

Results of Proficiency Test  
**Perspired** Metals in textile  
October 2009

Organised by: Institute for Interlaboratory Studies  
Spijkenisse, the Netherlands

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## **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 perspirated metals in textile. Also this year this scheme is part of the proficiency testing program 2009/2010.

In this international interlaboratory study 56 laboratories in 19 different countries participated. See appendix 3 for a list of participants in (alphabetical) country order. In this report the results of this proficiency test are presented and discussed.

## **2 SET UP**

The Institute for Interlaboratory Studies in Spijkensisse was the organiser of this proficiency test. Sample preparation and analyses were subcontracted.

It was decided to use 2 different textile samples in this round and to request to use a solid/liquid ratio of 1/50 by preference (see paragraph 6 and the report of the previous PT iis07A05).

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 Spijkensisse, the Netherlands, has implemented a quality system based on ISO guide 43 and ILAC-G13:2007. 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 November 2008 (iis-protocol, version 3.1).

### **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 of 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 materials used in this proficiency test were prepared by a subcontractor. The two finely cut textile samples, a brown cotton fabric (sample #0979) and a blue cotton fabric (sample #0980) were each well mixed and divided over 76 subsamples of approx. 3.5 grams. The samples were labelled and tested for homogeneity on 5 randomly selected samples. The homogeneity testing was performed by a subcontracted ISO17025 accredited laboratory.

See the following tables for the homogeneity test results.

<i>Orange hosiery fabric</i>	<i>Perspirated Copper in mg/kg</i>
Sample #0979-1	88.1
Sample #0979-2	88.2
Sample #0979-3	88.6
Sample #0979-4	88.6
Sample #0979-5	88.5

table 1: homogeneity test of subsamples #0979

<i>Yellow hosiery fabric</i>	<i>Perspirated Copper in mg/kg</i>
Sample #0980-1	19.30
Sample #0980-2	19.76
Sample #0980-3	19.34
Sample #0980-4	19.44
Sample #0980-5	19.80

table 2: homogeneity test of subsamples #0980

From the above results of the homogeneity tests, the repeatabilities were calculated and compared with 0.3 times the corresponding reproducibility of the reference method in agreement with the procedure of ISO 13528, Annex B2 in the next table:

	<i>Perspirated Copper in #0979</i>	<i>Perspirated Copper in #0980</i>
r (observed)	0.7	0.7
reference method	Horwitz	Horwitz
0.3 x R (reference method)	6.1	1.7

Table 3: : repeatabilities of subsamples #0979 and #0980

The calculated repeatabilities are both in good agreement with the estimated targets, calculated using the Horwitz equation. Therefore, homogeneity of all subsamples was assumed.

In total approx. 3.5 grams of each of the samples #0979 and #0980 were sent to the participating laboratories on October 7, 2009.

## 2.5 ANALYSES

The participants were asked to determine the concentrations of perspired heavy metals: Arsenic, Antimony, Cadmium, Chromium, Cobalt, Copper, Lead, Mercury and Nickel, applying the analysis procedure that is routinely used in the laboratory, but to use preferably a solid/liquid ration of 1/50. To get comparable results detailed report forms, were sent together with each set of samples. On the report forms the requested heavy metals, including the units and questions about the analytical details, were 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 3.

### 3.1 STATISTICS

Statistical calculations were performed as described in the report 'iis Interlaboratory Studies: Protocol for the Organisation, Statistics and Evaluation' of November 2008 (iis-protocol, version 3.1)

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.8 and 9) 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:

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

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 reporting of the results. Eight (!) laboratories decided not to report any results due to various reasons. Four laboratories reported results after the final reporting date.

Finally, the 48 reporting laboratories did report in total 142 numerical results. The majority except 4, of the participating used a solid/liquid ratio of 1/50 as requested. The 4 laboratories used a different solid/liquid ration e.g. 1/20, 1.5/50, 1/2500 g/mL.

Observed were 11 statistical outlying results, which is 7.7 % of the numerical results. In proficiency studies, outlier percentages of 3 % - 7.5 % are quite normal.

Not all original data sets proved to have a normal distribution. For Antimony #0979 and Copper #0980 a non-Gaussian, distribution was found and therefore the statistical evaluation for this determination should be used with care.

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

#### 4.1 EVALUATION PER METAL

In this section, the determinations per metal are discussed. All statistical results reported on the samples are summarised in appendix 1.

Only for Antimony and Copper in sample #0979 and Copper in sample #0980 a sufficient number of numerical results were reported in order to perform a statistical evaluation. For all other elements of both samples, no significant conclusions could be drawn as only a few participants reported a numerical result, which were probably near or below the detection limit of the methods used. All other participants reported "not detected" in these cases.

Antimony: The determination of this element is problematic for sample #0979 at a perspiration level of 16.8 mg/kg. For sample #0979, four statistical outliers were observed after exclusion of three results, determined with a s/l ratio other than 1:50. The observed reproducibility is, even after rejection of the statistical outliers, not in agreement with the estimated target reproducibility calculated using the Horwitz equation. For sample #0980 only six laboratories reported a numerical result. The reported results are probably near or below the detection limit of the methods used.

Copper: The determination of this element is problematic for both samples. In total seven statistical outliers were observed after exclusion of in total seven results (4 laboratories) determined with a ratio other than 1:50. The observed reproducibility of both samples is, even after rejection of the statistical outliers, not at all in agreement with the estimated target reproducibility calculated using the Horwitz equation.

## 4.2 PERFORMANCE EVALUATION FOR THE GROUP OF LABORATORIES

A comparison has been made between the very strict 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 two tables.

<i>Parameter</i>	<i>unit</i>	<i>n</i>	<i>average</i>	<i>2.8 * sd</i>	<i>R (target)</i>
Perspirated Antimony	mg/kg	39	16.82	6.91	4.93
Perspirated Copper	mg/kg	41	142.45	68.98	30.25

table 4: reproducibilities of sample #0979

<i>Parameter</i>	<i>unit</i>	<i>n</i>	<i>average</i>	<i>2.8 * sd</i>	<i>R (target)</i>
Perspirated Copper	mg/kg	40	34.60	15.78	9.09

table 5: reproducibilities of sample #0980

From the above tables it can be concluded that, without statistical calculations, the group of participating laboratories again have 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 that were found in the results during the present round are in agreement with the spreads as observed in previous rounds (see below table).

<i>Parameter</i>	<i>October 2009</i>	<i>November 2008</i>	<i>November 2007</i>	<i>November 2006</i>	<i>November 2005</i>	<i>November 2004</i>	<i>November 2003</i>
Arsenic	--	--	66%	--	--	62%	--
Antimony	41%	46%	--	--	--	--	80%
Cadmium	--	--	--	85%	57%	--	--
Chromium	--	--	114%	47%	83%	--	--
Cobalt	--	28%	--	--	50%	--	116%
Copper	48-46%	26%	64-80%	93-39	66%	71%	91%
Lead	--	--	375%	138-172%	--	245%	--
Mercury	--	--	--	134%	--	--	170%
Nickel	--	23%	41%	--	88-39%	28%	--

table 6: Comparison of observed relative reproducibilities (since 2008 s/l ratio prescribed on 1:50)

The improvement of the results in the last two rounds is most probably caused by the use of a more uniform solid/liquid ratio than in previous (90% of all participating laboratories reported results after use of a liquor ratio of 1:50).

In this proficiency test for Perspiration of Heavy Metals in Textile, the samples from proficiency tests November 2002 (iis02A03) and November 2003 (iis03A03) were reused. An overview of the differences in results is summarized in table 7 and 8.

Parameter	Unit	iis09A05			iis02A03		
		n	average	2.8 * sd	n	average	2.8 * sd
Perspirated Antimony #0979	mg/kg	39	16.82	6.91	32	17.58	14.07
Perspirated Copper #0979	mg/kg	41	142.5	69.0	37	140.6	128.1

table 7: comparison results of PT iis09A05 and iis02A03

Parameter	Unit	iis09A05			iis03A03		
		n	average	2.8 * sd	n	average	2.8 * sd
Perspirated Copper #0980	mg/kg	40	34.60	15.78	26	24.90	19.74

table 8: comparison results of PT iis09A05 and iis03A03

## 6 DISCUSSION

When the results of this interlaboratory study were compared to the Ecolabelling Standards and Requirements for Textiles in EU (table 9), 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. The detection limit reported by many laboratories does not meet the requirements of the Standards (Detection limit is larger than the maximum required concentration by the Ecolabelling standard).

<i>Ecolabel</i>	EU-adult clothes	EU-baby clothes	Öko-Tex 103 non skin contact	Öko-Tex 103 direct skin contact	Öko-Tex 106 baby clothes
Arsenic (As) mg/kg	1)	1)	1.0	1.0	0.2
Antimony (Sb) mg/kg	1)	1)	30.0	30.0	30.0
Cadmium (Cd) mg/kg	1)	1)	0.1	0.1	0.1
Chromium (Cr) mg/kg	1)	1)	2.0	2.0	1.0
Cobalt (Co) mg/kg	1)	1)	4.0	4.0	1.0
Copper (Cu) mg/kg	1)	1)	50.0	50.0	25.0
Lead (Pb) mg/kg	1)	1)	1.0	1.0	0.2
Mercury (Hg) mg/kg	1)	1)	0.02	0.02	0.02
Nickel (Ni) mg/kg	1)	1)	4.0	4.0	1.0

table 9: Ecolabelling Standards and Requirements for Textiles in EU

1) No use of metals in dyes and pigments

Methods for determination of these Heavy Metals are specified in the Standards of the Ecolabelling Institutes. Unfortunately, only test methods for the release of heavy metals via perspiration is mentioned. The method for detection of the metals is specified as "Detection via A.A.S or ICP".

It should be noticed that for the results reported in this proficiency test, all participants have performed the acid perspiration step according to almost the same conditions. Differences in sample intake and perspiration time and temperature may be parameters of importance. However, the liquor ratio (ml of perspiration liquid / gram of textile) appeared to be a parameter of utmost importance and without mentioning this ratio (or the

respective test method), the test results may have little value (see previous reports iis07A05 and iis08A05 on "Perspirated Metals in Textile"). Therefore in this proficiency test the participating laboratories were advised to use preferably a ratio of 1:50. This ratio of solid/liquid of 1:50 is mentioned in DIN 54020 as well as in DIN 54233-1 through -4 that are currently drafted and that will be published in 2009 [ref. 15].

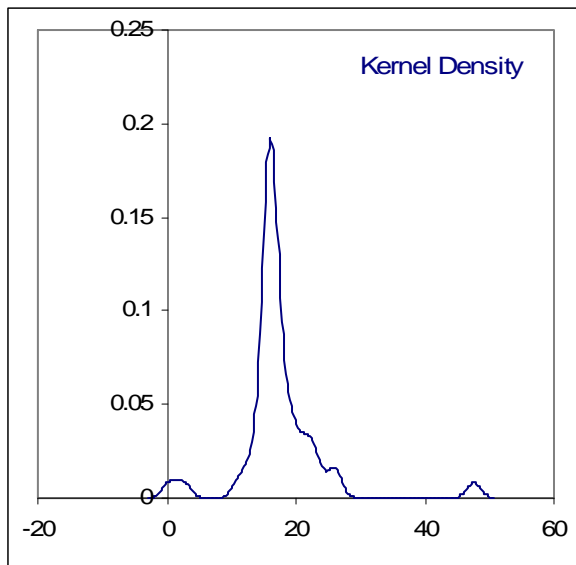
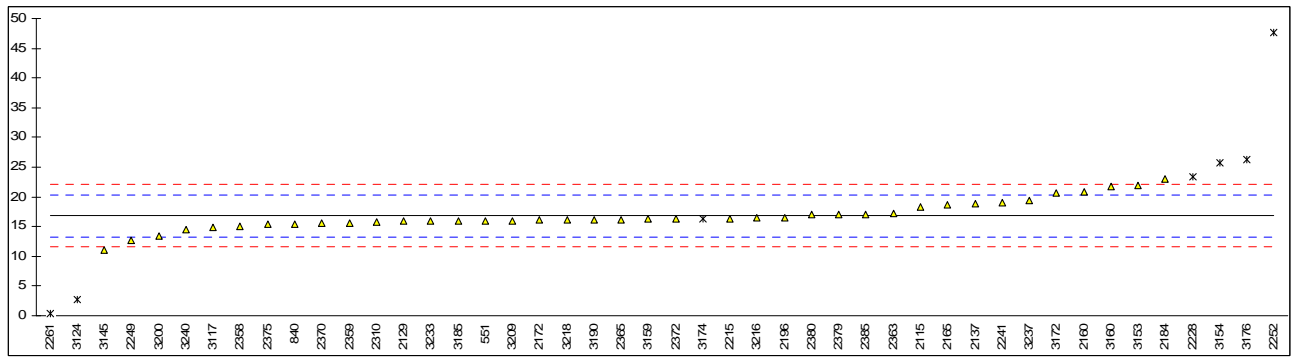
### **General**

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 rise of the quality of the analytical results.

**APPENDIX 1**

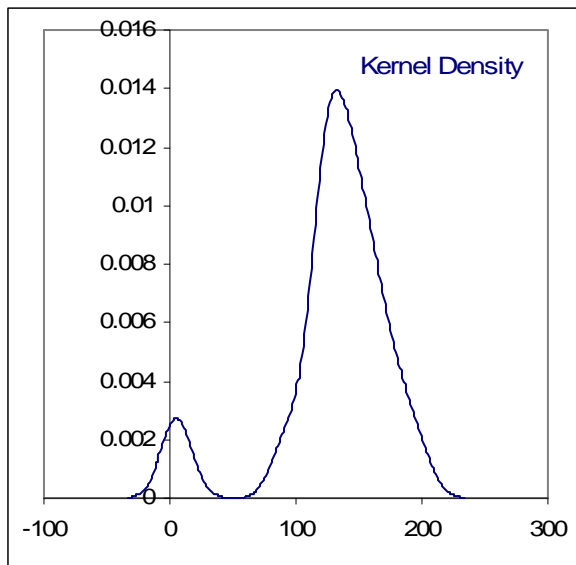
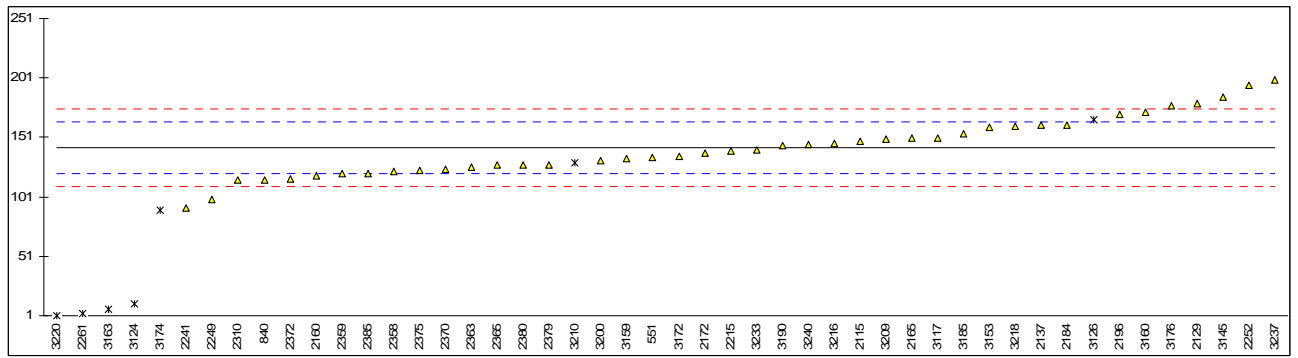
Determination of perspired Antimony (s/l ratio = 1/50) on sample #0979; results in mg/kg

lab	method	value	mark	z(targ)	Remarks
110		----		----	
551	ISO105 E04	15.9		-0.52	
840	ISO105 E04	15.4		-0.80	
2115	Oeko-tex 201	18.38		0.89	
2129	ISO105 E04	15.9		-0.52	
2137	ISO105 E04	18.9		1.19	
2160	In house	20.84		2.29	
2165	ISO105-E04	18.6		1.01	
2172	DIN38406	16.1		-0.41	
2184	ISO105 E04	23.0		3.52	
2196	Oeko-TEX 200	16.49		-0.18	
2197		----		----	
2215	DIN54233	16.39		-0.24	
2227		----		----	
2228	EN71	23.4	DG(0.05)	3.74	
2241	GB/T 17953.2	19.056		1.27	
2249	ISO105 E04	12.6		-2.40	
2252	GB/T 17593.2	47.6	G(0.01)	17.50	
2256		----		----	
2258		----		----	
2261	GB/T 17953.2	0.36	ex	-9.35	Result excluded for statistical calculations, ratio used 1/2500
2310	ISO105 E04	15.68		-0.65	
2358	ISO105 E04	15.0		-1.03	
2359	ISO105 E04	15.6		-0.69	
2363	ISO105 E04	17.2		0.22	
2365	ISO105 E04	16.2		-0.35	
2370	ISO105 E04	15.5		-0.75	
2372	ISO105 E04	16.3		-0.29	
2375	ISO105 E04	15.4		-0.80	
2379	ISO105 E04	17.0		0.11	
2380	ISO105 E04	16.94		0.07	
2385	Oeko-tex 200	17.0		0.11	
3117	Oeko-tex 200	14.9		-1.09	
3124	ISO105 E04	2.64	G(0.01)	-8.06	
3126		----		----	
3145	In house	11.1		-3.25	
3153	ISO105 E04	22.0		2.95	
3154	In house	25.7	ex	5.05	Result excluded for statistical calculations, ratio used 1.5/50
3159	ISO105 E04	16.30		-0.29	
3160	UNE59511	21.8		2.83	
3163		----		----	
3172	ISO105 E04	20.59		2.15	
3174	In house	16.36	ex	-0.26	Result excluded for statistical calculations, ratio used 1/20
3176	DIN38406	26.3	DG(0.05)	5.39	
3185	In house	15.9		-0.52	
3190	ISO105 E04	16.2		-0.35	
3200	In house	13.4		-1.94	
3209	ISO105 E04	16.0		-0.46	
3210	In house	<30		----	
3216	ISO105 E04	16.42		-0.22	
3218	DIN54020	16.1		-0.41	
3220	DIN54020	N.D.		----	
3226		----		----	
3233	Oeko-tex 200	15.9		-0.52	
3237	In house	19.3		1.41	
3240	GB/T 17593.2	14.5		-1.32	
	normality	not OK			
	n	39			
	outliers	4			
	mean (n)	16.82			
	st.dev. (n)	2.468			
	R(calc.)	6.91			
	R(Horwitz)	4.93			



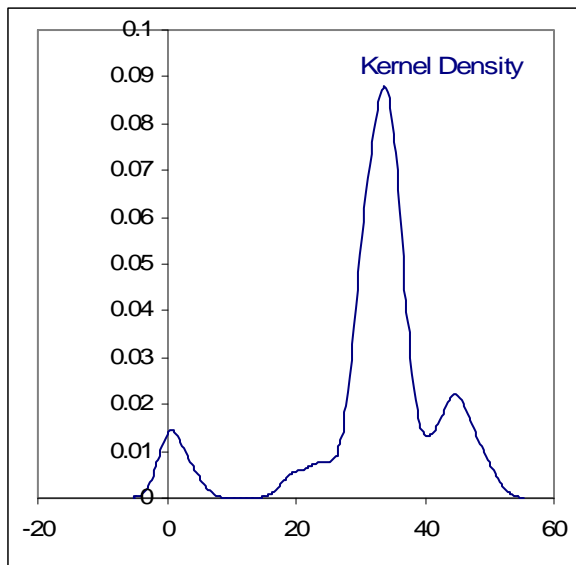
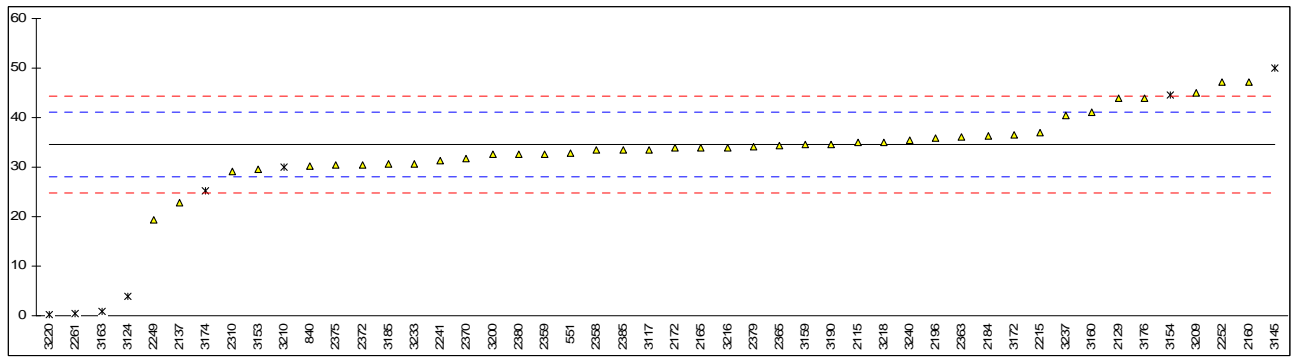
## Determination of perspired Copper (s/l ratio = 1/50) on sample #0979; results in mg/kg

lab	method	value	mark	z(targ)	remarks
110		----		----	
551	ISO105 E04	134.6		-0.73	
840	ISO105 E04	115.4		-2.50	
2115	Oeko-tex 201	147.67		0.48	
2129	ISO105 E04	179.8		3.46	
2137	ISO105 E04	161.0		1.72	
2160	In house	118.7		-2.20	
2165	ISO105-E04	150.3		0.73	
2172	DIN38406	138		-0.41	
2184	ISO105 E04	161.5		1.76	
2196	Oeko-Tex 200	170.02		2.55	
2197		----		----	
2215	DIN54233	140.0		-0.23	
2227		----		----	
2228		----		----	
2241	GB/T 17953.2	91.697		-4.70	
2249	ISO105 E04	99.1		-4.01	
2252	GB/T 17593.2	195.0		4.86	
2256		----		----	
2258		----		----	
2261	GB/T 17953.2	3.26	ex	-12.88	Result excluded for statistical calculations, ratio used 1/2500
2310	ISO105 E04	115		-2.54	
2358	ISO105 E04	122.4		-1.86	
2359	ISO105 E04	120.5		-2.03	
2363	ISO105 E04	126.3		-1.49	
2365	ISO105 E04	127.8		-1.36	
2370	ISO105 E04	124		-1.71	
2372	ISO105 E04	116		-2.45	
2375	ISO105 E04	123.6		-1.74	
2379	ISO105 E04	128.1		-1.33	
2380	ISO105 E04	128.00		-1.34	
2385	Oeko-tex 200	121		-1.99	
3117	Oeko-tex 200	150.5		0.74	
3124	ISO105 E04	10.9	G(0.01)	-12.17	
3126		----		----	
3145	In house	184.9		3.93	
3153	ISO105 E04	159.3		1.56	
3154		----		----	
3159	ISO105 E04	133.30		-0.85	
3160	UNE59511	172.5		2.78	
3163		6.671	G(0.01)	-12.57	
3172	ISO105 E04	135.27		-0.66	
3174	In house	89.9	ex	-4.86	Result excluded for statistical calculations, ratio used 1.5/50
3176	DIN38406	178		3.29	
3185	In house	153.9		1.06	
3190	ISO105 E04	144.4		0.18	
3200	In house	131.8		-0.99	
3209	ISO105 E04	150.0		0.70	
3210	In house	130	ex	-1.15	Result excluded for statistical calculations, ratio used 1/20
3216	ISO105 E04	146.11		0.34	
3218	DIN54020	160.2		1.64	
3220	DIN54020	0.7	G(0.05)	-13.12	
3226		----		----	
3233	Oeko-tex 200	140.3		-0.20	
3237	In house	199.4		5.27	
3240	GB/T 17593.2	145.1		0.25	
	normality	OK			
	n	41			
	outliers	3			
	mean (n)	142.45			
	st.dev. (n)	24.635			
	R(calc.)	68.98			
	R(Horwitz)	30.25			



## Determination of perspired Copper (s/l ratio = 1/50) on sample #0980; results in mg/kg

lab	method	value	mark	z(targ)	remarks
110		----		----	
551	ISO105 E04	32.8		-0.55	
840	ISO105 E04	30.3		-1.32	
2115	Oeko-tex 201	35.0		0.12	
2129	ISO105 E04	43.9		2.87	
2137	ISO105 E04	22.9		-3.60	
2160	In house	47.27		3.90	
2165	ISO105-E04	34.0		-0.18	
2172	DIN38406	33.9		-0.21	
2184	ISO105 E04	36.4		0.56	
2196	Oeko-Tex 200	35.88		0.40	
2197		----		----	
2215	DIN54233	37.02		0.75	
2227		----		----	
2228		----		----	
2241	GB/T 17953.2	31.390		-0.99	
2249	ISO105 E04	19.4		-4.68	
2252	GB/T 17593.2	47.1		3.85	
2256		----		----	
2258		----		----	
2261	GB/T 17953.2	0.41	ex	-10.53	Result excluded for statistical calculations, ratio used 1/2500
2310	ISO105 E04	29.04		-1.71	
2358	ISO105 E04	33.4		-0.37	
2359	ISO105 E04	32.7		-0.58	
2363	ISO105 E04	36.1		0.46	
2365	ISO105 E04	34.4		-0.06	
2370	ISO105 E04	31.7		-0.89	
2372	ISO105 E04	30.5		-1.26	
2375	ISO105 E04	30.5		-1.26	
2379	ISO105 E04	34.2		-0.12	
2380	ISO105 E04	32.60		-0.61	
2385	Oeko-tex 200	33.5		-0.34	
3117	Oeko-tex 200	33.5		-0.34	
3124	ISO105 E04	3.94	G(0.01)	-9.44	
3126		----		----	
3145	In house	50.0	G(0.05)	4.74	
3153	ISO105 E04	29.6		-1.54	
3154	In house	44.5	ex	3.05	Result excluded for statistical calculations, ratio used 1.5/50
3159	ISO105 E04	34.55		-0.01	
3160	UNE59511	41.1		2.00	
3163		0.918	G(0.01)	-10.37	
3172	ISO105 E04	36.54		0.60	
3174	In house	25.26	ex	-2.87	Result excluded for statistical calculations, ratio used 1/20
3176	DIN38406	44		2.90	
3185	In house	30.7		-1.20	
3190	ISO105 E04	34.6		0.00	
3200	In house	32.6		-0.61	
3209	ISO105 E04	45.0		3.20	
3210	In house	30	ex	-1.42	Result excluded for statistical calculations, ratio used 1.5/50
3216	ISO105 E04	34.01		-0.18	
3218	DIN54020	35.1		0.16	
3220	DIN54020	0.2	G(0.05)	-10.59	
3226		----		----	
3233	Oeko-tex 200	30.7		-1.20	
3237	In house	40.41		1.79	
3240	GB/T 17593.2	35.5		0.28	
	normality	not OK			
	n	40			
	outliers	4			
	mean (n)	34.60			
	st.dev. (n)	5.636			
	R(calc.)	15.78			
	R(Horwitz)	9.09			



## Determination of other perspired metals on sample #0979; results in mg/kg

lab	As	Cd	Cr	Co	Pb	Hg	Ni
110	----	----	----	----	----	----	----
551	----	----	----	----	----	----	----
840	----	----	----	----	----	----	----
2115	0.028	----	----	2.30	0.37	----	0.13
2129	----	----	----	----	----	----	----
2137	----	----	----	----	----	----	----
2160	----	----	----	----	----	----	----
2165	----	----	----	----	----	----	----
2172	----	----	----	----	----	----	----
2184	----	----	----	----	----	----	----
2196	0.32	0.30	0.60	0.23	0.13	0.25	0.85
2197	----	----	----	----	----	----	----
2215	----	----	----	----	----	----	----
2227	----	----	----	----	----	----	----
2228	----	----	----	----	2.3	----	----
2241	----	----	----	----	----	----	----
2249	----	----	----	----	----	----	----
2252	0.38	0.30	0.26	0.30	0.67	0.19	0.55
2256	----	----	----	----	----	----	----
2258	----	----	----	----	----	----	----
2261	----	----	----	----	----	----	----
2310	----	----	----	----	----	----	----
2358	----	----	----	----	----	----	----
2359	----	----	----	----	----	----	----
2363	----	----	----	----	----	----	----
2365	----	----	----	----	----	----	----
2370	----	----	----	----	----	----	----
2372	----	----	----	----	----	----	----
2375	----	----	----	----	----	----	----
2379	----	----	----	----	----	----	----
2380	----	----	----	----	----	----	----
2385	----	----	----	----	----	----	----
3117	----	----	----	----	----	----	----
3124	----	----	----	----	----	----	----
3126	----	----	----	----	----	----	----
3145	----	0.04	----	----	0.03	----	0.36
3153	----	0.08	----	----	----	----	----
3154	----	----	----	----	----	----	----
3159	----	----	----	----	----	----	----
3160	----	----	----	----	----	----	----
3163	0.007	0.082	0.026	----	----	----	0.011
3172	0.002	0.007	0.028	0.015	0.127	0.0019	0.164
3174	----	----	----	----	----	----	----
3176	----	----	----	----	----	----	----
3185	----	----	----	----	----	----	----
3190	----	----	----	----	----	----	----
3200	----	----	----	----	----	----	----
3209	----	----	----	----	----	----	----
3210	----	----	----	----	----	----	----
3216	----	----	----	----	----	----	0.07
3218	----	----	----	----	----	----	----
3220	----	----	0.5	----	----	----	----
3226	----	----	----	----	----	----	----
3233	0.1	0.3	0.3	----	1.9	----	0.1
3237	----	----	----	----	----	----	----
3240	----	----	----	----	----	----	----

## Determination of other perspired metals on sample #0980; results in mg/kg

lab	As	Sb	Cd	Cr	Co	Pb	Hg	Ni
110	----	----	----	----	----	----	----	----
551	----	----	----	----	----	----	----	----
840	----	----	----	----	----	----	----	----
2115	0.051	0.09	----	0.10	0.17	0.27	----	0.23
2129	----	----	----	----	----	----	----	----
2137	----	----	----	----	----	----	----	----
2160	----	----	----	----	----	----	----	----
2165	----	----	----	----	----	----	----	----
2172	----	----	----	----	----	----	----	----
2184	----	----	----	----	----	----	----	----
2196	0.56	1.05	0.30	0.49	0.26	0.16	0.25	1.07
2197	----	----	----	----	----	----	----	----
2215	----	----	----	----	----	----	----	----
2227	----	----	----	----	----	----	----	----
2228	----	----	----	0.2	----	1.3	----	----
2241	----	----	----	----	----	----	----	----
2249	----	----	----	----	----	----	----	0.13
2252	0.34	1.95	0.27	0.24	0.24	0.25	0.62	0.40
2256	----	----	----	----	----	----	----	----
2258	----	----	----	----	----	----	----	----
2261	----	----	----	----	----	----	----	----
2310	----	----	----	----	----	----	----	----
2358	----	----	----	----	----	----	----	----
2359	----	----	----	----	----	----	----	----
2363	----	----	----	----	----	----	----	----
2365	----	----	----	----	----	----	----	----
2370	----	----	----	----	----	----	----	----
2372	----	----	----	----	----	----	----	----
2375	----	----	----	----	----	----	----	----
2379	----	----	----	----	----	----	----	----
2380	----	----	----	----	----	----	----	----
2385	----	----	----	----	----	----	----	----
3117	----	----	----	----	----	----	----	----
3124	----	----	----	----	----	----	----	----
3126	----	----	----	----	----	----	----	----
3145	----	2.9	----	----	----	0.03	----	0.19
3153	----	----	----	----	----	----	----	----
3154	----	----	----	----	----	----	----	----
3159	----	----	----	----	----	----	----	----
3160	----	----	----	2.5	----	----	----	----
3163	----	----	0.003	0.427	0.003	0.028	----	0.031
3172	0.002	0.054	0.003	0.044	0.006	0.063	0.0002	0.139
3174	----	----	----	----	----	----	0.04	----
3176	----	----	----	0.3	0.11	0.1	----	0.3
3185	----	----	----	----	----	----	----	----
3190	----	----	----	----	----	----	----	----
3200	----	----	----	----	----	----	----	----
3209	----	----	----	----	----	----	----	----
3210	----	----	----	----	----	----	----	----
3216	----	----	----	----	----	----	----	0.10
3218	----	----	----	----	----	----	----	----
3220	----	----	----	0.8	----	----	----	----
3226	----	----	----	----	----	----	----	----
3233	0.1	0.1	0.2	0.2	----	0.4	----	0.1
3237	----	----	----	----	----	----	----	----
3240	----	----	----	----	----	----	----	----

**APPENDIX 2****Number of participants in alphabetic country order:**

1 laboratory in	BANGLADESH
1 laboratory in	BRASIL
1 laboratory in	DENMARK
2 laboratories in	FRANCE
5 laboratories in	GERMANY
1 laboratory in	GUATEMALA
4 laboratories in	HONG KONG
2 laboratories in	INDIA
3 laboratories in	ITALY
1 laboratory in	KOREA
1 laboratory in	MEXICO
19 laboratories in	P.R. of CHINA
2 laboratories in	SPAIN
2 laboratories in	TAIWAN R.O.C.
2 laboratories in	THAILAND
2 laboratories in	THE NETHERLANDS
4 laboratories in	TURKEY
2 laboratories in	U.S.A.
1 laboratory in	VIETNAM

## APPENDIX 3

### Abbreviations:

C	= final result after checking of first reported suspect result
D(0.01)	= outlier in Dixon's outlier test
D(0.05)	= straggler in Dixon's outlier test
G(0.01)	= outlier in Grubbs' outlier test
G(0.05)	= straggler in Grubbs' outlier test
DG(0.01)	= outlier in Double Grubbs' outlier test
DG(0.05)	= straggler in Double Grubbs' outlier test
n.a.	= not applicable
n.d.	= not detected
n.r.	= not reported

### Literature:

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