0.86684
sample #12052-2	99.96	0.86683
sample #12052-3	99.96	0.86684
sample #12052-4	99.95	0.86684
sample #12052-5	99.96	0.86684
sample #12052-6	99.96	0.86684
sample #12052-7	99.96	0.86686
sample #12052-8	96.96	0.86686

table 3: homogeneity test results of Toluene sub samples #12052

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

	Purity in %M/M	Density at 20°C in kg/L
r (sample #12052)	0.004	0.00003
target	ASTM 4492:10	ASTM D4052:11
0.3*R (target)	0.006	0.00015

table 4: evaluation of repeatabilities of subsamples #12052

The calculated repeatabilities were in agreement with 0.3 times the corresponding target reproducibility. Therefore, homogeneity of the samples was assumed.

Depending on their registration to each of the participating laboratories one 1 litre bottle of Benzene labelled #12051 and/or one 1 litre bottle of Toluene labelled #12052 were sent on April 4, 2012.

2.5 STABILITY OF THE SAMPLES

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

2.6 ANALYSES

The participants were requested to determine on the Benzene sample #12051: Acid Wash Color, Acidity, Appearance, Bromine Index, Color Pt-Co, Density @ 20°C, Distillation, Organic Chlorides, Total Chlorides, Total Nitrogen, Solidification Point, Methylcyclohexane, Toluene, Nonaromatics and Purity.

On Toluene sample #12052 were requested: Acid Wash Color, Appearance, Copper Corrosion, Color Pt-Co, Density @ 20°C, Distillation, Purity, Nonaromatics, Benzene and Styrene.

To get maximum information for the statistical calculations, the participants were requested to report unrounded results and results below the usual lower reporting limits, where

possible. To get comparable results a detailed report form, on which the units were prescribed, was sent together with each set of samples. Also, a letter of instructions and a SDS was added to the package.

3 RESULTS

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

Directly after the deadline, a reminder fax was sent to those laboratories that had not yet reported any results at that moment.

Shortly after the deadline, the available results were screened for suspect data. A result was called suspect in case the Huber Elimination Rule (a robust outlier test) found it to be an outlier. The laboratories that produced these suspect data were asked to check the results. Additional or corrected results are used for data analysis and original results are placed under 'Remarks' in the result tables in appendix 1.

3.1 STATISTICS

Statistical calculations were performed as described in the report 'iis Interlaboratory Studies: Protocol for the Organisation, Statistics and Evaluation' (iis-protocol, version 3.2) of January 2010.

For 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 results of the statistical evaluation should be used with due care.

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

For each assigned value the uncertainty was determined in accordance with ISO13528. Subsequently the calculated uncertainty was evaluated against the respective requirement based on the target reproducibility in accordance with ISO13528. When the uncertainty passed the evaluation no remarks are made in the report. However, when the uncertainty failed the evaluation it is mentioned in the report and it will have consequences for the evaluation of the test results.

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

3.2 GRAPHICS

In order to visualise the data against the reproducibilities from literature, Gauss plots were made, using the sorted data for one determination (see appendix 1). On the Y-axis the reported analysis results are plotted. The corresponding laboratory numbers are under the X-axis.

The straight horizontal line presents the consensus value (a trimmed mean). The four striped lines, parallel to the consensus value line, are the +3s, +2s, -2s and -3s target reproducibility limits of the selected standard. Outliers and other data, which were excluded from the calculations, are represented as a cross. Accepted data are represented as a triangle. Furthermore, Kernel Density Graphs were made. This method is for producing a smooth density approximation to a set of data that avoids some problems associated with histograms (see appendix 3; nr.14 and 15).

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.

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 the fit-for-useness of the reported test result.

The z-scores were calculated according to:

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

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

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

4 EVALUATION

In this proficiency test, problems were encountered during the execution. Laboratories in Brazil and Saudi Arabia did receive the samples late due to courier problems and/or custom clearance. For #12051 (Benzene) and #12052 (Toluene) respectively three and four participants reported test results after the final reporting date.

Not all laboratories were able to perform all analysis requested. Finally, for sample #12051 (Benzene) and sample #12052 (Toluene) in total 718 results were submitted. Observed were in total 27 outlying results, which is 3.8%. In proficiency studies, outlier percentages of 3% - 7.5% are normal.

4.1 EVALUATION PER SAMPLE AND TEST

In this section, the results are discussed per sample and test. The methods, which are used by the various laboratories, were taken into account for explaining the observed differences when possible and applicable. These methods are also in the tables together with the original data. The abbreviations, used in these tables, are listed in appendix 3. In case no suitable test method is available, the Horwitz equation was used.

Not all original data sets proved to have a normal distribution. Not normal distributions were found for sample #12051: Color Pt-Co, Density, Distillation (IBP, 50% and DP), Organic Chloride, Solidification Point and Purity. For sample #12052 not normal distributions were found for: Color Pt-Co, Density, Distillation (IBP, 50% and DP), Non aromatics and Benzene. For these determinations the results of the statistical evaluation should be used with due care.

For Benzene sample #12051

Acid Wash Color: No analytical problems were observed. Twenty-four laboratories reported the Acid Wash Color as 1-. Other laboratories reported the Acid Wash Color as 0, 0+ or '0-1'.

Acidity: This determination was not problematic. The way of reporting varies strongly and should be improved in accordance with ASTM D847:08: report "no free acid" (NFA) or, when positive, "acidity as mg NaOH/100 mL".

Appearance: No analytical problems were observed. All labs agreed about the appearance of the sample #12051, which was bright, clear and free of suspended matter.

Bromine Index: This determination was not problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is in good agreement with the estimated reproducibility requirements of ASTM D5776:07e1.

Color Pt-Co: This determination was not problematic. Two statistical outliers were observed. However, the calculated reproducibility after rejection of the

statistical outliers is in good agreement with the requirements of ASTM D1209:05e1.

Density @20°C: This determination was not problematic. Two statistical outliers were observed. The calculated reproducibility after rejection of the statistical outlier is in good agreement with the requirements of ASTM D4052:11.

Distillation: This determination was problematic for two laboratories. In total six statistical outliers were observed. The calculated reproducibilities for IBP 50% recovered and DP, after rejection of statistical outliers, are all in agreement with the requirements of ASTM D850:08e1. From the reported results of the 50% recovered, it appears that four participants obviously did not correct the results for barometric pressure and thermometer inaccuracy as described in ASTM D850-08e1 (paragraph 11.4).

Organic Chloride: This determination was not problematic. Two statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers is in good agreement with the requirements of ASTM D5808:09a. The average concentration is in good agreement with the average concentration of total chloride and with the spiked amount of chlorotoluene.

Total Chloride: This determination may be problematic. No statistical outliers were observed. However, the calculated reproducibility is almost in agreement with the requirements of ASTM D5194:11. The average concentration is in good agreement with the average concentration of organic chloride. One participant used standard IP510. Using this standard organic halogens are determined, but not total chloride and with the spiked amount of chlorotoluene.

Total Nitrogen: This determination may be problematic. No statistical outliers were observed. However, the calculated reproducibility is almost in agreement with the requirements of ASTM D6069:06. The average recovery of Total Nitrogen (theoretical increment of 1.10 mg/kg) has to be reported as "less than 109%". This due to the fact that the actual blank Total Nitrogen is unknown.

Solidification Point: This determination was problematic. No statistical outliers were observed. However, the calculated reproducibility is not in agreement with the requirements of ASTM D852:08. Important in this solidification point determination is addition of water, the correct benzene container and the correction by 0.09°C.

Methylcyclohexane: The concentration of methylcyclohexane was near of below the detection limit of the method used and most of the participants reported a less than result. Therefore no statistical conclusions were drawn.

- Toluene: This determination was not problematic. Only one statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is in good agreement with the reproducibility of ASTM D4492:10.
- Nonaromatics: This determination was very problematic. Two statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers, is not at all in agreement with the reproducibility of ASTM D4492:10. The large spread is probably (partly) caused by low concentration of nonaromatics (16 mg/kg).
- Purity: This determination was not problematic. Three statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers, is in good agreement with the estimated reproducibility of ASTM D4492:10.

For Toluene sample #12052

- Acid Wash Color: No analytical problems were observed. Eighteen laboratories reported the Acid Wash Color as 1-. Other laboratories reported the Acid Wash Color as 0, 0+, '0-1', 2 or 3.
- Appearance: No analytical problems were observed. All labs agreed about the appearance of the sample #12052, which was bright, clear and free of suspended matter. The uniformity of reporting can be improved.
- Copper Corr: No problems have been observed. The majority of the participants agreed on a result of 1 (1A). Three participants reported the Copper Corrosion as pass.
- Color Pt-Co: This determination was not problematic. Two statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers is in good agreement with the requirements of ASTM D1209:05e1.
- Density @20°C: This determination was not problematic. Three statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers is in good agreement with the requirements of ASTM D4052:11.
- Distillation: This determination was problematic for a one laboratory. In total two statistical outliers were observed. The calculated reproducibilities, after rejection of statistical outliers, are all in agreement with the requirements of ASTM D850:08e1.
From the reported results of the 50% recovered, it appears that one participant obviously did not correct the results for barometric pressure and thermometer inaccuracy as described in ASTM D850-08e1 (paragraph 11.4).

- Purity:** This determination was not problematic. Only one statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is in good agreement with the requirements of ASTM D2360:11.
- Nonaromatics:** This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in good agreement with the requirements of ASTM D2360:11.
- Benzene:** This determination may be very problematic. Only one statistical outlier was observed. However, the calculated reproducibility is not at all in agreement with the strict estimated reproducibility limits calculated using the Horwitz equation.
- Styrene:** The concentration of styrene was or near of below the detection limit of the method used and most of the participants reported a less than result. Therefore no statistical conclusions were drawn.

4.2 PERFORMANCE EVALUATION FOR THE GROUP OF LABORATORIES

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

Parameter	unit	n	average	2.8 *sd _R	R (lit)
Acid Wash Color		34	1-	n.a.	n.a.
Acidity	mgNaOH/100ml	33	no free acid	n.a.	n.a.
Appearance		36	pass	n.a.	n.a.
Bromine Index	mg Br/100g	14	1.70	3.03	4.60
Color Pt-Co		24	2.7	3.5	7.0
Density @ 20°C	kg/l	40	0.8790	0.0002	0.0005
Distillation, IBP	°C	33	79.81	0.29	0.42
Distillation, 50%	°C	33	80.09	0.18	0.42
Distillation, DP	°C	33	80.35	0.36	0.42
Organic Chloride	mg/kg	13	1.44	0.32	1.30
Total Chloride	mg/kg	8	1.46	1.04	0.90
Total Nitrogen	mg/kg	20	1.20	0.52	0.46
Solidification Point	°C	27	5.47	0.07	0.05
Methylcyclohexane	mg/kg	25	<10	n.a.	n.a.
Toluene	mg/kg	36	369.4	50.9	172.0
Nonaromatics	mg/kg	26	16.4	13.4	4.1
Purity	%M/M	35	99.961	0.005	0.027

Table 5: reproducibilities of Benzene sample #12051

Parameter	unit	n	average	2.8 *sd _R	R (lit)
Acid Wash Color		33	1-	n.a.	n.a.
Appearance		34	pass	n.a.	n.a.
Copper corrosion		30	1(1A)	n.a.	n.a.
Color Pt-Co		22	3.7	4.7	7.0
Density @ 20°C	kg/L	36	0.8669	0.0002	0.0005
Distillation, IBP	°C	34	110.32	0.27	0.58
Distillation, 50% rec.	°C	33	110.60	0.10	0.16
Distillation, DP	°C	33	110.70	0.23	0.46
Purity	%M/M	32	99.959	0.014	0.021
Nonaromatics	mg/kg	31	365.6	105.1	174.8
Benzene	mg/kg	32	15.0	8.7	4.5
Styrene	mg/kg	26	<10	n.a.	n.a.

Table 6: reproducibilities of Toluene sample #12052

Without further statistical calculations, it can be concluded that for most of the tests there is a compliance of the group of participating laboratories with the relevant standards. The tests that are problematic have been discussed in paragraph 4.1.

4.3 COMPARISON OF THE PROFICIENCY TEST OF APRIL 2012 WITH PREVIOUS PTS

	April 2012	April 2011	April 2010	April 2009
Number of reporting labs	46	45	44	42
Number of results reported	718	833	684	811
Statistical outliers	27	45	28	28
Percentage outliers	3.8%	5.4%	4.1%	3.5%

table 7: 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:

	April 2012	April 2011	April 2010	April 2009
Acid Wash Color	n.e.	++	++	++
Acidity	n.e.	++	n.e.	++
Appearance	n.e.	++	n.e.	++
Bromine Index	++	++	++	+/-
Color Pt-Co	++	++	++	++
Density @ 20°C	++	++	++	++
Distillation, IBP	++	++	++	+
Distillation, 50%	++	++	++	++
Distillation, DP	+	--	++	--
Organic Chloride	++	-	+/-	+/-
Total Chloride	-	n.e.	n.e.	n.e.
Total Nitrogen	-	--	--	--
Solidification Point	-	--	--	--
Methylcyclohexane	n.e.	--	++	--
Toluene	++	++	++	++
Nonaromatics	--	--	+	--
Purity	++	+	++	+

table 8: comparison determinations on Benzene against the standards

	March 2012	April 2011	April 2010	April 2009
Acid Wash Color	n.e	++	++	++
Appearance	n.e	++	+	++
Copper Corrosion	n.e	++	++	++
Color Pt-Co	++	++	++	++
Density @ 20 °C	++	++	++	++
Distillation, IBP	++	++	++	++
Distillation, 50%	++	++	++	--
Distillation, DP	++	++	++	++
Purity	++	--	++	++
Nonaromatics	++	++	++	++
Benzene	-- *)	-- *)	- *)	-- *)
Styrene	n.e.	++ *)	+ *)	+/- *)

table 9: comparison determinations on Toluene against the standard
*) against the strict Horwitz equation

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

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

APPENDIX 1

Determination of Acid Wash Color on Benzene sample #12051

lab	method	value	mark	z(targ)	remarks
52	D848	0		----	
150	D848	-1		----	
158	D848	1-		----	
171	D848	1-		----	
174	D848	1-		----	
311	D848	0+		----	
323	D848	1-		----	
329	D848	1-		----	
333		----		----	
334		----		----	
444		----		----	
497	D848	1-		----	
551		----		----	
555		----		----	
663	D848	0+		----	
823	D848	1-		----	
855	D848	1-		----	
862	D848	1-		----	
864	D848	1-		----	
865	D848	1-		----	
866	D848	1-		----	
868	D848	1-		----	
870	D848	1-		----	
902	D848	0-1		----	
912	D848	1-		----	
913	D848	1		----	
963	D848	1-		----	
1040	D848	0+		----	
1067	D848	1-		----	
1081	D848	0+		----	
1117		----		----	
1172	D848	1-		----	
1252		----		----	
1263		----		----	
1264	D848	0-1		----	
1429	D848	1		----	
1434	D848	1		----	
1467		----		----	
1480		----		----	
1538	D848	1		----	
1603		----		----	
1614	D848	1		----	
1653		----		----	
1657	D848	1-		----	
1728	D848	1-		----	
1866		----		----	
9005	D848	1-		----	
9008	D848	1-		----	
	normality	n.a			
	n	34			
	outliers	0			
	mean (n)	1-			
	st.dev. (n)	n.a			
	R(calc.)	n.a			
	R(D848:09)	n.a			

Determination of Acidity on Benzene sample #12051; results in mg NaOH per 100mL

lab	method	value	mark	z(targ)	remarks
52	D847	nil		----	
150	D847	<0.1		----	
158	D847	NFA		----	
171	D847	neutral		----	
174	D847	NFA		----	
311	D847	NFA		----	
323	D847	NFA		----	
329	D847	NFA		----	
333		----		----	
334		----		----	
444		----		----	
497	D847	NFA		----	
551		----		----	
555		----		----	
663	D847	NFA		----	
823	D847	NFA		----	
855	D847	NFA		----	
862	D847	NFA		----	
864	D847	NFA		----	
865	D847	NFA		----	
866	D847	NFA		----	
868	D847	NFA		----	
870	D847	NFA		----	
902	D847	NFA		----	
912	D847	NFA		----	
913	D847	nil		----	
963	D847	NFA		----	
1040		----		----	
1067		----		----	
1081	D847	0		----	
1117	D847	0.2		----	
1172		----		----	
1252		----		----	
1263		----		----	
1264	D847	NFA		----	
1429	D847	6.742		----	
1434	D847	nil		----	
1467		----		----	
1480		----		----	
1538	D847	NFA		----	
1603		----		----	
1614	D847	nil		----	
1653		----		----	
1657		NFA		----	
1728	D847	absent		----	
1866	D847	NFA		----	
9005	D847	NFA		----	
9008	D847	NFA		----	
	normality	n.a			
	n	33			
	outliers	0			
	mean (n)	NFA			
	st.dev. (n)	n.a			
	R(calc.)	n.a			
	R(D847:08)	n.a			

Abbreviation

NFA =No Free Acid

Determination of Appearance on Benzene sample #12051

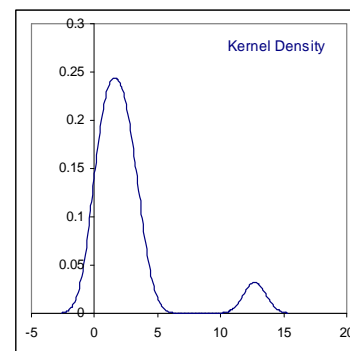
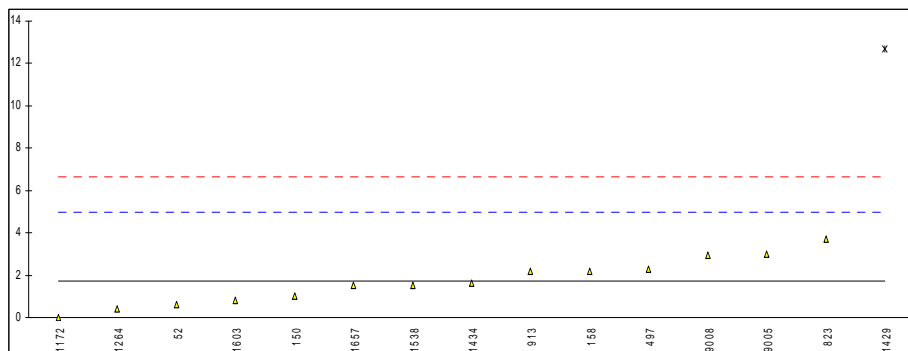
lab	method	value	mark	z(targ)	remarks
52	Visual	pass		----	
150	Visual	C&B		----	
158		C&F		----	
171	Visual	C&B		----	
174	E2680	pass		----	
311		C&B		----	
323	INH-001	CFMS		----	
329	INH-001	CFMS		----	
333		----		----	
334		----		----	
444	E2680	pass		----	
497		C&B		----	
551		----		----	
555		----		----	
663	E2680	pass		----	
823	E2680	pass		----	
855	E2680	pass		----	
862		----		----	
864	E2680	pass		----	
865	E2680	pass		----	
866	E2680	pass		----	
868	E2680	pass		----	
870	E2680	pass		----	
902	E2680	C&B		----	
912	Visual	CFSM		----	
913	E2680	CFSM		----	
963	E2680	pass		----	
1040	D4176	C&B		----	
1067		pass		----	
1081	in house	C&B		----	
1117	D4176	CFMS		----	
1172		----		----	
1252		----		----	
1263		----		----	
1264		clear		----	
1429	Visual	C&B FFVI		----	
1434		clear		----	
1467		----		----	
1480		----		----	
1538	Visual	C&B		----	
1603	in house	CFP		----	
1614	E2680	CLFSH		----	
1653		----		----	
1657		----		----	
1728	Visual	clear		----	
1866	in house	clear		----	
9005		clear		----	
9008	D4176	clear		----	
	normality	n.a			
	n	36			
	outliers	n.a			
	mean (n)	pass			
	st.dev. (n)	n.a			
	R(calc.)	n.a			
	R(E2680:09e1)	n.a			

Abbreviations:

C	= clear
B&C	= bright and clear
C&F	= clear and free
CFSM	= clear and free from suspended matter
CLFSH	= clear liquid free of sediment and haze
FFVI	= free from visible impurities

Determination of Bromine Index on Benzene sample #12051; results in mg Br/100g

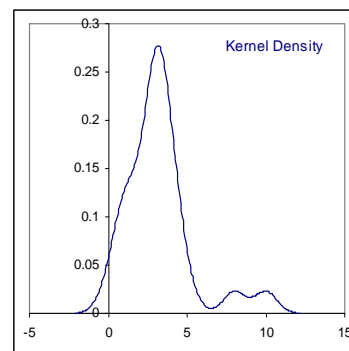
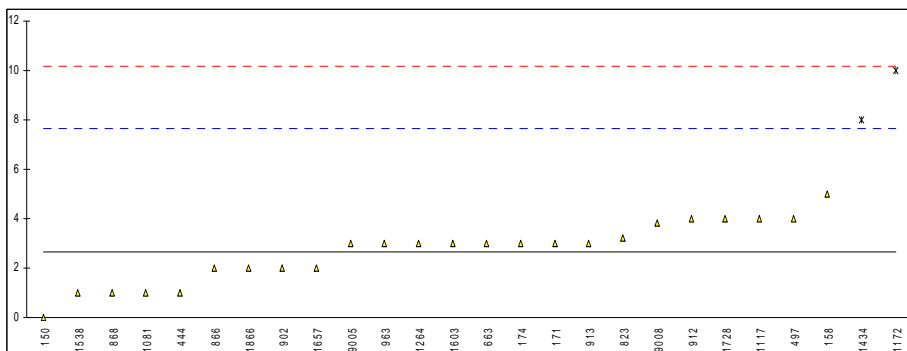
lab	method	value	mark	z(targ)	remarks
52	D1492	0.6		-0.67	
150	D1492	1		-0.43	
158	D5776	2.2		0.30	
171	D5776	<0.5		----	
174		----		----	
311	D5776	<0.5		----	
323	D5776	<1		----	
329	D5776	<1		----	
333		----		----	
334		----		----	
444	D5776	<0.5		----	
497	D5776	2.3		0.37	
551		----		----	
555		----		----	
663		----		----	
823	D1492	3.7		1.22	
855	D5776	<0.5		----	
862	D5776	<0.5		----	
864	D5776	<0.5		----	
865	D5776	<5		----	
866	D5776	<0.5		----	
868	D5776	<0.5		----	
870	D5776	<0.5		----	
902		----		----	
912		----		----	
913	D5776	2.2		0.30	
963		----		----	
1040		----		----	
1067		----		----	
1081	D1492	<1		----	
1117	D1492	<2		----	
1172	D1492	0		-1.03	
1252		----		----	
1263		----		----	
1264	D5776	0.41		-0.79	
1429	D2710	12.7	G(0.01)	6.70	
1434	D5776	1.61		-0.05	
1467		----		----	
1480		----		----	
1538	D1492	1.53		-0.10	
1603	in house	0.8		-0.55	
1614	D1492	<1		----	
1653		----		----	
1657	D1492	1.5		-0.12	
1728		----		----	
1866		----		----	
9005	D1492	3.0		0.79	
9008	D1492	2.95		0.76	
	normality	OK			
	n	14			
	outliers	1			
	mean (n)	1.70			
	st.dev. (n)	1.083			
	R(calc.)	3.03			
	R(D5776:07e1)	4.60			



Determination of Color Pt-Co on Benzene sample #12051

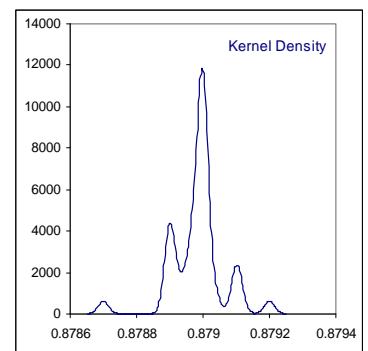
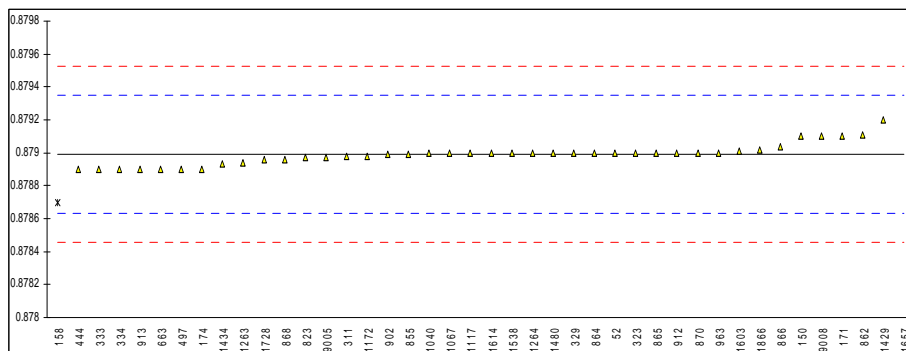
lab	method	value	mark	z(targ)	remarks
52	D1209	<5		----	
150	D1209	0		-1.07	
158	D1209	5		0.93	
171	D1209	3		0.13	
174	D1209	3		0.13	
311	D1209	<5		----	
323	D1209	<5		----	
329	D1209	<5		----	
333		----		----	
334		----		----	
444	D5386	1		-0.67	
497	D1209	4		0.53	
551		----		----	
555		----		----	
663	D1209	3		0.13	
823	D5386	3.2		0.21	
855	D1209	<5		----	
862	D1209	<5		----	
864	D1209	<5		----	
865	D1209	<5		----	
866	D1209	2		-0.27	
868	D1209	1		-0.67	
870	D1209	<5		----	
902	D5386	2		-0.27	
912	D5386	4		0.53	
913	D5386	3		0.13	
963	D1209	3		0.13	
1040	ISO6271	<5		----	
1067	D1209	<5		----	
1081	D5386	1		-0.67	
1117	D1209	4		0.53	
1172	D1209	10	G(0.01)	2.93	
1252		----		----	
1263		----		----	
1264	D1209	3		0.13	
1429	D1209	<5		----	
1434	D1209	8	G(0.05)	2.13	
1467		----		----	
1480		----		----	
1538	D1209	1		-0.67	
1603	in house	3		0.13	
1614	D1209	<10		----	
1653		----		----	
1657	D1209	2		-0.27	
1728	D1209	4		0.53	
1866	D1209	2		-0.27	
9005	D5386	3		0.13	
9008	D5386	3.81		0.46	

normality not OK
n 24
outliers 2
mean (n) 2.67
st.dev. (n) 1.234
R(calc.) 3.46
R(D1209:05e1) 7.00



Determination of Density @ 20°C on Benzene sample #12051; results in kg/L

lab	method	value	mark	z(targ)	remarks
52	D4052	0.8790		0.05	
150	D4052	0.8791		0.61	
158	D4052	0.8787	G(0.01)	-1.63	
171	D4052	0.8791		0.61	
174	D4052	0.8789		-0.51	
311	D4052	0.87898		-0.06	
323	D4052	0.8790		0.05	
329	D4052	0.8790		0.05	
333	D4052	0.8789		-0.51	
334	D4052	0.8789		-0.51	
444	D4052	0.87890		-0.51	
497	D4052	0.8789		-0.51	
551		----		----	
555		----		----	
663	D4052	0.8789		-0.51	
823	D4052	0.87897		-0.12	
855	D4052	0.87899		-0.01	
862	D4052	0.87911		0.67	
864	D4052	0.8790		0.05	
865	D4052	0.87900		0.05	
866	D4052	0.87904		0.27	
868	D4052	0.87896		-0.17	
870	D4052	0.8790		0.05	
902	D4052	0.87899		-0.01	
912	D4052	0.8790		0.05	
913	D4052	0.8789		-0.51	
963	D4052	0.8790		0.05	
1040	D4052	0.8790		0.05	
1067	D4052	0.8790		0.05	
1081		----		----	
1117	D4052	0.8790		0.05	
1172	D4052	0.87898		-0.06	
1252		----		----	
1263	ISO12185	0.87894		-0.29	
1264	D4052	0.8790		0.05	
1429	D4052	0.8792		1.17	
1434	D4052	0.87893		-0.34	
1467		----		----	
1480	D4052	0.879		0.05	
1538	D4052	0.8790		0.05	
1603	in house	0.87901		0.11	
1614	D4052	0.8790		0.05	
1653		----		----	
1657	D4052	0.8827	G(0.01)	20.77	
1728	D4052	0.87896		-0.17	
1866	D4052	0.87902		0.16	
9005	D4052	0.87897		-0.12	
9008	D4052	0.8791		0.61	
	normality	not OK			
	n	40			
	outliers	1			
	mean (n)	0.87899			
	st.dev. (n)	0.000065			
	R(calc.)	0.00018			
	R(D4052:11)	0.00050			

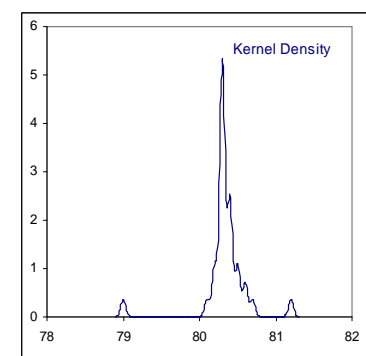
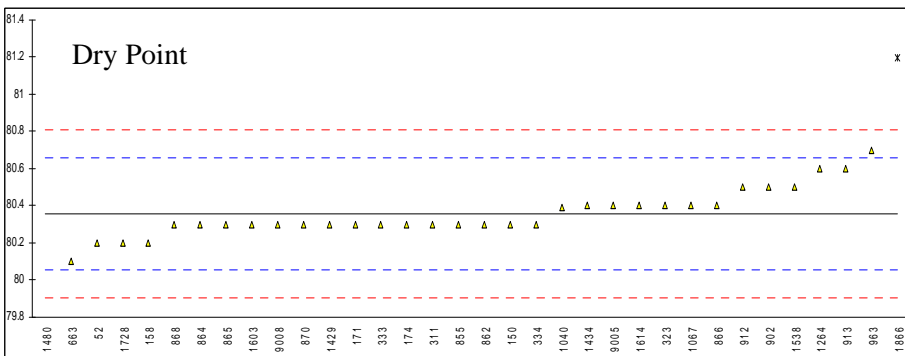
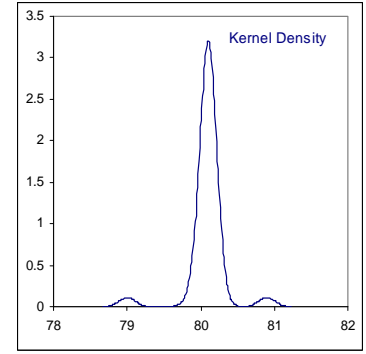
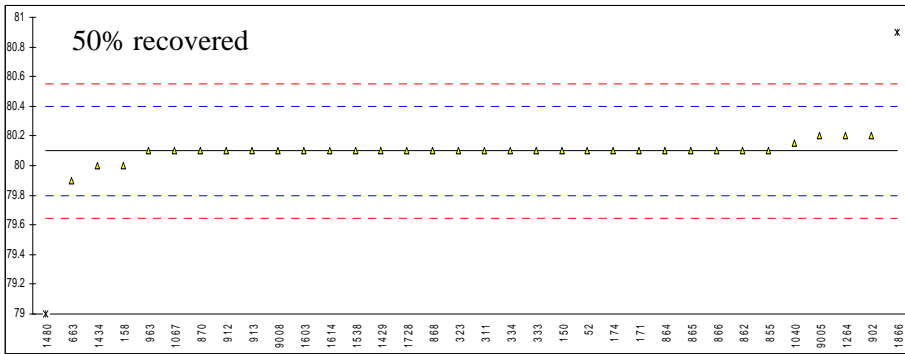
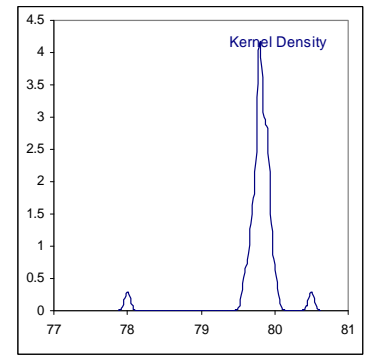
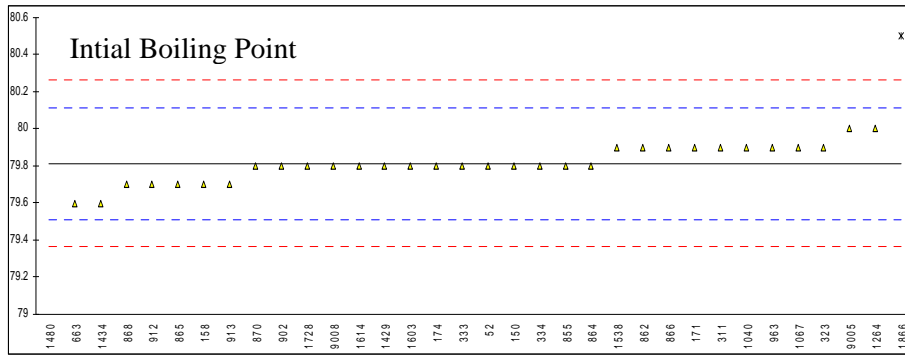


Determination of Distillation (automated +manual) on Benzene sample #12051; results in °C

Lab	method	IBP	Mark	z(targ)	50%	mark	z(targ)	DP	mark	z(targ)	remarks
52	D850-A	79.8		-0.04	80.1		0.05	80.2		-1.01	
150	D850-A	79.8		-0.04	80.1		0.05	80.3		-0.34	
158	D850-A	79.7		-0.71	80.0		-0.62	80.2		-1.01	
171	D850-A	79.9		0.63	80.1		0.05	80.3		-0.34	
174	D850-A	79.8	fr 79.4	-0.04	80.1		0.05	80.3		-0.34	
311	D850-M	79.9		0.63	80.1		0.05	80.3		-0.34	
323	D850-M	79.9		0.63	80.1		0.05	80.4		0.33	
329		----		----			----			----	
333	D850-A	79.8		-0.04	80.1		0.05	80.3		-0.34	
334	D850-A	79.8		-0.04	80.1		0.05	80.3		-0.34	
444		----		----			----			----	
497		----		----			----			----	
551		----		----			----			----	
555		----		----			----			----	
663	D850-A	79.6		-1.37	79.9		-1.28	80.1		-1.67	
823		----		----			----			----	
855	D850-M	79.8		-0.04	80.1		0.05	80.3		-0.34	
862	D850-M	79.9		0.63	80.1		0.05	80.3		-0.34	
864	D850-M	79.8		-0.04	80.1		0.05	80.3		-0.34	
865	D850-M	79.7		-0.71	80.1		0.05	80.3		-0.34	
866	D850-M	79.9		0.63	80.1		0.05	80.4		0.33	
868	D850-M	79.7		-0.71	80.1		0.05	80.3		-0.34	
870	D850-M	79.8		-0.04	80.1		0.05	80.3		-0.34	
902	D850-M	79.8		-0.04	80.2		0.72	80.5		0.99	
912	D850-M	79.7		-0.71	80.1		0.05	80.5		0.99	
913	D850-M	79.7		-0.71	80.1		0.05	80.6		1.66	
963	D850-M	79.9		0.63	80.1		0.05	80.7		2.33	
1040	DIN51761-M	79.90		0.63	80.15		0.38	80.39		0.26	
1067	D850-M	79.9		0.63	80.1		0.05	80.4		0.33	
1081		----		----			----			----	
1117		----		----			----			----	
1172		----		----			----			----	
1252		----		----			----			----	
1263		----		----			----			----	
1264	D850-A	80.0		1.29	80.2		0.72	80.6		1.66	
1429	D850-A	79.8		-0.04	80.1		0.05	80.3		-0.34	
1434	D850-A	79.6		-1.37	80.0		-0.62	80.4		0.33	
1467		----		----			----			----	
1480	D850-M	78	G(0.01)	-12.04	79	G(0.01)	-7.28	79	G(0.01)	-9.01	
1538	D850-A	79.9		0.63	80.1		0.05	80.5		0.99	
1603	in house-A	79.8		-0.04	80.1		0.05	80.3		-0.34	
1614	D850-A	79.8		-0.04	80.1		0.05	80.4		0.33	
1653		----		----			----			----	
1657	D850	79.6		-1.37	79.9		-1.28	80.2		-1.01	
1728	D850-M	79.8		-0.04	80.1		0.05	80.2		-1.01	
1866	D850-M	80.5	G(0.01)	4.63	80.9	G(0.01)	5.38	81.2	G(0.01)	5.66	
9005	D850-A	80		1.29	80.2		0.72	80.4		0.33	
9008	D850-A	79.8		-0.04	80.1		0.05	80.3		-0.34	
	normality	not OK			not OK			not OK			
	n	33			33			33			
	outliers	2			2			2			
	mean (n)	79.81			80.09			80.35			
	st.dev. (n)	0.103			0.064			0.13			
	R(calc.)	0.29			0.18			0.36			
	R(D850:11-M)	0.42			0.42			0.42			

After manual correction:

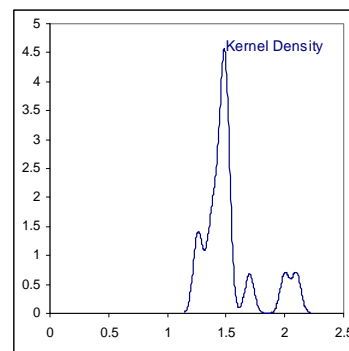
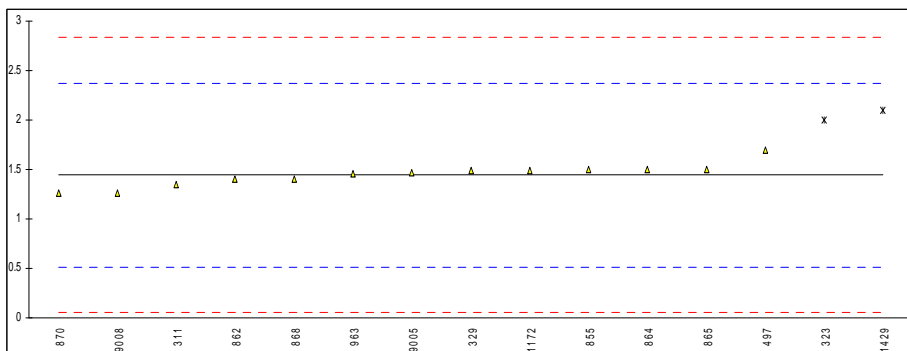
663	D850-A	79.8		-0.10	80.1		0.00	80.3		-0.37	
1480	D850-M	79.1		-4.77	80.1		0.00	80.1		-1.70	
1657	D850	79.8		-0.10	80.1		0.00	80.4		0.30	
1866	D850-M	79.7		-0.77	80.1		0.00	80.4		0.30	
	normality	not OK			not OK			not OK			
	n	34			35			35			
	outliers	1			0			0			
	mean (n)	79.82			80.10			80.36			
	st.dev. (n)	0.091			0.040			0.123			
	R(calc.)	0.25			0.11			0.35			
	R(D850:11-M)	0.42			0.42			0.42			



Determination of Organic Chloride on Benzene sample #12051; results in mg/kg

lab	method	value	mark	z(targ)	remarks
52	D5194	<1		<-0.89	false negative?
150		----		----	
158		----		----	
171	D5808	<1		<-0.89	false negative?
174		----		----	
311	D5808	1.35		-0.20	
323	D5808	2	DG(0.01)	1.20	
329	D5808	1.49	C	0.10	first reported: 1
333		----		----	
334		----		----	
444	IP510	<2	C	----	reported under total chloride
497	D5808	1.7		0.55	
551		----		----	
555		----		----	
663		----		----	
823		----		----	
855	D5808	1.5		0.12	
862	D5808	1.4		-0.10	
864	D5808	1.5		0.12	
865	D5808	1.5		0.12	
866		----		----	
868	D5808	1.4		-0.10	
870	D5808	1.26		-0.40	
902		----		----	
912		----		----	
913		----		----	
963	D5808	1.46		0.03	
1040		----		----	
1067		----		----	
1081		----		----	
1117		----		----	
1172	D5808	1.49		0.10	
1252		----		----	
1263		----		----	
1264		----		----	
1429	D5808	2.1	DG(0.01)	1.41	
1434		----		----	
1467		----		----	
1480		----		----	
1538		----		----	
1603		----		----	
1614		----		----	
1653		----		----	
1657		----		----	
1728		----		----	
1866		----		----	
9005	D5808	1.47		0.05	
9008	D5808	1.26		-0.40	

normality not OK
n 13
outliers 2 Spike:
mean (n) 1.44 1.60 recovery: <90%
st.dev. (n) 0.116
R(calc.) 0.32
R(D5808:09a) 1.30

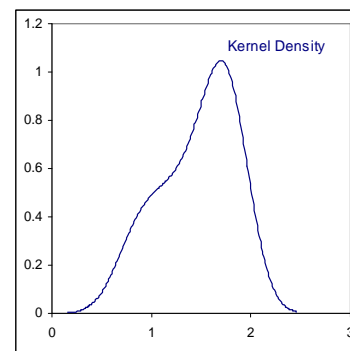
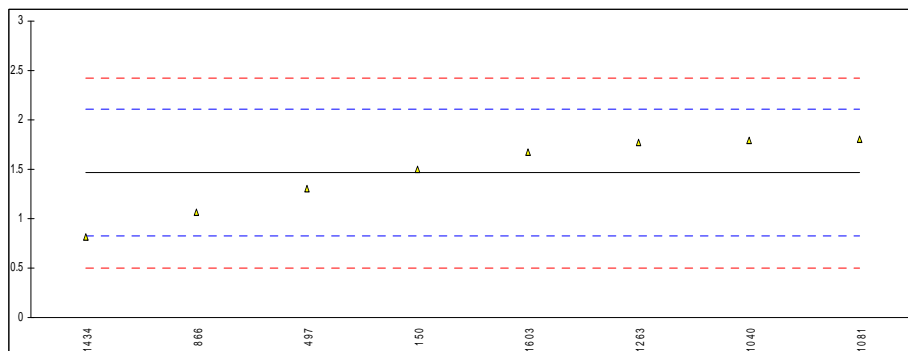


Determination of Total Chloride on Benzene sample #12051; results in mg/kg

lab	method	value	mark	z(targ)	remarks
52	D5194	<1		<-1.28	false negative?
150	D7359	1.5		0.11	
158		----		----	
171	D5194	<1		<-1.28	false negative?
174		----		----	
311		----		----	
323		----		----	
329		----		----	
333		----		----	
334		----		----	
444		----		----	See organic chloride
497	D5194	1.3		-0.51	
551		----		----	
555		----		----	
663		----		----	
823		----		----	
855		----		----	
862		----		----	
864		----		----	
865		----		----	
866	D5194	1.06		-1.26	
868		----		----	
870		----		----	
902		----		----	
912		----		----	
913		----		----	
963		----		----	
1040	EN14077	1.795		1.03	
1067		----		----	
1081	D5808	1.8		1.05	
1117		----		----	
1172		----		----	
1252		----		----	
1263	ISO12937	1.767		0.94	
1264		----		----	
1429		----		----	
1434	D7536	0.82		-2.00	
1467		----		----	
1480		----		----	
1538		----		----	
1603	in house	1.67		0.64	
1614		----		----	
1653		----		----	
1657		----		----	
1728		----		----	
1866		----		----	
9005		----		----	
9008		----		----	

normality OK
n 8
outliers 0
mean (n) 1.46
st.dev. (n) 0.371
R(calc.) 1.04
R(D5194:11) 0.90

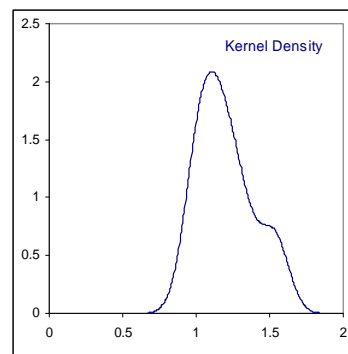
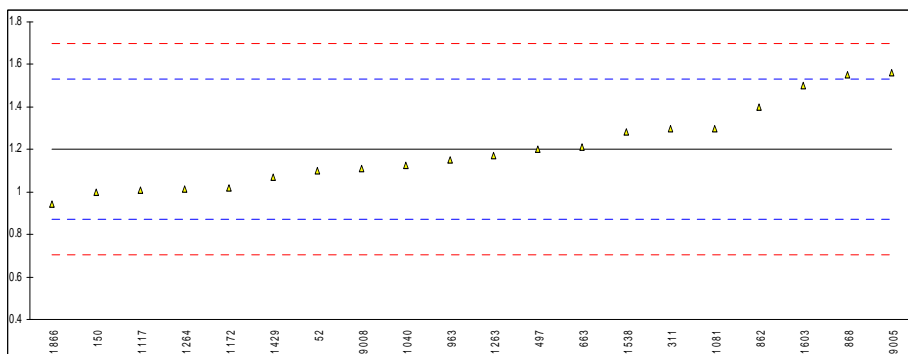
Spike:
1.60 recovery: <90%



Determination of Total Nitrogen on Benzene sample #12051; results in mg/kg

lab	method	value	mark	z(targ)	remarks
52	D6069	1.1		-0.61	
150	D6069	1.0		-1.21	
158		-----		-----	
171	D6069	<1		-----	
174		-----		-----	
311	D6069	1.3		0.60	
323	D6069	<1		-----	
329		-----		-----	
333		-----		-----	
334		-----		-----	
444		-----		-----	
497	D6069	1.2	C	0.00	first reported: 1.9
551		-----		-----	
555		-----		-----	
663	D6069	1.21		0.06	
823		-----		-----	
855		-----		-----	
862	D6069	1.4		1.20	
864		-----		-----	
865		-----		-----	
866		-----		-----	
868	D6069	1.55		2.11	
870		-----		-----	
902		-----		-----	
912		-----		-----	
913		-----		-----	
963	D6069	1.15		-0.31	
1040	D4629	1.127		-0.44	
1067		-----		-----	
1081	D6069	1.3		0.60	
1117	D6069	1.01		-1.15	
1172	D6069	1.02		-1.09	
1252		-----		-----	
1263	D4629	1.169		-0.19	
1264	D6069	1.015		-1.12	
1429	D4629	1.07		-0.79	
1434		-----		-----	
1467		-----		-----	
1480		-----		-----	
1538	D6069	1.281		0.48	
1603	in house	1.50		1.81	
1614		-----		-----	
1653		-----		-----	
1657		-----		-----	
1728		-----		-----	
1866	D6069	0.941		-1.57	
9005	D6069	1.56		2.17	
9008	D6069	1.11		-0.55	

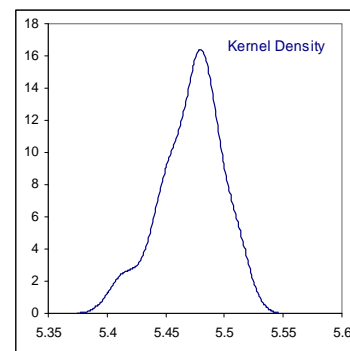
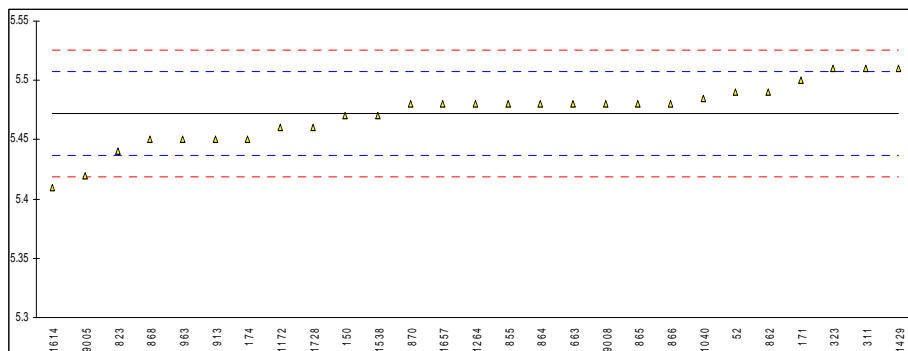
normality OK
n 20
outliers 0 Spike:
mean (n) 1.200 1.10 recovery: <109%
st.dev. (n) 0.1867
R(calc.) 0.523
R(D6069:06) 0.464



Determination of Solidification Point (anhydrous) on Benzene sample #12051; results in °C

lab	method	value	mark	z(targ)	remarks
52	D852	5.49		1.01	
150	D852	5.47		-0.11	
158		----		----	
171	D852	5.50		1.57	
174	D852	5.45		-1.23	
311	D852	5.51		2.13	
323	D852	5.51		2.13	
329		----		----	
333		----		----	
334		----		----	
444		----		----	
497		----		----	
551		----		----	
555		----		----	
663	D852	5.48		0.45	
823	D852	5.44		-1.79	
855	D852	5.48		0.45	
862	D852	5.49		1.01	
864	D852	5.48		0.45	
865	D852	5.48		0.45	
866	D852	5.48		0.45	
868	D852	5.45		-1.23	
870	D852	5.48		0.45	
902		----		----	
912		----		----	
913	D852	5.45		-1.23	
963	D852	5.45		-1.23	
1040	DIN51798	5.485		0.73	
1067		----		----	
1081		----		----	
1117		----		----	
1172	D852	5.46		-0.67	
1252		----		----	
1263		----		----	
1264	D852	5.48		0.45	
1429	D852	5.51		2.13	
1434		----		----	
1467		----		----	
1480		----		----	
1538	D852	5.47		-0.11	
1603		----		----	
1614	D852	5.41		-3.47	
1653		----		----	
1657	D852	5.48		0.45	
1728	D852	5.46		-0.67	
1866		----		----	
9005	D852	5.42		-2.91	
9008	D852	5.48	C	0.45	first reported: 5.53

normality not OK
n 27
outliers 0
mean (n) 5.472
st.dev. (n) 0.0250
R(calc.) 0.070
R(D852:08) 0.050

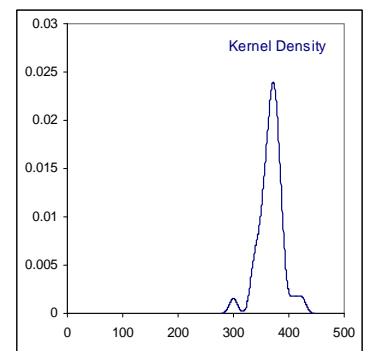
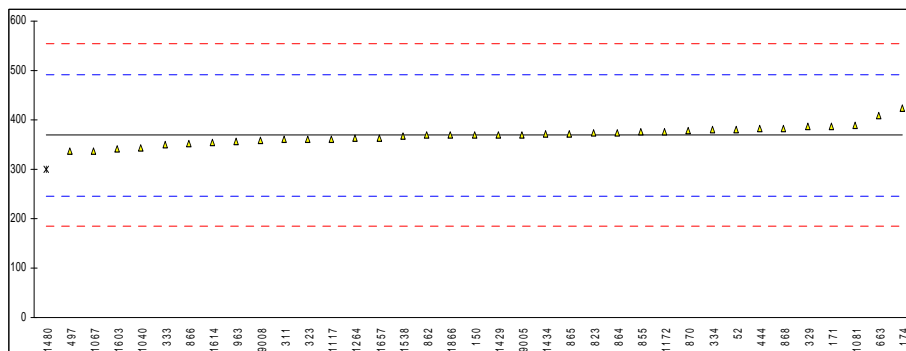


Determination of Methylcyclohexane on Benzene sample #12051 in mg/kg

lab	method	value	mark	z(targ)	remarks
52	D5713	<10		----	
150		----		----	
158		----		----	
171		<10		----	
174	D4492	<10		----	
311		2		----	
323	D4492	<10		----	
329	D4492	<20		----	
333		----		----	
334		----		----	
444	D5713	<1		----	
497		<10		----	
551		----		----	
555		----		----	
663		----		----	
823		----		----	
855		<10		----	
862	D4492	<10		----	
864	D4492	<10		----	
865	D4492	<10		----	
866		----		----	
868	D4492	<10		----	
870	D4492	<10		----	
902		----		----	
912		----		----	
913		----		----	
963	D4492Mod.	<10		----	
1040	D4492	0.2		----	
1067	in house	<5		----	
1081	D4492	<1		----	
1117	D4492	<10		----	
1172		----		----	
1252		----		----	
1263		----		----	
1264		----		----	
1429	D4492	<10		----	
1434		0		----	
1467		----		----	
1480		----		----	
1538		----		----	
1603	in house	<5		----	
1614	D4492	<10		----	
1653		----		----	
1657		----		----	
1728		----		----	
1866	D4492	1.1		----	
9005		----		----	
9008	D5135	n.d		----	
	normality	n.a			
	n	25			
	outliers	0			
	mean (n)	<10			
	st.dev. (n)	n.a			
	R(calc.)	n.a			
	R(lit)	n.a			

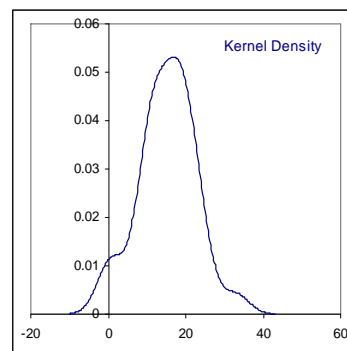
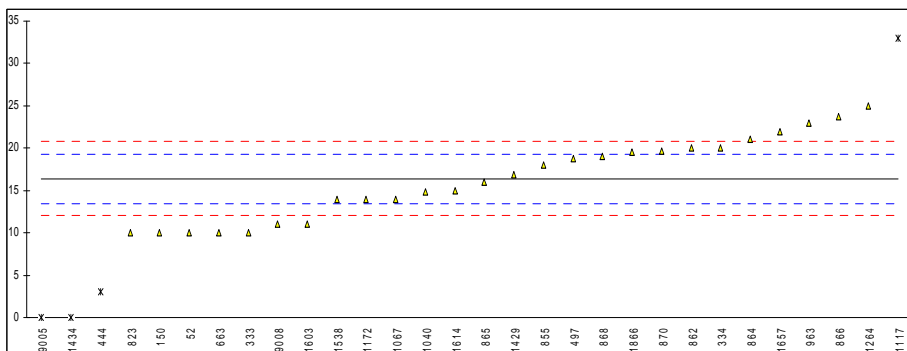
Determination of Toluene on Benzene sample #12051; results in mg/kg

lab	method	value	mark	z(targ)	remarks
52	D4492	380		0.17	
150	D4492	370		0.01	
158		-----		-----	
171	D4492	388		0.30	
174	D4492	424		0.89	
311	D4492	360		-0.15	
323	D4492	360		-0.15	
329	D4492	387		0.29	
333	D4492	350		-0.32	
334	D4492	380		0.17	
444	D4492	382		0.21	
497	D4492	336		-0.54	
551		-----		-----	
555		-----		-----	
663	D4492	409		0.64	
823	D4492	373		0.06	
855	D4492	376		0.11	
862	D4492	369		-0.01	
864	D4492	375		0.09	
865	D4492	372		0.04	
866	D4492	351.5		-0.29	
868	D4492	383		0.22	
870	D4492	378		0.14	
902		-----		-----	
912		-----		-----	
913		-----		-----	
963	D4492	357		-0.20	
1040	D4492	343.9		-0.42	
1067	in house	336		-0.54	
1081	D4492	390		0.34	
1117	D4492	361		-0.14	
1172	INH-2435	376		0.11	
1252		-----		-----	
1263		-----		-----	
1264	D4492	363		-0.10	
1429	D4492	370.4		0.02	
1434	D4492	371.1		0.03	
1467		-----		-----	
1480	D4492	300	G(0.05)	-1.13	
1538	D4492	367		-0.04	
1603	in house	342		-0.45	
1614	D4492	355		-0.23	
1653		-----		-----	
1657	D4492	363		-0.10	
1728		-----		-----	
1866	D4492	369.8		0.01	
9005	D4492	370.5		0.02	
9008	D4492	359		-0.17	
	normality	OK			
	n	36			
	outliers	1			
	mean (n)	369.39			
	st.dev. (n)	18.165			
	R(calc.)	50.86			
	R(D4492:10)	171.96			



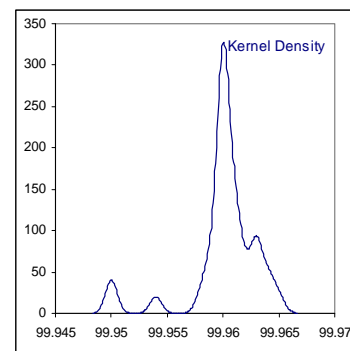
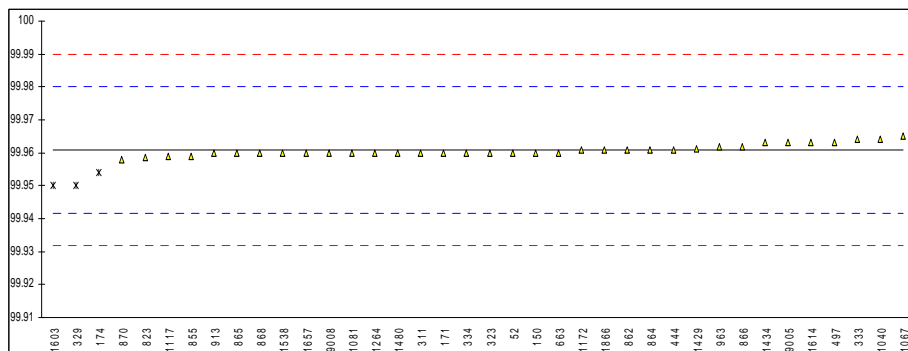
Determination of Nonaromatics on Benzene sample #12051; results in mg/kg

lab	method	value	mark	z(targ)	remarks
52	D4492	10		-4.38	
150	D4492	10		-4.38	
158		-----		-----	
171	D4492	<10		-----	
174	D4492	<10		-----	
311	D4492	<10		-----	
323	D4492	<50		-----	
329	D4492	<50		-----	
333	D4492	10		-4.38	
334	D4492	20		2.46	
444	D4492	3	DG(0.05)	-9.16	
497	D4492	18.8		1.64	
551		-----		-----	
555		-----		-----	
663	D4492	10		-4.38	
823	D4492	10	C	-4.38	first reported:27
855	D4492	18		1.09	
862	D4492	20		2.46	
864	D4492	21.1		3.21	
865	D4492	16		-0.27	
866	D4492	23.7		4.99	
868	D4492	19		1.78	
870	D4492	19.6		2.19	
902		-----		-----	
912		-----		-----	
913		-----		-----	
963	D4492	23		4.51	
1040	D4492	14.8		-1.09	
1067	in house	14		-1.64	
1081	D4492	<10		-----	
1117	D4492	33	DG(0.05)	11.35	
1172	INH-2435	14		-1.64	
1252		-----		-----	
1263		-----		-----	
1264	D4492	25		5.88	
1429	D4492	16.9		0.34	
1434	D4492	0	ex	-11.22	excluded, zero is not a real value
1467		-----		-----	
1480		-----		-----	
1538	D4492	14		-1.64	
1603	in house	11		-3.69	
1614	D4492	15		-0.96	
1653		-----		-----	
1657	D4492	22		3.83	
1728		-----		-----	
1866	D4492	19.5		2.12	
9005	D4492	0	ex	-11.22	excluded, zero is not a real value
9008	D4492	11		-3.69	
normality		OK			
n		26			
outliers		2			
mean (n)		16.40			
st.dev. (n)		4.777			
R(calc.)		13.37			
R(D4492:10)		4.09			



Determination of Purity on Benzene sample #12051; results in %M/M

lab	method	value	mark	z(targ)	remarks
52	D4492	99.96		-0.09	
150	D4492	99.96		-0.09	
158		-----		-----	
171	D4492	99.960		-0.09	
174	D4492	99.954	G(0.01)	-0.71	
311	D4492	99.96		-0.09	
323	D4492	99.96		-0.09	
329	D4492	99.95	G(0.01)	-1.12	
333	D4492	99.964		0.33	
334	D4492	99.96		-0.09	
444	D4492	99.961		0.02	
497	D4492	99.963		0.22	
551		-----		-----	
555		-----		-----	
663	D4492	99.96		-0.09	
823	D4492	99.9587		-0.22	
855	D4492	99.959		-0.19	
862	D4492	99.961		0.02	
864	D4492	99.961		0.02	
865	D4492	99.960		-0.09	
866	D4492	99.962		0.12	
868	D4492	99.960		-0.09	
870	D4492	99.958		-0.29	
902		-----		-----	
912		-----		-----	
913	D4492	99.96		-0.09	
963	D4492	99.962		0.12	
1040	D4492	99.9641		0.34	
1067	in house	99.965		0.43	
1081	D4492	99.96		-0.09	
1117	D4492	99.959		-0.19	
1172	INH-2435	99.961		0.02	
1252		-----		-----	
1263		-----		-----	
1264	D4492	99.96		-0.09	
1429	D4492	99.9613		0.05	
1434	D4492	99.963		0.22	
1467		-----		-----	
1480	D4492	99.96		-0.09	
1538	D4492	99.96		-0.09	
1603	in house	99.95	G(0.05)	-1.12	
1614	D4492	99.963		0.22	
1653		-----		-----	
1657	D4492	99.96		-0.09	
1728		-----		-----	
1866	D4492	99.961		0.02	
9005	D4492	99.963		0.22	
9008	D4492	99.96		-0.09	
normality		not OK			
n		35			
outliers		3			
mean (n)		99.9608			
st.dev. (n)		0.00163			
R(calc.)		0.0046			
R(D4492:10)		0.0270			



Determination of Acid Wash Color on Toluene sample #12052

lab	method	value	mark	z(targ)	remarks
52	D848	0+		----	
150	D848	1-	C	----	first reported: -4
158	D848	1		----	
171	D848	1-		----	
174	D848	1-		----	
311	D848	0+		----	
323	D848	1-		----	
333	D848	<1		----	
334		----		----	
342		----		----	
396	D848	1		----	
444		----		----	
445	D848	1		----	
494	D848	2		----	
497	D848	1-		----	
551		----		----	
555		----		----	
840	D848	1		----	
855	D848	1-		----	
862	D848	1-		----	
864	D848	1-		----	
865	D848	1-		----	
866	D848	1-		----	
868	D848	1-		----	
870	D848	1-		----	
902	D848	0-1		----	
912	D848	1		----	
913	D848	1		----	
1011	D848	1-		----	
1040	D848	1-		----	
1067	D848	1-		----	
1081		----		----	
1172	D848	1-		----	
1434	D848	1		----	
1481	D848	0+		----	
1538	D848	1		----	
1603		----		----	
1614	D848	3		----	
1653		----		----	
1728	D848	1-		----	
1866		----		----	
1908	D848	1-		----	
7002		----		----	
	normality	n.a			
	n	33			
	outliers	n.a			
	mean (n)	1-			
	st.dev. (n)	n.a			
	R(calc.)	n.a			
	R(D848:09)	n.a			

Determination of Appearance on Toluene sample #12052

lab	method	value	mark	z(targ)	remarks
52	E2680	pass		----	
150	E2680	pass		----	
158		----		----	
171	E2680	C&B		----	
174	E2680	pass		----	
311	E2680	pass		----	
323	E2680	CFFMS		----	
333		----		----	
334		----		----	
342	E2680	pass		----	
396	E2680	pass		----	
444	E2680	pass		----	
445	E2680	pass		----	
494	E2680	pass		----	
497	E2680	C&B		----	
551		----		----	
555		----		----	
840	E2680	pass		----	
855	E2680	pass		----	
862		----		----	
864	E2680	pass		----	
865	E2680	pass		----	
866	E2680	pass		----	
868	E2680	pass		----	
870	E2680	pass		----	
902	E2680	C&B		----	
912	E2680	pass		----	
913	E2680	CFSM		----	
1011	E2680	C&B		----	
1040	D4176	C&B		----	
1067	E2680	pass		----	
1081		----		----	
1172		----		----	
1434	E2680	clear		----	
1481	E2680	pass		----	
1538	E2680	C&B		----	
1603	in house	CFP		----	
1614	E2680	CLFSH		----	
1653		----		----	
1728	Visual	clear		----	
1866	E2680	clear		----	
1908	Visual	C&B		----	
7002	E2680	Clear		----	
	normality	n.a			
	n	34			
	outliers	n.a			
	mean (n)	pass			
	st.dev. (n)	n.a			
	R(calc.)	n.a			
	R(E2680:09e1)	n.a			

Abbreviations:

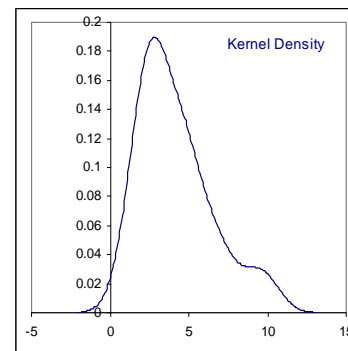
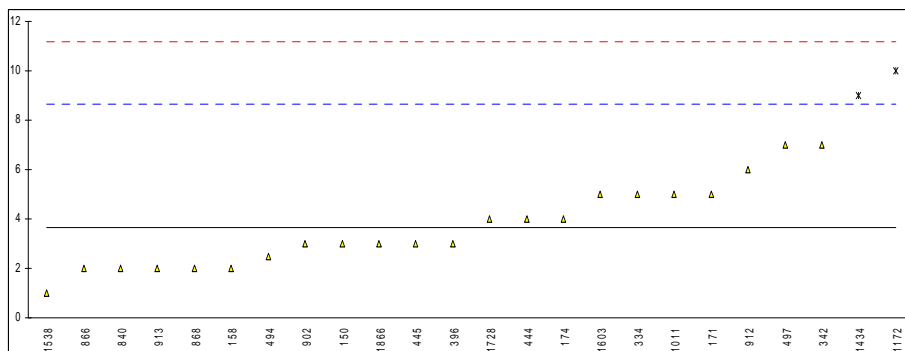
B&C	= bright and clear
C&F	= clear and free
CFP	= clear and free of particles
CFSM	= clear and free from suspended matter
CCLFFSH	= clear colourless liquid free from sediment and haze

Determination of Copper Corrosion on Toluene sample #12052

lab	method	value	mark	z(targ)	remarks
52	D849	1a		----	
150	D849	1a		----	
158	D849	1a		----	
171	D849	1a		----	
174	D849	1a		----	
311	D849	1a		----	
323	D849	1a		----	
333	D849	pass		----	
334		----		----	
342		----		----	
396		----		----	
444		----		----	
445	D849	1a		----	
494		----		----	
497	D849	1a		----	
551		----		----	
555		----		----	
840	D849	1a		----	
855	D849	1a		----	
862	D849	1a		----	
864	D849	1a		----	
865	D849	1a		----	
866	D849	1a		----	
868	D849	1a		----	
870	D849	1a		----	
902		----		----	
912	D849	1a		----	
913		----		----	
1011	D849	1a		----	
1040	ISO2160	1		----	
1067	D849	1a		----	
1081		----		----	
1172	D849	1a		----	
1434	D849	1a		----	
1481	D849	1a		----	
1538	D849	1		----	
1603	in house	1a		----	
1614	D849	pass		----	
1653		----		----	
1728	D849	pass		----	
1866		----		----	
1908	D849	1a		----	
7002		----		----	
	normality	n.a			
	n	30			
	outliers	n.a			
	mean (n)	1a			
	st.dev. (n)	n.a			
	R(calc.)	n.a			
	R(D849:11)	n.a			

Determination of Color (Pt-Co scale) on Toluene sample #12052

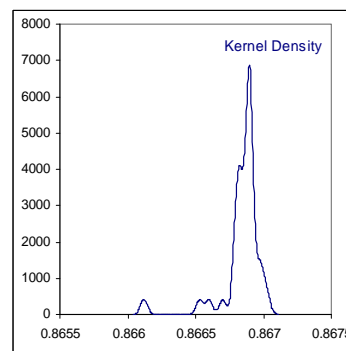
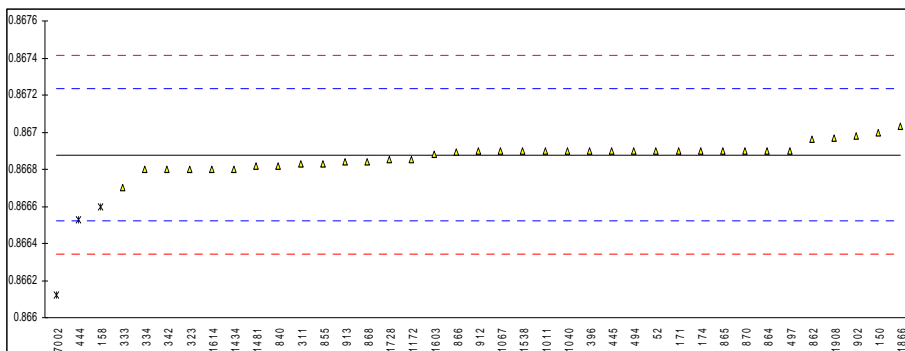
lab	method	value	mark	z(targ)	remarks
52	D1209	<5		----	
150	D1209	3		-0.26	
158	D1209	2		-0.66	
171	D1209	5		0.54	
174	D1209	4		0.14	
311	D1209	<5		----	
323	D1209	<5		----	
333		----		----	
334	D1209	5		0.54	
342	D5386	7		1.34	
396	D1209	3		-0.26	
444	D5386	4		0.14	
445	D1209	3		-0.26	
494	D1209	2.5		-0.46	
497	D1209	7		1.34	
551		----		----	
555		----		----	
840	D1209	2		-0.66	
855	D1209	<5		----	
862	D1209	<5		----	
864	D1209	<5		----	
865	D1209	<5		----	
866	D1209	2		-0.66	
868	D1209	2		-0.66	
870	D1209	<5		----	
902	D5386	3		-0.26	
912	D5386	6		0.94	
913	D5386	2		-0.66	
1011	D1209	5		0.54	
1040	ISO6271	<5		----	
1067	D1209	<5		----	
1081		----		----	
1172	D1209	10	DG(0.05)	2.54	
1434	D1209	9	DG(0.05)	2.14	
1481	D1209	<5		----	
1538	D1209	1		-1.06	
1603	in house	5		0.54	
1614	D1209	<10		----	
1653		----		----	
1728	D1209	4		0.14	
1866	D1209	3		-0.26	
1908	D1209	<5		----	
7002	D1209	<5		----	
normality		not OK			
n		22			
outliers		2			
mean (n)		3.66			
st.dev. (n)		1.686			
R(calc.)		4.72			
R(D1209:05e1)		7.00			



Determination of Density @ 20°C on Toluene sample #12052: results in kg/L

lab	method	value	mark	z(targ)	remarks
52	D4052	0.8669		0.13	
150	D4052	0.8670		0.69	
158	D4052	0.8666	G(0.01)	-1.55	
171	D4052	0.8669		0.13	
174	D4052	0.8669		0.13	
311	D4052	0.86683		-0.26	
323	D4052	0.8668		-0.43	
333	D4052	0.8667		-0.99	
334	D4052	0.8668		-0.43	
342	D4052	0.8668		-0.43	
396	D4052	0.8669		0.13	
444	D4052	0.86653	G(0.01)	-1.94	
445	D4052	0.8669		0.13	
494	D4052	0.8669		0.13	
497	D4052	0.8669	C	0.13	first reported: 0.8663
551		-----		-----	
555		-----		-----	
840	D4052	0.86682		-0.32	
855	D4052	0.86683		-0.26	
862	D4052	0.86696		0.46	
864	D4052	0.8669		0.13	
865	D4052	0.86690		0.13	
866	D4052	0.86689		0.07	
868	D4052	0.86684		-0.21	
870	D4052	0.8669		0.13	
902	D4052	0.86698		0.58	
912	D4052	0.8669		0.13	
913	D4052	0.86684		-0.21	
1011	D4052	0.8669		0.13	
1040	D4052	0.8669		0.13	
1067	D4052	0.8669		0.13	
1081		-----		-----	
1172	D4052	0.86685		-0.15	
1434	D4052	0.86680		-0.43	
1481	D4052	0.86682		-0.32	
1538	D4052	0.8669		0.13	
1603	in house	0.86688		0.02	
1614	D4052	0.8668		-0.43	
1653		-----		-----	
1728	D4052	0.86685		-0.15	
1866	D4052	0.86703		0.86	
1908	D4052	0.86697		0.52	
7002	D4052	0.86612	C, G(0.01)	-4.24	reported: 866.12, probably unit error?

normality not OK
n 36
outliers 3
mean (n) 0.86688
st.dev. (n) 0.000065
R(calc.) 0.00018
R(D4052:11) 0.00050

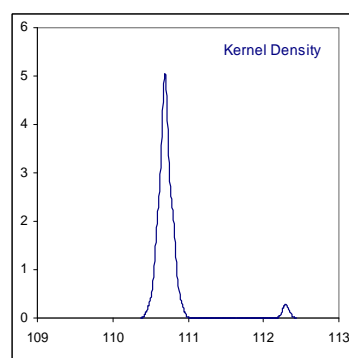
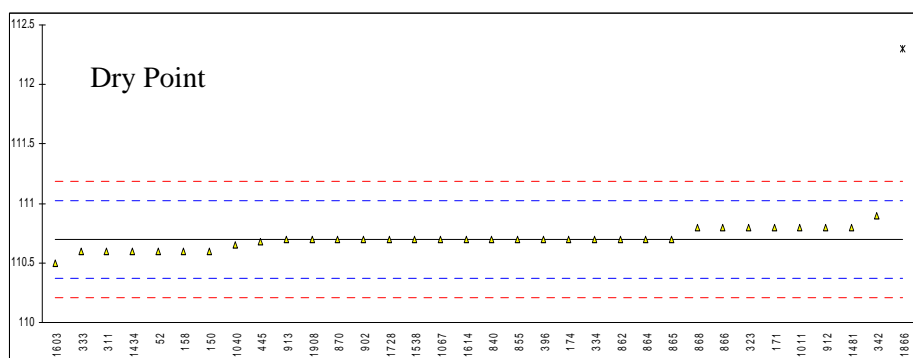
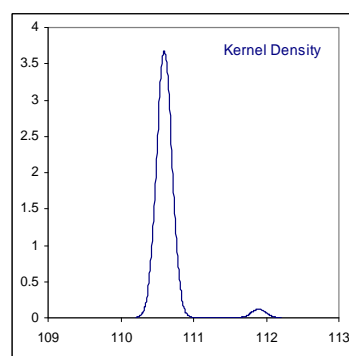
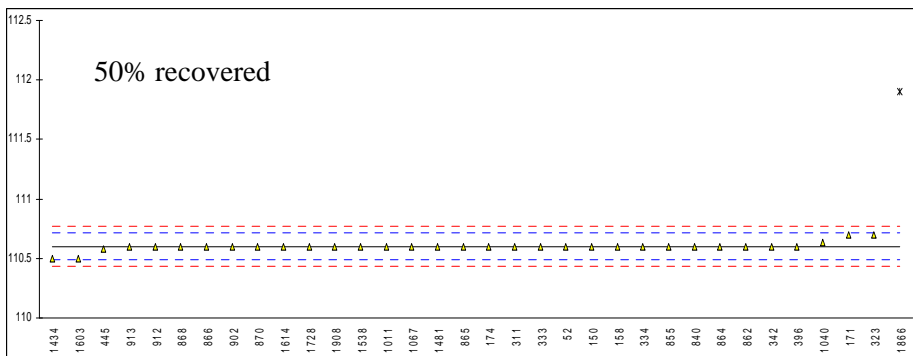
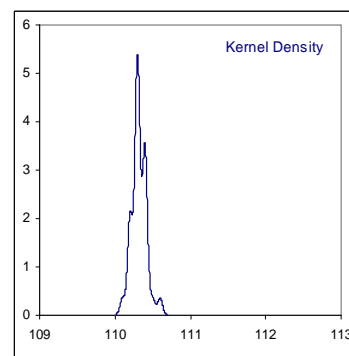
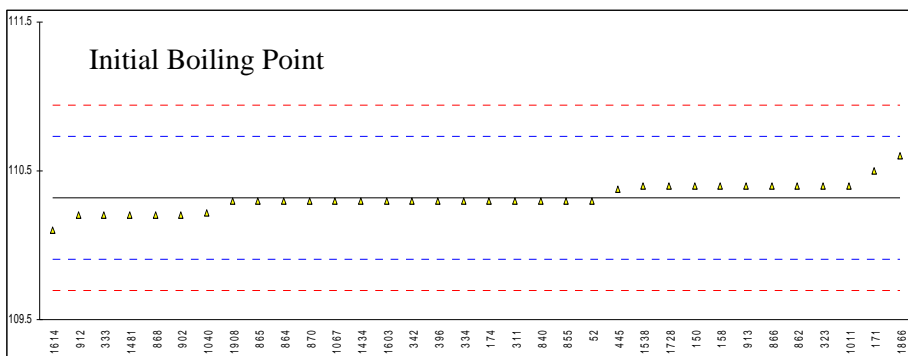


Determination of Distillation (automated and manual) on Toluene sample #12052; results in °C

lab	method	IBP	Mark	z(targ)	50%	mark	z(targ)	DP	mark	z(targ)	remarks
52	D850-A	110.3		-0.10	110.6		-0.01	110.6		-0.62	
150	D850-A	110.4		0.38	110.6		-0.01	110.6		-0.62	
158	D850-A	110.4		0.38	110.6		-0.01	110.6		-0.62	
171	D850-A	110.5		0.86	110.7		1.79	110.8		0.61	
174	D850-A	110.3		-0.10	110.6		-0.01	110.7		-0.01	
311	D850-M	110.3		-0.10	110.6		-0.01	110.6		-0.62	
323	D850-M	110.4		0.38	110.7		1.79	110.8		0.61	
333	D850-A	110.2		-0.58	110.6		-0.01	110.6		-0.62	
334	D850-A	110.3		-0.10	110.6		-0.01	110.7		-0.01	
342	D850-M	110.3		-0.10	110.6		-0.01	110.9		1.22	
396	D850-M	110.3		-0.10	110.6		-0.01	110.7		-0.01	
444		----		----	----		----	----		----	
445	D850-M	110.38		0.29	110.58		-0.36	110.68		-0.13	
494		----		----	----		----	----		----	
497		----		----	----		----	----		----	
551		----		----	----		----	----		----	
555		----		----	----		----	----		----	
840	D850-A	110.3		-0.10	110.6		-0.01	110.7		-0.01	
855	D850-M	110.3		-0.10	110.6		-0.01	110.7		-0.01	
862	D850-M	110.4		0.38	110.6		-0.01	110.7		-0.01	
864	D850-M	110.3		-0.10	110.6		-0.01	110.7		-0.01	
865	D850-A	110.3		-0.10	110.6		-0.01	110.7		-0.01	
866	D850-M	110.4		0.38	110.6		-0.01	110.8		0.61	
868	D850-M	110.2		-0.58	110.6		-0.01	110.8		0.61	
870	D850-M	110.3		-0.10	110.6		-0.01	110.7		-0.01	
902	D850-M	110.2		-0.58	110.6		-0.01	110.7		-0.01	
912	D850-M	110.2		-0.58	110.6		-0.01	110.8		0.61	
913	D850-M	110.4		0.38	110.6		-0.01	110.7		-0.01	
1011	D850-A	110.4		0.38	110.6		-0.01	110.8		0.61	
1040	DIN51761-M	110.22		-0.48	110.63		0.53	110.65		-0.31	
1067	D850-M	110.3		-0.10	110.6		-0.01	110.7		-0.01	
1081		----		----	----		----	----		----	
1172		----		----	----		----	----		----	
1434	D850-A	110.3		-0.10	110.5		-1.80	110.6		-0.62	
1481	D850-M	110.2		-0.58	110.6		-0.01	110.8		0.61	
1538	D850-A	110.4		0.38	110.6		-0.01	110.7		-0.01	
1603	in house-A	110.3		-0.10	110.5		-1.80	110.5		-1.23	
1614	D850-A	110.1		-1.06	110.6		-0.01	110.7		-0.01	
1653		----		----	----		----	----		----	
1728	D850-M	110.4		0.38	110.6		-0.01	110.7		-0.01	
1866	D850-M	110.6		1.35	111.9	G(0.01)	23.33	112.3	G(0.01)	9.82	
1908	D850-M	110.3		-0.10	110.6		-0.01	110.7		-0.01	
7002		----		----	----		----	----		----	
	normality	not OK			not OK			not OK			
	n	34			33			33			
	outliers	0			1			1			
	mean (n)	110.32			110.60			110.70			
	st.dev. (n)	0.097			0.036			0.082			
	R(calc.)	0.27			0.10			0.23			
	R(D850:11)	0.58			0.16			0.46			

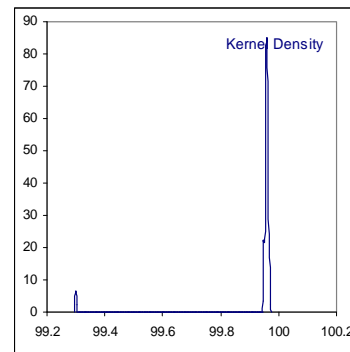
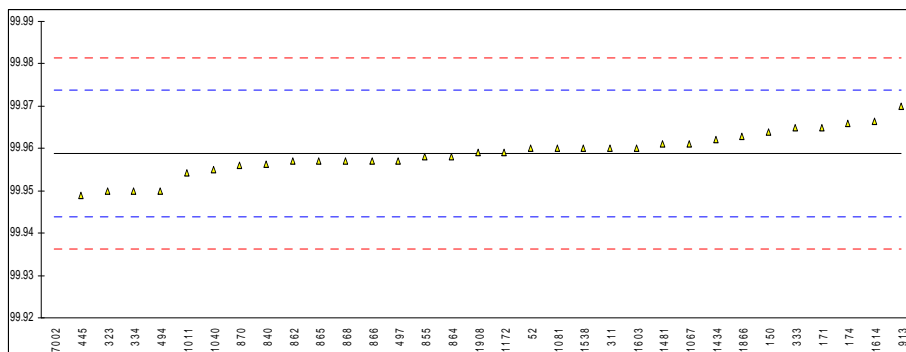
After manual correction

1866	D850-M	109.3		-4.88	110.6		0.00	111.0		1.85	
	normality	not OK			not OK			not OK			
	n	33			34			33			
	outliers	1			0			1			
	mean (n)	110.31			110.60			110.70			
	st.dev. (n)	0.084			0.035			0.082			
	R(calc.)	0.24			0.10			0.23			
	R(D850:11)	0.58			0.16			0.46			



Determination of Purity on Toluene sample #12052; results in %M/M

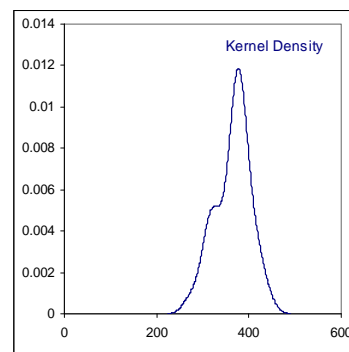
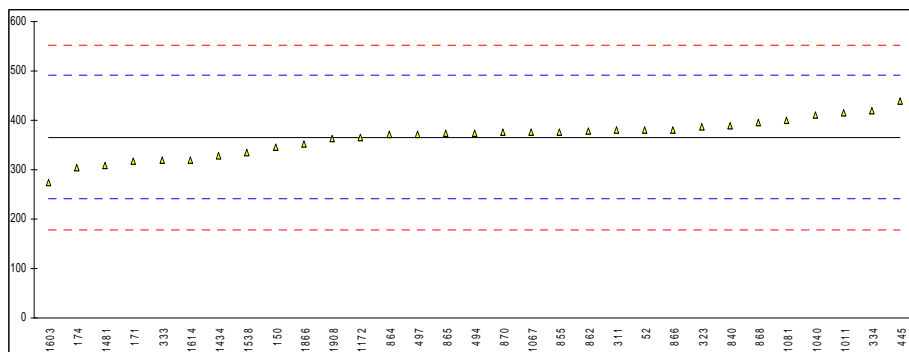
lab	method	value	mark	z(targ)	remarks
52	D7504	99.96		0.15	
150	D2360	99.964		0.69	
158		-----		-----	
171	D2360	99.965		0.82	
174	D2360	99.966		0.95	
311	D2360	99.96		0.15	
323	D2360	99.95		-1.18	
333	D2360	99.965		0.82	
334	D2360	99.95	C	-1.18	first reported: 99.94
342		-----		-----	
396		-----		-----	
444		-----		-----	
445	D6526	99.949		-1.31	
494	D6729	99.95		-1.18	
497	D2360	99.957		-0.25	
551		-----		-----	
555		-----		-----	
840	D2360	99.9562		-0.35	
855	D2360	99.958		-0.11	
862	D2360	99.957		-0.25	
864	D7504	99.958		-0.11	
865	D2360	99.957		-0.25	
866	D2360	99.957		-0.25	
868	D2360	99.957		-0.25	
870	D2360	99.956		-0.38	
902		-----		-----	
912		-----		-----	
913	D2360	99.97		1.49	
1011	D2360	99.9542		-0.62	
1040	D2360	99.9550		-0.51	
1067	D2360	99.961		0.29	
1081	D2360	99.96		0.15	
1172	INH-2435	99.959		0.02	
1434	D4492	99.962		0.42	
1481	D2360	99.961		0.29	
1538	D2360	99.96		0.15	
1603	in house	99.96		0.15	
1614	D2360	99.9665		1.02	
1653		-----		-----	
1728		-----		-----	
1866	D2360	99.9628		0.53	
1908	D2360	99.959		0.02	
7002	D2360	99.3	G(0.01)	-87.83	
normality		OK			
n		32			
outliers		1			
mean (n)		99.9588			
st.dev. (n)		0.00502			
R(calc.)		0.0140			
R(D2360:11)		0.0210			



Determination of Non aromatics on Toluene sample #12052; results in mg/kg

lab	method	value	mark	z(targ)	remarks
52	D7504	380		0.23	
150	D2360	345		-0.33	
158		-----		-----	
171	D2360	317.2		-0.77	
174	D2360	305		-0.97	
311	D2360	380		0.23	
323	D2360	388		0.36	
333	D2360	320		-0.73	
334	D2360	420	C	0.87	first reported: 510
342		-----		-----	
396		-----		-----	
444		-----		-----	
445	D2360	439		1.18	
494	D6729	375		0.15	
497	D2360	372		0.10	
551		-----		-----	
555		-----		-----	
840	D2360	389.92		0.39	
855	D2360	377		0.18	
862	D2360	379		0.22	
864	D7504	372		0.10	
865	D2360	375		0.15	
866	D2360	380.3		0.24	
868	D2360	395		0.47	
870	D2360	376		0.17	
902		-----		-----	
912		-----		-----	
913		-----		-----	
1011	D2360	416	C	0.81	first reported: 0.0416
1040	D2360	411.2		0.73	
1067	D2360	376		0.17	
1081	D2360	400		0.55	
1172	INH-2435	365		-0.01	
1434	D4492	327.7		-0.61	
1481	D2360	308		-0.92	
1538	D2360	334		-0.51	
1603	in house	275		-1.45	
1614	D2360	320		-0.73	
1653		-----		-----	
1728		-----		-----	
1866	D2360	352.1		-0.22	
1908	D2360	362		-0.06	
7002		-----		-----	

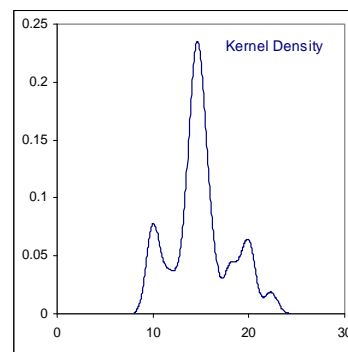
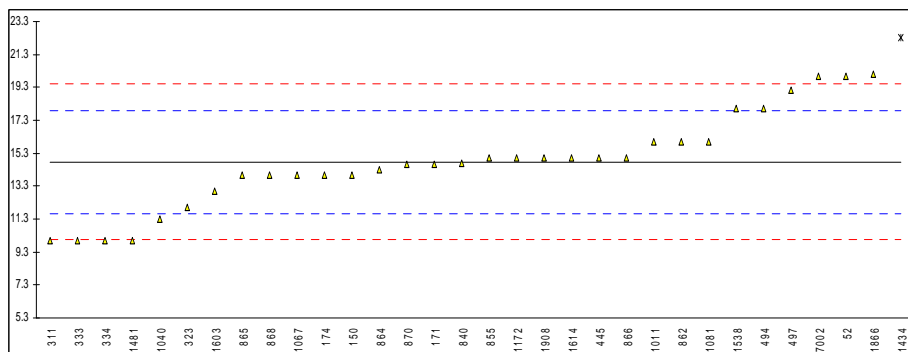
normality not OK
n 31
outliers 0
mean (n) 365.56
st.dev. (n) 37.590
R(calc.) 105.11
R(D2360:11) 174.83



Determination of Benzene on Toluene sample #12052; results in mg/kg

lab	method	value	mark	z(targ)	remarks
52	D7504	20		3.32	
150	D2360	14		-0.49	
158		----		----	
171	D2360	14.6		-0.10	
174	D2360	14		-0.49	
311	D2360	10		-3.02	
323	D2360	12	C	-1.76	first reported: 21
333	D2360	10		-3.02	
334	D2360	10		-3.02	
342		----		----	
396		----		----	
444		----		----	
445	D2360	15		0.15	
494	D6729	18		2.05	
497	D2360	19.1		2.75	
551		----		----	
555		----		----	
840	D2360	14.72		-0.03	
855	D2360	15		0.15	
862	D2360	16		0.78	
864	D7504	14.3		-0.30	
865	D2360	14		-0.49	
866	D2360	15.0		0.15	
868	D2360	14		-0.49	
870	D2360	14.6		-0.10	
902		----		----	
912		----		----	
913		----		----	
1011	D2360	16	C	0.78	first reported: 0.016
1040	D2360	11.3		-2.20	
1067	D2360	14		-0.49	
1081	D2360	16		0.78	
1172	INH-2435	15		0.15	
1434	D4492	22.3	G(0.05)	4.78	
1481	D2360	10		-3.02	
1538	D2360	18		2.05	
1603	in house	13		-1.12	
1614	D2360	15		0.15	
1653		----		----	
1728		----		----	
1866	D2360	20.1		3.39	
1908	D2360	15		0.15	
7002	D2360	20	C	3.32	reported 0.002, probably unit error?

normality not OK
n 31
outliers 1
mean (n) 14.76
st.dev. (n) 2.856
R(calc.) 8.00
R(Horwitz) 4.41



Determination of Styrene on Toluene sample #12052; results in mg/kg

lab	method	value	mark	z(targ)	remarks
52		<10		----	
150	D2360	26		----	false positive?
158		----		----	
171	D2360	<10		----	
174	D2360	<10		----	
311	D2360	<10		----	
323	D2360	<10		----	
333		----		----	
334		----		----	
342		----		----	
396		----		----	
444		----		----	
445		<1		----	
494	D2360	2		----	
497		<10		----	
551		----		----	
555		----		----	
840	D2360	<3		----	
855	D2360	<10		----	
862	D2360	<10		----	
864	D7504	<10		----	
865	D2360	<10		----	
866	D2360	<10		----	
868	D2360	<10		----	
870	D2360	<10		----	
902		----		----	
912		----		----	
913		----		----	
1011	D2360	<10	C	----	first reported: <0.001
1040	D2360	0		----	
1067		<5		----	
1081	D2360	<1		----	
1172		----		----	
1434		----		----	
1481	D2360mod	<10		----	
1538	D2360	<10		----	
1603		----		----	
1614	D2360	<10		----	
1653		----		----	
1728		----		----	
1866	D2360	n.d.		----	
1908	D2360	0		----	
7002		----		----	
	normality	n.a			
	n	26			
	outliers	n.a			
	mean (n)	<10			
	st.dev. (n)	n.a			
	R(calc.)	n.a			
	R(Horwitz)	n.a			

APPENDIX 2

Number of participants in the Benzene PT

1 lab in AUSTRIA
2 labs in BELGIUM
3 labs in BRAZIL
1 lab in CANADA
2 labs in FRANCE
3 labs in GERMANY
3 labs in INDIA
1 lab in ISRAEL
1 lab in KOREA
2 labs in KUWAIT
1 lab in MALAYSIA
8 labs in P.R. of CHINA
1 lab in POLAND
1 lab in ROMANIA
4 labs in SAUDI ARABIA
1 lab in SPAIN
1 lab in THAILAND
4 labs in THE NETHERLANDS
1 lab in TURKEY
1 lab in U.A.E.
4 labs in U.S.A.
2 labs in UNITED KINGDOM

Number of participants in the Toluene PT

1 lab in BELGIUM
3 labs in BRAZIL
1 lab in CANADA
2 labs in FRANCE
4 labs in GERMANY
3 labs in INDIA
1 lab in IRAN
1 lab in ISRAEL
1 lab in ITALY
9 labs in P.R. of CHINA
1 lab in POLAND
1 lab in PORTUGAL
1 lab in ROMANIA
1 lab in SAUDI ARABIA
1 lab in SPAIN
4 labs in THE NETHERLANDS
1 lab in TURKEY
4 labs in U.S.A.
2 labs in UNITED KINGDOM
1 lab in VIETNAM

APPENDIX 3

Abbreviations:

C	= final result after checking of first reported suspect result
D(0.01)	= outlier in Dixon's outlier test
D(0.05)	= straggler in Dixon's outlier test
G(0.01)	= outlier in Grubbs' outlier test
G(0.05)	= straggler in Grubbs' outlier test
DG(0.01)	= outlier in Double Grubbs' outlier test
DG(0.05)	= straggler in Double Grubbs' outlier test
fr	= first reported
E	= error in calculations
ex	= excluded from calculations
n.a.	= not applicable
fr	= first reported
U	= reported in different unit
SDS	= Safety Data Sheet

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