Results of Proficiency Test
Free Formaldehyde in textile
October 2010

Organised by: Institute for Interlaboratory Studies
Spijkenisse, the Netherlands

Author: Ing. M. Jafar
Correctors: Dr. R.G. Visser & Ing. N. Boelhouwer

Report: iis10A06

December 2010

CONTENTS

1 INTRODUCTION

Since the 1990's, many countries have adopted environmental standards and requirements restricting the use of harmful chemicals in the production of textiles and clothing. Laws and regulations impose some of these standards and requirements. In addition to mandatory environmental standards and requirements for textiles, there are some Ecolabelling schemes imposing environmental requirements for textile products on a voluntary basis. Well known programs are for instance Milieukeur (the Netherlands), Öko-Tex Standard 100 (Germany) and Thai Green Label (Thailand).
Since several years, the Institute for Interlaboratory Studies (iis) organises a proficiency scheme for Free Formaldehyde in textile. Also, this year this scheme is part of the proficiency testing program 2010/2011.
In this interlaboratory study 129 laboratories in 29 different countries participated. See appendix 3 for a list of participants per country. In this report, the results of this proficiency test are presented and discussed.

2 SET UP

The Institute for Interlaboratory Studies in Spijkenisse was the organiser of this proficiency test. Sample preparation and analyses of fit for use and homogeneity were subcontracted. In this Proficiency Test, it was decided to use two different samples (#1078 and #1079, each approx. 3 grams) which were treated to find two different concentration levels of Free Formaldehyde. Participants were requested to report results with one extra figure. These unrounded results were preferably used for the statistical evaluations.

2.1 QUALITY SYSTEM

The Institute for Interlaboratory Studies in Spijkenisse, the Netherlands, has implemented a quality system based on ISO guide 43, ILAC-G13:2007, ISO 17043:2010. This ensures 100% confidentiality of participant's data. Feedback from the participants on the reported data is encouraged and customer's satisfaction is measured on regular basis by sending out questionnaires.

2.2 PROTOCOL

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

2.3 CONFIDENTIALITY STATEMENT

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

2.4 SAMPLES

The two textile samples, a Royal Blue hosiery fabric (sample #1078) and a navy Blue Hosiery Fabric (sample #1079) were each well mixed and divided over 140 subsamples of approx. 3 grams. The samples were labelled and tested for homogeneity on 4 randomly selected samples. The homogeneity testing was performed by a subcontracted ISO17025 accredited laboratory. See the following tables for the test results.

Navy Blue Fabric Textile	Free Formaldehyde in mg/kg
Sample #1078-1	107
Sample #1078-2	111
Sample #1078-3	118
Sample #1078-4	106

Table 1: homogeneity test of subsamples #1078

Pink Fabric Textile	Free Formaldehyde in mg/kg
Sample #1079-1	152
Sample #1079-2	157
Sample #1079-3	146
Sample #1079-4	148

Table 2: homogeneity test of subsamples #1079

From the above results of the homogeneity tests, the repeatabilities were calculated. The calculated repeatabilities are both in good agreement with the repeatability of the subcontracted laboratory. Therefore, homogeneity of all subsamples was assumed.

In total approx. 3 grams of each of the samples, #1078 and #1079 were sent to the participating laboratories on October 7, 2010.

2.5 ANALYSES

The participants were asked to determine on samples #1078 and #1079 the concentrations of Free Formaldehyde with the analytical procedure that is routinely used in the laboratory. To get comparable results, detailed report forms were sent together with each set of samples. On the report form the requested Free Formaldehyde concentration, including the units was pre-printed. Also a letter of instructions was sent along.

3 RESULTS

During four weeks after sample despatch, the results of the individual laboratories were gathered. The original data are tabulated in the appendices 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. 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, see lit.5) found it to be an outlier. The laboratories that produced these suspect data were asked to check the results. Additional or corrected data are placed under 'Remarks' in the result tables in appendix 1. A list of abbreviations used in the tables can be found in appendix 4.

3.1 STATISTICS

Statistical calculations were performed as described in the report 'iis Interlaboratory Studies: Protocol for the Organisation, Statistics and Evaluation' of January 2010 (iis-protocol, version 3.2).
For the statistical evaluation the *unrounded* (when available) figures were used instead of the rounded results. Results reported as '<…' or '>…" were not used in the statistical evaluation.
Before further calculations, the normality of the distribution of the various data sets per determination was checked by means of the Lilliefors-test. In the case of an anormal distribution, the statistical evaluation should be used with care.

According to ISO 5725 (1986 and 1994, lit.7 and 8) the original results per determination were submitted subsequently to Dixon's and Grubbs' outlier tests. Outliers are marked by D(0.01) for the Dixon's test, by G(0.01) or DG(0.01) for the Grubbs' test. Stragglers are marked by D(0.05) for the Dixon's test, by G(0.05) or DG(0.05) for the Grubbs' test. Both outliers and stragglers were not included in the calculations of averages and standard deviations.

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

3.2 GRAPHICS

In order to 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 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 individual participating laboratories the z-scores were calculated.
In order to be able to have an objective evaluation of the performance of the individual participants, it was decided to evaluate this performance against the literature requirements. Therefore, the z-scores were calculated using a target standard deviation. This target standard deviation was calculated from the literature reproducibility by division with 2.8.

The $z_{(target)}$-scores were calculated according to:

$z_{(target)}$ = (individual result - average of proficiency test) / target standard deviation

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

Absolute values for z<2 are very common and absolute values for z>3 are very rare. 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

During the execution of this proficiency test some problems occurred with the delivery of the samples. Two of late reporting laboratories received the samples late.
One laboratory did not report any results and 12 laboratories reported results after the final reporting date.

Finally, the 128 reporting laboratories send in total 256 numerical results. Observed were 4 statistical outlying results, which is 1.6% of the numerical results. In proficiency studies, outlier percentages of 3% - 7.5% are quite normal.

For sample #1078, a not normal distribution was found. Therefore the statistical evaluation for this sample should be used with due care.

Due to the lack of precision data in the relevant test methods for the determination of Free Formaldehyde, the z-scores and the calculated reproducibilities were compared with the reproducibilities estimated by the Horwitz equation.

4.1 EVALUATION PER SAMPLE

In this section, the samples #1078 and #1079 are discussed. All statistical results reported on the textile samples are summarised in appendix 1.

Sample #1078: At this concentration level (159 mg/kg) this determination was only problematic for a number of laboratories for this sample. Four statistical outliers were observed. The calculated reproducibility, after rejection of the statistical outliers, is in full agreement with the estimated reproducibility calculated using the Horwitz equation.

Sample #1079: At this concentration level (187 mg/kg) this determination was somewhat problematic for this sample. Three statistical outliers were observed. The calculated reproducibility, after rejection of the statistical outliers, is not in agreement with the estimated reproducibility calculated using the Horwitz equation.

4.2 PERFORMANCE EVALUATION FOR THE GROUP OF LABORATORIES

A comparison has been made between the calculated reproducibilities using the Horwitz equation and the reproducibilities as found for the group of participating laboratories. The number of significant results, the average results, the calculated reproducibilities (standard deviation*2.8) and the target reproducibilities (Horwitz equation), are compared in the next table.

Parameter	unit	n	average	2.8 * sd	R (target)
Free Formaldehyde #1078	mg/kg	124	158.85	33.26	33.19
Free Formaldehyde #1079	mg/kg	125	187.16	45.55	38.15

Table 3: reproducibilities of textile samples #1078 and #1079

From the above tables it can be concluded that, without statistical calculations, the group of participating laboratories has difficulties with the analysis when compared with the strict target results calculated with the Horwitz equation. See also the discussions in paragraphs 4.1 and 6.

5 COMPARISON WITH THE PREVIOUS PROFICIENCY TESTS

The spreads, which were found in the results of the samples Free Formaldehyde during the present round, are approximately the same as the spreads as observed in previous rounds (see next table).

Parameter	October 2010	October 2009	October 2008	November 2007	November 2006
Free Formaldehyde	21-24%	24-33%	19-25-42%	24-25%	27-31%

Table 4: Development of relative reproducibilities of Free Formaldehyde over the last years

6 DISCUSSION

When the results of this interlaboratory study were compared to the Ecolabelling Standards and Requirements for Textiles in EU (table 5), it could be noticed that some participants would make different decisions about the acceptability of the textiles for the determined parameters, to the majority of the group.

Ecolabel	EU-adult clothes	EU-baby clothes	Öko-Tex 103 non skin contact	Öko-Tex 103 direct skin contact	Öko-Tex 106 baby clothes
Free Formaldehyde in mg/kg	75	30	300	75	20

Table 5: Ecolabelling Standards and Requirements for Textiles in EU

The method for determination of the Free Formaldehyde is specified in the Standards of the Ecolabelling Institutes.
It should be noticed that ISO14184-1 corresponds to the Japanese method specified in the Japanese Law 112 and is described in the Japanese Standard JIS L1096.

All participating laboratories would accept both samples #1078 and #1079 for the category “Öko-Tex 103 non skin contact” (<300 mg/kg). Except one laboratory would falsely accept both samples #1078 and #1079 for the category “Öko-Tex 103 direct skin contact” or “EU-adult clothes” (<75 mg/kg), according to the "Ecolabelling Standards and Requirements for Textile in Europe".

General

The Free Formaldehyde content was determined at two different levels. The spreads observed in this interlaboratory study are not caused by just one critical point in the analysis. Consequently, the reproducibilities cannot be improved by only one change in the analysis. Each laboratory has to evaluate its performance in this study and make decisions about necessary corrective actions. Therefore, participation on a regular basis in this scheme could be helpful to improve the performance and thus raise of the quality of the analytical results.

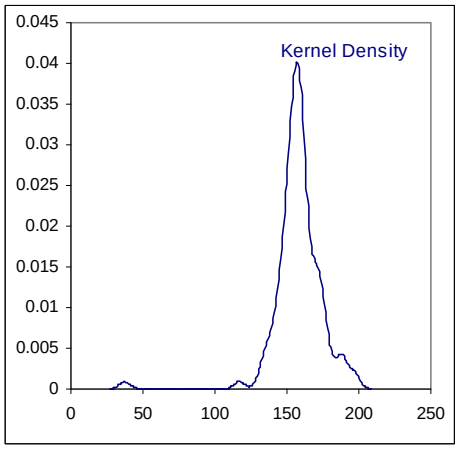
APPENDIX 1

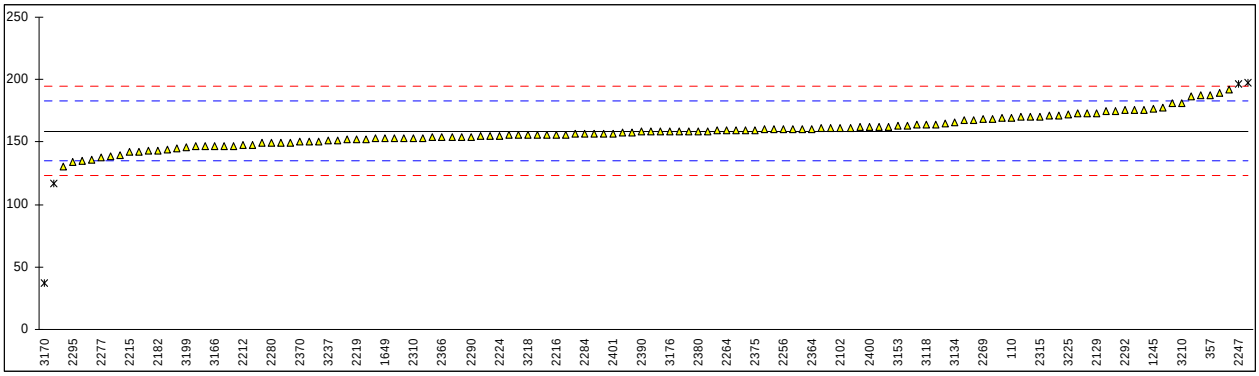
Determination of Free Formaldehyde on sample #1078; results in mg/kg

lab	method	value	mark	z(targ)	remarks
110	ISO14184-1	169.4		0.89	
357	ISO14184-1	187.7		2.43	
361	ISO14184-1	162.2		0.28	
551	ISO14184-1	160.933		0.18	
623	ISO14184-1	176.0		1.45	
826		-----		-----	
840	ISO14184-1	160.4		0.13	
1213	TLVN7421-1	158.6		-0.02	
1245	ISO14184-1	176.5		1.49	
1649	ISO14184-1	153.0		-0.49	
2102	ISO14184-1	161.4		0.22	
2117	ISO14184-1	158.7		-0.01	
2120	ISO14184-1	146.5		-1.04	
2127	Photometric	155.0		-0.32	
2129	ISO14184-1	173.0		1.19	
2132	ISO14184-1	117.1	C, G(0.05)	-3.52	First reported 103.0
2137	ISO14184-1	161.5		0.22	
2146	ISO14184-1	153.6		-0.44	
2165	ISO14184-1	155.6		-0.27	
2170	ISO14184-1	170.9		1.02	
2172	ISO14184-1	152.5		-0.54	
2182	ISO14184-1	143.2		-1.32	
2190	ISO14184-1	187.0		2.38	
2196	ISO14184-1	156.3		-0.21	
2197	ISO14184-1	168.2		0.79	
2212	JIS L 1041	147.6		-0.95	
2215	ISO14184-1	142.0		-1.42	
2216	Japanese Law	155.9		-0.25	
2219	ISO14184-1	152.4		-0.54	
2224	ISO14184-1	155.1		-0.32	
2226	ISO14184-1	169.9		0.93	
2227	JIS L 1041	177.4		1.57	
2228	JIS L 1041	192.3	C	2.82	First reported 195.7
2229	ISO14184-1	158.2		-0.05	
2235	ISO14184-1	139.1		-1.67	
2241	ISO14184-1	156.4		-0.21	
2245	ISO14184-1	160.2		0.11	
2246	ISO14184-1	162.0		0.27	
2247	ISO14184-1	197.0	DG(0.05)	3.22	
2248	ISO14184-1	174.9		1.35	
2255	ISO14184-1	187.5		2.42	
2256	ISO14184-1	160.13		0.11	
2264	JIS L 1041	159.4		0.05	
2265	ISO14184-1	197.7	DG(0.05)	3.28	
2266	ISO14184-1	135.2		-1.99	
2269	ISO14184-1	168.2		0.79	
2271	ISO14184-1	160.0		0.10	
2272	ISO14184-1	162.2		0.28	
2273	ISO14184-1	130.8		-2.37	
2277	ISO14184-1	138.0		-1.76	
2279	ISO14184-1	154.2		-0.39	
2280	ISO14184-1	149.2		-0.81	
2284	ISO14184-1	156.3		-0.21	
2290	ISO14184-1	154.3		-0.38	
2292	ISO14184-1	175.36		1.39	
2295	ISO14184-1	133.9		-2.10	
2297	ISO14184-1	149.8		-0.76	
2298	JIS L 1041	146.30		-1.06	
2300	ISO14184-1	149.2		-0.81	
2303	ISO14184-1	147.0		-1.00	
2308	ISO14184-1	157.0		-0.16	
2310	ISO14184-1	153.4		-0.46	
2311	ISO14184-1	169.2		0.87	
2313	ISO14184-1	155.8		-0.26	
2314	ISO14184-1	163.36		0.38	
2315	ISO14184-1	170.1		0.95	
2350	ISO14184-1	154.7		-0.35	
2356	ISO14184-1	164.4		0.47	
2358	ISO14184-1	167.3		0.71	
2359	ISO14184-1	155.7		-0.27	
2360	ISO14184-1	144.4		-1.22	
2362	ISO14184-1	159.7		0.07	
2363	ISO14184-1	157.8		-0.09	
2364	ISO14184-1	160.4		0.13	
2365	ISO14184-1	159.4		0.05	
2366	ISO14184-1	153.9		-0.42	

2367	ISO14184-1	153.4		-0.46	
2368	ISO14184-1	158.0		-0.07	
2369	ISO14184-1	165.1		0.53	
2370	ISO14184-1	150.0		-0.75	
2372	ISO14184-1	149.7		-0.77	
2375	ISO14184-1	159.73		0.07	
2379	ISO14184-1	161.1		0.19	
2380	ISO14184-1	158.60		-0.02	
2386	ISO14184-1	153.0		-0.49	
2390	ISO14184-1	158.1		-0.06	
2400	ISO14184-1	162.0		0.27	
2401	ISO14184-1	157.1		-0.15	
2402	ISO14184-1	152.1		-0.57	
2403	ISO14184-1	152.8		-0.51	
2404	ISO14184-1	158.2		-0.05	
2405	GB/T2912.1	167.4		0.72	
2407	ISO14184-1	160.1		0.11	
2411	ISO14184-1	159.5		0.06	
3104	ISO14184-1	156.14		-0.23	
3110	ISO14184-1	147.0		-1.00	
3116	ISO14184-1	170.0		0.94	
3117	ISO14184-1	158.4		-0.04	
3118	ISO14184-1	164.07		0.44	
3134	ISO14184-1	165.7		0.58	
3153	ISO14184-1	163.0		0.35	
3154	ISO14184-1	142.4		-1.39	
3159	ISO14184-1	175.2	C	1.38	First reported 205.7
3162	ISO14184-1	145.0		-1.17	
3166	HPLC	146.8		-1.02	
3167	ISO14184-1	175.4		1.40	
3170	ISO14184-1	37.17	G(0.01)	-10.27	
3172	ISO14184-1	172.9		1.19	
3176	ISO14184-1	158.4		-0.04	
3180	ISO14184-1	154.0		-0.41	
3182	ISO14184-1	171.3		1.05	
3185	ISO14184-1	150.2		-0.73	
3190	ISO14184-1	150.7		-0.69	
3191	ISO14184-1	142.9		-1.35	
3195	ISO14184-1	148.0		-0.92	
3199	ISO14184-1	145.8		-1.10	
3200	ISO14184-1	153.4		-0.46	
3207	JIS L 1041	155.70		-0.27	
3208	LFGB-B-82-02-1	138.6		-1.71	
3210	ISO14184-1	181.5		1.91	
3218	ISO14184-1	155.7		-0.27	
3225	ISO14184-1	172.0		1.11	
3226	ISO14184-1	151.7		-0.60	
3232	ISO-TS-17226	163.5		0.39	
3233	ISO14184-1	181.3		1.89	
3237	ISO14184-1	151.5		-0.62	
3243	ISO14184-1	189.0		2.54	
3248	ISO14184-1	136.0		-1.93	
8005	Japanese Law	172.6		1.16	

normality	not OK
n	124
outliers	4
mean (n)	158.845
st.dev. (n)	11.8775
R(calc.)	33.257
R(Horwitz)	33.187



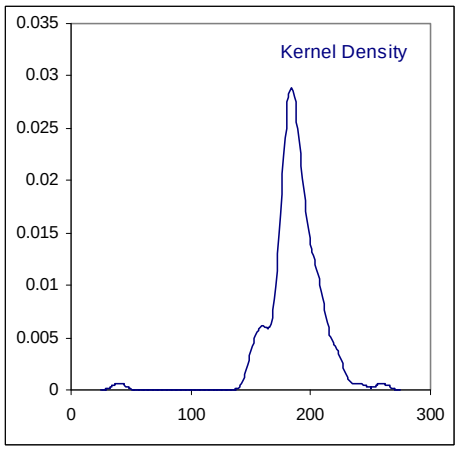


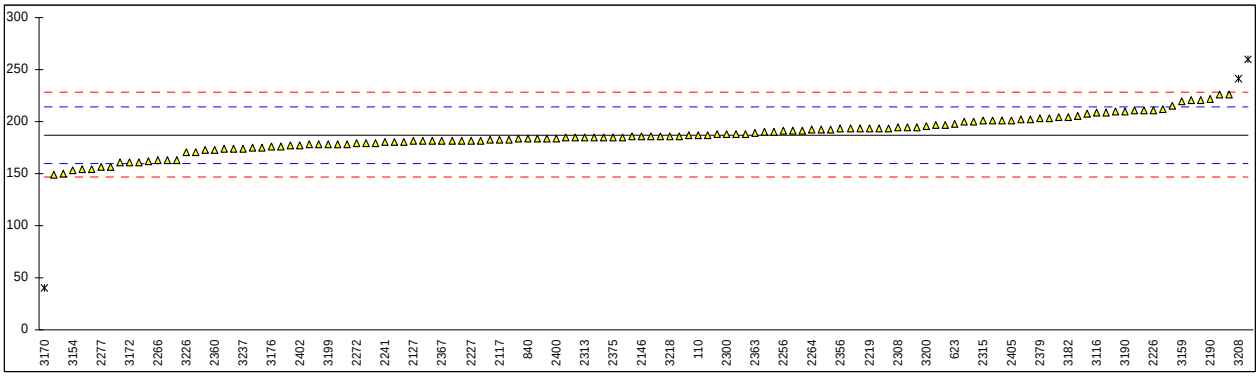
Determination of Free Formaldehyde on sample #1079; results in mg/kg

lab	method	value	mark	z(targ)	remarks
110	ISO14184-1	187.5		0.02	
357	ISO14184-1	202.3		1.11	
361	ISO14184-1	178.7		-0.62	
551	ISO14184-1	191.614		0.33	
623	ISO14184-1	198.0		0.80	
826		-----		-----	
840	ISO14184-1	183.2		-0.29	
1213	TLVN7421-1	220.3		2.43	
1245	ISO14184-1	226.3		2.87	
1649	ISO14184-1	178.0		-0.67	
2102	ISO14184-1	181.5		-0.42	
2117	ISO14184-1	182.6		-0.33	
2120	ISO14184-1	175.9		-0.83	
2127	Photometric	181.0		-0.45	
2129	ISO14184-1	207.9		1.52	
2132	ISO14184-1	149.4	C	-2.77	First reported 139.0
2137	ISO14184-1	200.1		0.95	
2146	ISO14184-1	185.8		-0.10	
2165	ISO14184-1	196.7		0.70	
2170	ISO14184-1	201.0		1.02	
2172	ISO14184-1	190.4		0.24	
2182	ISO14184-1	160.7		-1.94	
2190	ISO14184-1	222.0		2.56	
2196	ISO14184-1	200.0		0.94	
2197	ISO14184-1	211.5		1.79	
2212	JIS L1041	174.5		-0.93	
2215	ISO14184-1	193.5		0.47	
2216	Japanese Law	200.9		1.01	
2219	ISO14184-1	193.1		0.44	
2224	ISO14184-1	180.2		-0.51	
2226	ISO14184-1	211.4		1.78	
2227	JIS L1041	181.5		-0.42	
2228	JIS L1041	220.2	C	2.42	First reported 234.6
2229	ISO14184-1	186.3		-0.06	
2235	ISO14184-1	153.9		-2.44	
2241	ISO14184-1	180.2		-0.51	
2245	ISO14184-1	194.9		0.57	
2246	ISO14184-1	187.5		0.02	
2247	ISO14184-1	225.7		2.83	
2248	ISO14184-1	210.6		1.72	
2255	ISO14184-1	215.5		2.08	
2256	ISO14184-1	191.29		0.30	
2264	JIS L1041	192.2		0.37	
2265	ISO14184-1	203.7		1.21	
2266	ISO14184-1	162.8		-1.79	
2269	ISO14184-1	194.2		0.52	
2271	ISO14184-1	188.0		0.06	
2272	ISO14184-1	178.9		-0.61	
2273	ISO14184-1	173.6	C	-1.00	First reported 141.9
2277	ISO14184-1	156.0		-2.29	
2279	ISO14184-1	188.2		0.08	
2280	ISO14184-1	173.4		-1.01	
2284	ISO14184-1	178.2		-0.66	
2290	ISO14184-1	163.4		-1.74	
2292	ISO14184-1	209.50		1.64	
2295	ISO14184-1	150.0		-2.73	
2297	ISO14184-1	192.3		0.38	
2298	JIS L1041	163.10		-1.77	
2300	ISO14184-1	187.8		0.05	
2303	ISO14184-1	161.2		-1.91	
2308	ISO14184-1	194.2		0.52	
2310	ISO14184-1	181.0		-0.45	
2311	ISO14184-1	179.1		-0.59	
2313	ISO14184-1	185.0		-0.16	
2314	ISO14184-1	182.25		-0.36	
2315	ISO14184-1	200.7		0.99	
2350	ISO14184-1	190.3		0.23	
2356	ISO14184-1	193.0		0.43	
2358	ISO14184-1	185.1		-0.15	
2359	ISO14184-1	204.1		1.24	
2360	ISO14184-1	173.0		-1.04	
2362	ISO14184-1	187.8		0.05	
2363	ISO14184-1	189.5		0.17	
2364	ISO14184-1	183.2		-0.29	
2365	ISO14184-1	182.0		-0.38	
2366	ISO14184-1	202.1		1.10	
2367	ISO14184-1	181.1		-0.44	
2368	ISO14184-1	181.0		-0.45	

2369	ISO14184-1	186.8		-0.03
2370	ISO14184-1	186.0		-0.09
2372	ISO14184-1	180.4		-0.50
2375	ISO14184-1	185.10		-0.15
2379	ISO14184-1	203.6		1.21
2380	ISO14184-1	185.00		-0.16
2386	ISO14184-1	179.0		-0.60
2390	ISO14184-1	186.0		-0.09
2400	ISO14184-1	184.0		-0.23
2401	ISO14184-1	181.4		-0.42
2402	ISO14184-1	177.1		-0.74
2403	ISO14184-1	184.6		-0.19
2404	ISO14184-1	208.7		1.58
2405	GB/T2912.1	201.1		1.02
2407	ISO14184-1	183.8		-0.25
2411	ISO14184-1	171.1		-1.18
3104	ISO14184-1	185.44		-0.13
3110	ISO14184-1	154.0		-2.43
3116	ISO14184-1	208.6		1.57
3117	ISO14184-1	177.9		-0.68
3118	ISO14184-1	204.92		1.30
3134	ISO14184-1	196.3		0.67
3153	ISO14184-1	175.0		-0.89
3154	ISO14184-1	152.8		-2.52
3159	ISO14184-1	219.1		2.34
3162	ISO14184-1	161.7		-1.87
3166	HPLC	191.7		0.33
3167	ISO14184-1	185.3		-0.14
3170	ISO14184-1	40.00	G(0.01)	-10.80
3172	ISO14184-1	160.9		-1.93
3176	ISO14184-1	175.7		-0.84
3180	ISO14184-1	193.0		0.43
3182	ISO14184-1	204.2		1.25
3185	ISO14184-1	184.4		-0.20
3190	ISO14184-1	209.8		1.66
3191	ISO14184-1	176.8		-0.76
3195	ISO14184-1	193.0		0.43
3199	ISO14184-1	178.0		-0.67
3200	ISO14184-1	195.9		0.64
3207	JIS L1041	183.95		-0.24
3208	LFGB-B-82-02-1	240.9	G(0.05)	3.94
3210	ISO14184-1	172.9		-1.05
3218	ISO14184-1	186.2		-0.07
3225	ISO14184-1	183.0		-0.31
3226	ISO14184-1	170.3		-1.24
3232	ISO-TS-17226	193.5		0.47
3233	ISO14184-1	192.4		0.38
3237	ISO14184-1	174.0		-0.97
3243	ISO14184-1	259.6	G(0.01)	5.32
3248	ISO14184-1	156.0		-2.29
8005	Japanese Law	210.4		1.71

normality	OK
n	125
outliers	3
mean (n)	187.163
st.dev. (n)	16.2671
R(calc.)	45.548
R(Horwitz)	38.150





APPENDIX 2

Number of participants in alphabetical country order

1	laboratories in AUSTRIA
3	laboratories in BANGLADESH
1	laboratories in BRASIL
1	laboratories in BULGARIA
3	laboratories in FINLAND
4	laboratories in FRANCE
9	laboratories in GERMANY
1	laboratories in GREECE
15	laboratories in HONG KONG
9	laboratories in INDIA
3	laboratories in INDONESIA
4	laboratories in ITALY
3	laboratories in KOREA
3	laboratories in MEXICO
1	laboratories in NEW ZEALAND
41	laboratories in P.R. of CHINA
1	laboratories in PAKISTAN
1	laboratories in PERU
1	laboratories in PORTUGAL
1	laboratories in SINGAPORE
1	laboratories in SLOVENIA
2	laboratories in SWITZERLAND
3	laboratories in TAIWAN R.O.C.
3	laboratories in THAILAND
1	laboratories in THE NETHERLANDS
4	laboratories in TURKEY
5	laboratories in U.S.A.
1	laboratories in UNITED KINGDOM
3	laboratories 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
n.a.	= not applicable
n.d.	= not detected
W	= withdrawn

Literature:

1. iis Interlaboratory Studies, Protocol for the Organisation, Statistics & Evaluation, January 2010
2. Öko-Tex Standard 100; January 2008.
3. Thai Green label. TGL-16. July 2002.
4. Impacts of Environmental Standards and requirements in EU Countries. Aug 99.
5. Horwitz. Journal of AOAC International Vol. 79 No.3. 1996.
6. P.L. Davies. Fr Z. Anal. Chem. 351. 513 (1988).
7. W.J. Conover. Practical; Nonparametric Statistics. J. Wiley&Sons. NY. p.302 (1971).
8. ISO 5725. (1986).
9. ISO 5725. parts 1-6 (1994).
10. ISO105 E4: 1994.
11. ISO14184-1: 1994.
12. ISO13528-05.
13. M. Thompson and R. Wood. J. AOAC Int. 76. 926. (1993).
14. Analytical Methods Committee Technical brief, No4 January 2001.
15. The Royal Society of Chemistry 2002, Analyst 2002, 127 page 1359-1364, P.J. Lowthian and M. Thompson (see http://www.rsc.org/suppdata/an/b2/b205600n/).
16. Offical Journal of the European Communities L133/29: May 2002.