# Results of Proficiency Test
# AZO dyes in leather
# March 2019


Organised by: Institute for Interlaboratory Studies
Spijkenisse, the Netherlands

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**CONTENTS**

# 1 INTRODUCTION

Since 1997, the Institute for Interlaboratory Studies (iis) organizes a proficiency test for banned AZO dyes in leather. During the annual proficiency testing program 2018/2019, it was decided to continue the proficiency test for the analysis of banned AZO dyes in leather. In this interlaboratory study, 121 laboratories in 29 different countries registered for participation. See appendix 4 for the number of participants per country. In this report, the results of the 2019 Azo dyes in leather proficiency test are presented and discussed. This report is also electronically available through the iis website www.iisnl.com.

# 2 SET UP

The Institute for Interlaboratory Studies (iis) in Spijkenisse was the organizer of this proficiency test. Sample analyzes for fit-for-use and homogeneity testing were subcontracted to an ISO/IEC 17025 accredited laboratory. Due to lack of a sufficient amount of suitable materials it was decided to send in this proficiency test only one leather sample of 3.5 grams, positive on banned AZO dyes and labelled #19522.
The participants were requested to report rounded and unrounded test results. The unrounded test results were preferably used for statistical evaluation.

## 2.1 ACCREDITATION

The Institute for Interlaboratory Studies in Spijkenisse, the Netherlands, is accredited in agreement with ISO/IEC 17043:2010 (R007), since January 2000, by the Dutch Accreditation Council (Raad voor Accreditatie). This PT falls under the accredited scope. This ensures strict adherence to protocols for sample preparation and statistical evaluation and 100% confidentiality of participant's data. Feedback from the participants on the reported data is encouraged and customer's satisfaction is measured on regular basis by sending out questionnaires

## 2.2 PROTOCOL

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

## 2.3 CONFIDENTIALITY STATEMENT

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

## 2.4 SAMPLES

A batch of black colored leather was made positive on a banned AZO-dye by a third party laboratory. The leather material was cut into small pieces and mixed thoroughly. In total 150 bags with 3.5 grams each material were filled and labelled #19522. The homogeneity of the subsamples was checked using an in-house test method on eight stratified randomly selected samples. See the following table for the test results.

| | 3,3'-Dimethoxybenzidine in mg/kg |
|---|---|
| sample #19522-1 | 38.9 |
| sample #19522-2 | 38.9 |
| sample #19522-3 | 41.3 |
| sample #19522-4 | 37.6 |
| sample #19522-5 | 41.8 |
| sample #19522-6 | 42.6 |
| sample #19522-7 | 43.8 |
| sample #19522-8 | 40.9 |

Table 1: homogeneity test results of subsamples #19522

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

| | 3,3'-dimethoxybenzidine in mg/kg |
|---|---|
| r (observed) | 5.9 |
| reference test method | ISO17234-1:2015 |
| r (reference test method) | 11.6 |

Table 2: evaluation of the repeatability of subsamples #19522

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

To each of the participating laboratories, one sample labelled #19522, containing approximately 3.5 grams leather, was sent on March 6, 2019.

## 2.5 ANALYSES

The participants were asked to determine the concentrations of 23 forbidden aromatic amines and 2,5-Xylidene and Total Xylidines (except for 4-aminoazobenzene, CAS no. 60-09-3), applying the analysis procedure that is routinely used in the laboratory. It was also requested to report if the laboratory was accredited for the determined components.

It was explicitly requested to treat the sample as if it was a routine sample, but not to age or to dry the sample. It was also requested to report the test results using the indicated units on the report form and not to round the test results, but to report as much significant figures as possible. It was also requested not to report ‘less than’ test results, which are above the detection limit, because such test results cannot be used for meaningful statistical evaluations.

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

# 3 RESULTS

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

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

### 3.1 STATISTICS

The protocol followed in the organization of this proficiency test was the one as described for proficiency testing in the report 'iis Interlaboratory Studies: Protocol for the Organisation, Statistics and Evaluation' of June 2018 (iis-protocol, version 3.5).
For the statistical evaluation, the *unrounded* (when available) figures were used instead of the rounded test results. Test results reported as '<...' or '>...' were not used in the statistical evaluation.

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

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

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

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

### 3.2 GRAPHICS

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

Furthermore, Kernel Density Graphs were made. The Kernel Density Graph is a method for producing a smooth density approximation to a set of data that avoids some problems associated with histograms. Also, a normal Gauss curve was projected over the Kernel Density Graph for reference.

### 3.3 Z-SCORES

To evaluate the performance of the participating laboratories the z-scores were calculated. As it was decided to evaluate the performance of the participants in this proficiency test (PT) against the literature requirements, e.g. ISO reproducibilities, the z-scores were calculated using a target standard deviation. This results in an evaluation independent of the variation in this interlaboratory study.
The target standard deviation was calculated from the literature reproducibility by division with 2.8. In general when no literature reproducibility is available, another target may be used, like Horwitz or an estimated reproducibility based on former iis proficiency tests.

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

The z-scores were calculated in accordance with:

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

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

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

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

# 4 EVALUATION

During the execution of this proficiency test some reporting problems occurred. Five participants reported test results after the deadline and four other participants did not report any test results at all. In total, 117 participants did report 117 numerical test results. Observed were 3 outlying test results, which is 2.6% of the numerical test results. In proficiency studies, outlier percentages of 3% - 7.5% are quite normal.

The test data set for 3,3'-Dimethoxybenzidine appeared to be normally distributed.

## 4.1 EVALUATION PER COMPONENT

In this section, the test results are discussed per component. All statistical results reported for 3,3'-Dimethoxybenzidine are listed in appendix 1. The abbreviations used in this table are listed in appendix 5. The target reproducibility for 3,3'-Dimethoxybenzidine is mentioned in table B.1 of test method ISO 17234-1:2015.

3,3'-Dimethoxybenzidine (CASno. 119-90-4):

The determination of this aromatic amine at a concentration level of 45 mg/kg was problematic. Three statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is not in agreement with the requirements of method ISO 17234-1:2015.

The reported test results of all other aromatic amines are listed in appendix 2.

## 4.2 PERFORMANCE EVALUATION FOR THE GROUP OF LABORATORIES

A comparison has been made between the reproducibility as declared by the relevant reference test method and the reproducibility as found for the group of participating laboratories. The number of significant test results, the average result, the calculated reproducibility (2.8 * standard deviation) and the target reproducibility, derived from the official test method ISO17234-1:2015 (equal to the reproducibility from LMBG 82.02.3:97) are presented in the next table.

| Component | unit | n | average | 2.8 * sd | R(target) |
|---|---|---|---|---|---|
| 3,3'-Dimethoxybenzidine | mg/kg | 114 | 45.0 | 28.5 | 18.7 |

Table 3: reproducibility of the aromatic amine in leather sample #19522

Without further statistical calculations, it can be concluded that the group of participating laboratories has a problem with the analysis of 3,3'-Dimethoxybenzidine in leather at this level.

### 4.3 COMPARISON OF THE PROFICIENCY TEST OF MARCH 2019 WITH PREVIOUS PTS

| | March 2019 | March 2018 | February 2017 | February 2016 | March 2015 |
|---|---|---|---|---|---|
| Number of reporting labs | 117 | 117 | 139 | 113 | 152 |
| Number of results reported | 117 | 116 | 143 | 205 | 147 |
| Number of statistical outliers | 3 | 4 | 7 | 3 | 3 |
| Percentage outliers | 2.6% | 3.4% | 4.9% | 1.4% | 2.0% |

Table 4: comparison with previous proficiency test

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

The performance of the determination of the proficiency test was compared, expressed as relative standard deviation of the PTs, see below table.

| Component | March 2019 | March 2018 | February 2017 | February 2016 | 2005-2015 | ISO17234-1 |
|---|---|---|---|---|---|---|
| 4-Aminodiphenyl | n.e. | n.e. | n.e. | n.e. | 25 - 45% | 15 - 33% |
| Benzidine | n.e. | 20% | 20% | 34% | 20 - 66% | 15 - 25% |
| 3,3'-Dimethoxybenzidine | 23% | n.e. | n.e. | n.e. | n.e. | 15% |
| 3,3'-Dimethylbenzidine | n.e. | n.e. | n.e. | 39% | 24 - 55% | 17 - 24% |
| *o*-Toluidine | n.e. | n.e. | n.e. | 37% | 50 - 63% | 30 - 37% |
| 2,4-Xylidine | n.e. | n.e. | n.e. | n.e. | 16 - 36% | 15 - 33% |

Table 5: development of the uncertainties over the years

Components not listed in table 5 have not been tested in an iis PT.

### 4.4 EVALUATION ANALYTICAL DETAILS

For this PT, only one question was requested: Is your laboratory accredited in accordance with ISO/IEC17025? Ninety-eight of the registered participants mentioned that they are accredited for determination of banned AZO-dyes in leather. Eleven participants mentioned that they are not accredited. No effect was observed on the average 3,3'-Dimethoxy-benzidine or variation between reported test results.

## 5 DISCUSSION

All reporting participants were able to detect in 3,3'-Dimethoxybenzidine in sample #19522. No other aromatic amines were detected.

When the results of this interlaboratory study were compared to the LEATHER STANDARD by OEKO-TEX and with the similar bluesign® systems substances list or BSSL (Table 6), it was noticed that nearly all participants would make an identical decision about the acceptability of the textiles for the determined components. For sample #19522, all reporting laboratories except one would have rejected the sample for all categories.

| Ecolabel | baby clothes | in direct skin contact | no direct skin contact |
|---|---|---|---|
| bluesign® BSSL | <20 mg/kg | <20 mg/kg | <20 mg/kg |
| LEATHER by OEKO-TEX | <20 mg/kg | <20 mg/kg | <20 mg/kg |

Table 6: Bluesign® BSSL and LEATHER STANDARD by OEKO-TEX

## 6 CONCLUSION

Although, it can be concluded that some of the participants have a problem with the determination of 3,3'-Dimethoxybenzidine in the sample of this PT, each participating laboratory will have to evaluate its performance in this study and decide about any corrective actions if necessary.
Therefore, participation on a regular basis in this scheme could be helpful to improve the performance and thus increase of the quality of the analytical results.

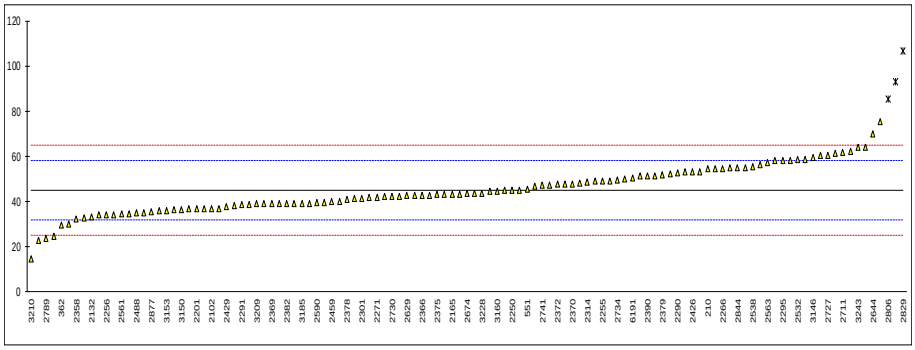
## APPENDIX 1

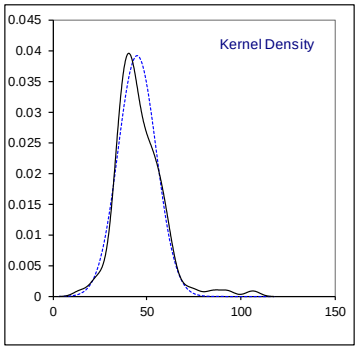
Determination of 3,3'-Dimethoxybenzidine (CAS no. 119-90-4) in sample #19522; results in mg/kg

| lab | method | value | mark | z(targ) | remarks |
|---|---|---|---|---|---|
| 210 | ISO17234-1 | 54.4 | | 1.41 | |
| 230 | ISO17234-1 | 58.7 | C | 2.06 | first reported: 94.6 |
| 339 | | ----- | | ----- | |
| 348 | In house | 48.10 | | 0.47 | |
| 362 | | 29.5 | | -2.32 | |
| 551 | In house | 45.4677 | | 0.08 | |
| 623 | ISO17234-1 | 61.20 | | 2.43 | |
| 2102 | ISO17234-1 | 36.89 | | -1.21 | |
| 2115 | ISO17234-1 | 44.84 | | -0.02 | |
| 2132 | ISO17234-1 | 33.29 | | -1.75 | |
| 2139 | ISO17234-1 | 32.52 | | -1.86 | |
| 2165 | ISO17234-1 | 43.2 | | -0.26 | |
| 2184 | ISO17234-1 | 42.4 | | -0.38 | |
| 2201 | EN14362-1 | 36.65 | | -1.25 | |
| 2213 | ISO17234-1 | 62 | | 2.55 | |
| 2247 | ISO17234-1 | 57.92 | | 1.94 | |
| 2250 | ISO17234-1 | 45 | | 0.01 | |
| 2255 | ISO17234-1 | 49.12 | | 0.62 | |
| 2256 | ISO17234-1 | 34.2 | | -1.61 | |
| 2266 | EN14362-1 | 54.6 | | 1.44 | |
| 2271 | ISO17234-1 | 41.9 | | -0.46 | |
| 2289 | ISO17234-1 | 39 | | -0.89 | |
| 2290 | ISO17234-1 | 52.5 | | 1.13 | |
| 2291 | ISO17234-1 | 38.5 | | -0.97 | |
| 2293 | EN14362-1 | 36.634 | | -1.25 | |
| 2295 | ISO17234-1 | 58 | | 1.95 | |
| 2301 | ISO17234-1 | 41.54 | | -0.51 | |
| 2310 | ISO17234-1 | 51.21 | | 0.94 | |
| 2311 | ISO17234-1 | 53.22 | | 1.24 | |
| 2314 | ISO17234-1 | 48.66 | | 0.55 | |
| 2330 | ISO17234-1 | 56.20 | | 1.68 | |
| 2347 | ISO17234-1 | 39 | | -0.89 | |
| 2350 | ISO17234-1 | 46.9932 | | 0.30 | |
| 2352 | ISO17234-1 | 39.6 | | -0.80 | |
| 2357 | ISO17234-1 | 41.4 | | -0.53 | |
| 2358 | ISO17234-1 | 32.5021 | | -1.87 | |
| 2364 | ISO17234-1 | 42.91 | | -0.31 | |
| 2365 | ISO17234-1 | 39.20 | | -0.86 | |
| 2366 | ISO17234-1 | 42.8 | | -0.32 | |
| 2367 | ISO17234-1 | 44.32 | | -0.10 | |
| 2369 | ISO17234-1 | 39 | | -0.89 | |
| 2370 | ISO17234-1 | 47.8 | | 0.42 | |
| 2372 | EN14362-1 | 47.50 | | 0.38 | |
| 2373 | ISO17234-1 | 42.7 | | -0.34 | |
| 2375 | ISO17234-1 | 43 | | -0.29 | |
| 2378 | GB/T19942 | 40.7 | | -0.64 | |
| 2379 | ISO17234-1 | 51.816 | C | 1.03 | first reported: 111.09 |
| 2380 | ISO17234-1 | 45.158 | | 0.03 | |
| 2381 | ISO17234-1 | 47.50 | | 0.38 | |
| 2382 | ISO17234-1 | 39.0 | | -0.89 | |
| 2386 | ISO17234-1 | 51.5 | | 0.98 | |
| 2390 | ISO17234-1 | 51.27 | | 0.94 | |
| 2410 | ISO17234-1 | 49.8 | | 0.72 | |
| 2415 | ISO17234-1 | 52.19 | | 1.08 | |
| 2426 | ISO17234-1 | 53.12 | | 1.22 | |
| 2429 | ISO17234-1 | 37.93 | | -1.05 | |
| 2432 | | ----- | | ----- | |
| 2442 | ISO17234-1 | 34.59 | | -1.55 | |
| 2449 | ISO17234-1 | 38.633 | | -0.95 | |
| 2455 | ISO17234-1 | 75.43 | | 4.56 | |
| 2459 | ISO17234-1 | 39.96 | C | -0.75 | first reported: 70.14 |
| 2467 | | ----- | | ----- | |
| 2472 | ISO17234-1 | 34.25 | | -1.61 | |
| 2488 | | 34.796 | | -1.52 | |
| 2489 | ISO17234-1 | 58.0 | | 1.95 | |
| 2492 | ISO17234-1 | 37 | | -1.19 | |
| 2495 | ISO17234-1 | 49.03 | | 0.61 | |
| 2497 | ISO17234-1 | 34.88 | | -1.51 | |
| 2504 | ISO17234-1 | 24.56 | | -3.06 | |
| 2511 | ISO17234-1 | 55.03 | | 1.51 | |
| 2514 | ISO17234-1 | 43.0 | | -0.29 | |
| 2532 | ISO14362-1 | 58.46 | | 2.02 | |
| 2538 | ISO14362-1 | 55.54 | | 1.58 | |

| lab | method | value | mark | z(targ) | remarks |
|---|---|---|---|---|---|
| 2561 | ISO17234-1 | 34.5 | | -1.57 | |
| 2563 | ISO17234-1 | 57 | | 1.80 | |
| 2565 | ISO17234-1 | 47.46 | | 0.37 | |
| 2572 | ISO17234-1 | 55.1 | | 1.52 | |
| 2590 | ISO17234-1 | 39.438 | | -0.83 | |
| 2592 | ISO17234-1 | 53.0 | C | 1.20 | first reported: 19.0 |
| 2629 | ISO17234-1 | 42.5 | C | -0.37 | first reported: 73.1 |
| 2643 | ISO17234-1 | 41.609 | | -0.50 | |
| 2644 | ISO17234-1 | 70 | C | 3.75 | first reported 92.10 |
| 2674 | ISO17234-1 | 43.4 | | -0.23 | |
| 2695 | ISO17234-1 | 92.994 | R(0.01) | 7.20 | |
| 2711 | ISO17234-1 | 61.75 | | 2.52 | |
| 2727 | ISO17234-1 | 60.521 | | 2.33 | |
| 2730 | ISO17234-1 | 42.285 | | -0.40 | |
| 2734 | ISO17234-1 | 49.282 | C | 0.65 | first reported: 117.564 |
| 2741 | ISO17234-1 | 47.2 | | 0.33 | |
| 2756 | | ----- | | ----- | |
| 2789 | ISO17234-1 | 23.50 | | -3.22 | |
| 2791 | ISO17234-1 | 54.52 | C | 1.43 | first reported: 94.52 |
| 2798 | ISO17234-1 | 43.2 | | -0.26 | |
| 2804 | ISO17234-1 | 34.0 | | -1.64 | |
| 2806 | ISO17234-1 | 85.3 | R(0.05) | 6.04 | |
| 2810 | ISO17234-1 | 42.214 | | -0.41 | |
| 2812 | ISO17234-1 | 35.92 | | -1.36 | |
| 2823 | ISO17234-1 | 22.584 | C | -3.35 | first reported: N/A |
| 2829 | ISO17234-1 | 106.56 | R(0.01) | 9.23 | |
| 2844 | ISO17234-1 | 55.03 | | 1.51 | |
| 2877 | ISO17234-1 | 35.6572 | | -1.39 | |
| 3100 | ISO17234-1 | 40.20 | | -0.71 | |
| 3116 | ISO17234-1 | 36.40 | | -1.28 | |
| 3146 | ISO17234-1 | 59.67 | | 2.20 | |
| 3150 | ISO17234-1 | 36.45 | | -1.28 | |
| 3153 | ISO17234-1 | 36.1 | | -1.33 | |
| 3154 | ISO17234-1 | 29.85 | | -2.26 | |
| 3160 | ISO17234-1 | 44.37 | | -0.09 | |
| 3172 | ISO14362-1 | 64.23 | | 2.89 | |
| 3185 | ISO17234-1 | 39.07 | | -0.88 | |
| 3190 | ISO17234-1 | 38.3 | | -1.00 | |
| 3197 | ISO17234-1 | 49.2 | | 0.63 | |
| 3200 | ISO14362-1 | 60.2 | | 2.28 | |
| 3209 | ISO17234-1 | 38.94 | | -0.90 | |
| 3210 | ISO17234-1 | 14.71 | | -4.53 | |
| 3214 | EN14362-1 | 43.46 | | -0.23 | |
| 3228 | ISO17234-1 | 43.8 | | -0.17 | |
| 3237 | ISO17234-1 | 36.7 | | -1.24 | |
| 3243 | ISO17234-1 | 64.05 | | 2.86 | |
| 3248 | EN14362-1 | 39 | | -0.89 | |
| 6191 | In house | 50.4 | C | 0.81 | first reported: 16.2 |

| | | | |
|---|---|---|---|
| | normality | OK | |
| | n | 114 | |
| | outliers | 3 | |
| | mean (n) | 44.9649 | |
| | st.dev. (n) | 10.18218 | RSD = 23% |
| | R(calc.) | 28.5101 | |
| | st.dev.(ISO17234-1:2015) | 6.67383 | |
| | R(ISO17234-1:2015) | 18.6867 | |





# APPENDIX 2

## Other reported aromatic amines in sample #19522

## Abbreviations of amine names as used in appendix 2:

4AD = 4-Aminodiphenyl (CASno. 92-67-1)
B = Benzidine (CASno. 92-87-5)
4CoT = 4-Chloro-o-toluidine (CASno. 95-69-2)
2NA = 2-Naphtylamine (CASno. 91-59-8)
oAAT = o-Aminoazotoluene (CASno. 97-56-3)
ANT = 2-Amino-4-nitrotoluene (CASno. 99-55-8)
4CA = 4-Chloraniline (CASno. 106-47-8)
DAA = 2,4-Diaminoanisol (CASno. 615-05-4)
DADM = 4,4'-Diaminodiphenyl methane (CASno. 101-77-9)
DCB = 3,3'-Dichlorobenzidine (CASno. 91-94-1)
DMoxB = 3,3'-Dimethoxybenzidine (CASno. 119-90-4)
DMB = 3,3'-Dimethylbenzidine (Casno. 119-93-7)
DDDM = 3,3'-Dimethyl-4,4'-Diaminodiphenyl methane (CASno. 838-88-0)
pC = p-Cresidine (CASno. 120-71-8)
DDM = 4,4'-Diamino-3,3'-dichlorodiphenyl methane (CASno. 101-14-4)
DDE = 4,4'-Diaminodiphenyl ether (CASno. 101-80-4)
DDS = 4,4'-Diaminodiphenyl sulphide (CASno. 139-65-1)
oT = o-Toluidine (CASno. 95-53-4)
24DAT = 2,4-Diaminotoluene (CASno. 95-80-7)
TMA = 2,4,5-Trimethylaniline (CASno. 137-17-7)
oA = o-Anisidine (CASno. 90-04-0)
24X = 2,4-Xylidine (CASno. 95-68-1)
25X = 2,5-Xylidine (CASno. 95-78-3)
26X = 2,6-Xylidine (CASno. 87-62-7)
TX = Total of Xylidines

**Other reported aromatic amines in sample #19522, see abbreviations on page 13**

| Lab | 4AD | B | 4CoT | 2NA | oAAT | ANT | 4CA | DAA | DADM | DCB | DMB | DDDM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 210 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 230 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 339 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 348 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 362 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 551 | N.D. | N.D. | N.D. | N.D. | N.D. | N.D. | N.D. | N.D. | N.D. | N.D. | N.D. | N.D. |
| 623 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2102 | ----- | 1.15 | ----- | 1.22 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2115 | ----- | 1.61 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2132 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2139 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2165 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2184 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2201 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2213 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2247 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2250 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2255 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| 2256 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2266 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2271 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2289 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2290 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2291 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2293 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2295 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2301 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2310 | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. |
| 2311 | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. |
| 2314 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2330 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2347 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2350 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2352 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2357 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2358 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2364 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2365 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2366 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2367 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2369 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2370 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2372 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2373 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2375 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2378 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2379 | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. |
| 2380 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2381 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2382 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2386 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2390 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2410 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2415 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2426 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2429 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2432 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2442 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2449 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2455 | <30 | <30 | <30 | <30 | <30 | <30 | <30 | <30 | <30 | <30 | <30 | <30 |
| 2459 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2467 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2472 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2488 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2489 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2492 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2495 | <5 | <5 | <5 | <5 | ----- | ----- | <5 | <5 | <5 | <5 | <5 | <5 |
| 2497 | ----- | 1.06 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2504 | ND | <10 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2511 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2514 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2532 | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. |
| 2538 | < 10 | < 10 | < 10 | <10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 |
| 2561 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 |

| Lab | 4AD | B | 4CoT | 2NA | oAAT | ANT | 4CA | DAA | DADM | DCB | DMB | DDDM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2563 | < 1 | 2.6 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2565 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2572 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2590 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2592 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 |
| 2629 | Nd | Nd | Nd | Nd | Nd | Nd | Nd | Nd | Nd | Nd | Nd | Nd |
| 2643 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2644 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2674 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2695 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2711 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2727 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2730 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2734 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| 2741 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2756 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2789 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2791 | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. |
| 2798 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2804 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2806 | ----- | 3.1 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.8 | 2.5 |
| 2810 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2812 | ----- | 1.11 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2823 | N/A | N/A | N/A | 0.643 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 2829 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2844 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 |
| 2877 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 3100 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 3116 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 3146 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 3150 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 3153 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 3154 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 3160 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 3172 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 |
| 3185 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 3190 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 3197 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 3200 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 3209 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 3210 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 3214 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 3228 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| 3237 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 3243 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| 3248 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 6191 | 0 | 0 | 0 | 0.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## Other aromatic amines in sample #19522, continued, see abbreviations

| Lab | pC | DDM | DDE | DDS | oT | 24DAT | TMA | oA | 24X | 25X | 26X | TX |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 210 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 230 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 339 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 348 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 362 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 551 | N.D. | N.D. | N.D. | N.D. | N.D. | N.D. | N.D. | N.D. | N.D. | ----- | N.D. | ----- |
| 623 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2102 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2115 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2132 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2139 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2165 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | ----- | n.d. | ----- |
| 2184 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | ----- | n.d. | ----- |
| 2201 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2213 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2247 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2250 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2255 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| 2256 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2266 | 0 | 0 | 0 | 0 | 1.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2271 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2289 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2290 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2291 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2293 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ----- | ND | ND |
| 2295 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2301 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2310 | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | ----- | Not det. | ----- |
| 2311 | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. |
| 2314 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2330 | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA | ND | ----- |
| 2347 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2350 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2352 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2357 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2358 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | N/A | n.d. | N/A |
| 2364 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2365 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | ----- | <5 | ----- |
| 2366 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2367 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2369 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | ----- | <5 | <5 |
| 2370 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2372 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2373 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2375 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2378 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2379 | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not test. | Not det. | Not test. |
| 2380 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2381 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2382 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2386 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2390 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2410 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2415 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2426 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2429 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2432 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2442 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ----- | ----- | ----- |
| 2449 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2455 | <30 | <30 | <30 | <30 | <30 | <30 | <30 | <30 | <30 | <30 | <30 | <30 |
| 2459 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2467 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2472 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | ----- | <5 | ----- |
| 2488 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2489 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2492 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2495 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | ----- | <5 | ----- |
| 2497 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2504 | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA | ND | NA |
| 2511 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2514 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2532 | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. |
| 2538 | < 10 | < 10 | < 10 | < 10 | < 10 | <10 | < 10 | < 10 | < 10 | ----- | < 10 | ----- |
| 2561 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 |

| Lab | pC | DDM | DDE | DDS | oT | 24DAT | TMA | oA | 24X | 25X | 26X | TX |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2563 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2565 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | ----- | <5 | ----- |
| 2572 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2590 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2592 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | ----- | < 5 | < 5 |
| 2629 | Nd | Nd | Nd | Nd | Nd | Nd | Nd | Nd | Nd | Nd | Nd | Nd |
| 2643 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2644 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2674 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | ----- | n.d. | ----- |
| 2695 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2711 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2727 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 2730 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2734 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| 2741 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | ----- | <5 | <5 |
| 2756 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2789 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2791 | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. | Not det. |
| 2798 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2804 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | ----- | ----- | ----- | ----- |
| 2806 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2810 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2812 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2823 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 2829 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 2844 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | Not det. | <20 | <20 |
| 2877 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 3100 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | ----- | <5 | ----- |
| 3116 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 3146 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 3150 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 3153 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 3154 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 3160 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 3172 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 |
| 3185 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | ----- | <5 | ----- |
| 3190 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | ----- | <5 | <5 |
| 3197 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 3200 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | ----- | <5 | ----- |
| 3209 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 3210 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 3214 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| 3228 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | ----- | ----- | ----- |
| 3237 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 3243 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| 3248 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 6191 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## APPENDIX 3

## Accreditation

| labnrs | ISO/IEC 17025 accredited | labnrs | ISO/IEC 17025 accredited |
|---|---|---|---|
| 210 | Yes | 2467 | --- |
| 230 | Yes | 2472 | Yes |
| 339 | --- | 2488 | --- |
| 348 | Yes | 2489 | Yes |
| 362 | --- | 2492 | Yes |
| 551 | Yes | 2495 | Yes |
| 623 | Yes | 2497 | Yes |
| 2102 | Yes | 2504 | Yes |
| 2115 | Yes | 2511 | --- |
| 2132 | Yes | 2514 | Yes |
| 2139 | Yes | 2532 | Yes |
| 2165 | Yes | 2538 | Yes |
| 2184 | Yes | 2561 | Yes |
| 2201 | Yes | 2563 | Yes |
| 2213 | Yes | 2565 | Yes |
| 2247 | Yes | 2572 | --- |
| 2250 | Yes | 2590 | Yes |
| 2255 | Yes | 2592 | Yes |
| 2256 | Yes | 2629 | Yes |
| 2266 | Yes | 2643 | Yes |
| 2271 | Yes | 2644 | No |
| 2289 | Yes | 2674 | Yes |
| 2290 | Yes | 2695 | Yes |
| 2291 | Yes | 2711 | No |
| 2293 | No | 2727 | Yes |
| 2295 | Yes | 2730 | No |
| 2301 | Yes | 2734 | Yes |
| 2310 | Yes | 2741 | Yes |
| 2311 | Yes | 2756 | --- |
| 2314 | Yes | 2789 | Yes |
| 2330 | Yes | 2791 | Yes |
| 2347 | --- | 2798 | Yes |
| 2350 | Yes | 2804 | No |
| 2352 | Yes | 2806 | No |
| 2357 | Yes | 2810 | Yes |
| 2358 | Yes | 2812 | Yes |
| 2364 | Yes | 2823 | Yes |
| 2365 | Yes | 2829 | No |
| 2366 | Yes | 2844 | No |
| 2367 | --- | 2877 | No |
| 2369 | Yes | 3100 | Yes |
| 2370 | Yes | 3116 | Yes |
| 2372 | Yes | 3146 | Yes |
| 2373 | Yes | 3150 | Yes |
| 2375 | Yes | 3153 | Yes |
| 2378 | Yes | 3154 | --- |
| 2379 | Yes | 3160 | No |
| 2380 | Yes | 3172 | Yes |
| 2381 | Yes | 3185 | Yes |
| 2382 | Yes | 3190 | Yes |
| 2386 | Yes | 3197 | Yes |
| 2390 | Yes | 3200 | Yes |
| 2410 | Yes | 3209 | Yes |
| 2415 | Yes | 3210 | Yes |
| 2426 | Yes | 3214 | Yes |
| 2429 | Yes | 3228 | Yes |
| 2432 | --- | 3237 | Yes |
| 2442 | Yes | 3243 | Yes |
| 2449 | --- | 3248 | Yes |
| 2455 | Yes | 6191 | No |
| 2459 | Yes | | |

## APPENDIX 4

### Number of participants per country

5 labs in BANGLADESH
1 lab in BRAZIL
1 lab in BULGARIA
1 lab in CAMBODIA
1 lab in ETHIOPIA
5 labs in FRANCE
8 labs in GERMANY
1 lab in GUATEMALA
8 labs in HONG KONG
9 labs in INDIA
2 labs in INDONESIA
13 labs in ITALY
1 lab in JAPAN
4 labs in KOREA
1 lab in MAURITIUS
1 lab in MOROCCO
28 labs in P.R. of CHINA
4 labs in PAKISTAN
1 lab in PORTUGAL
1 lab in ROMANIA
4 labs in SPAIN
3 labs in TAIWAN R.O.C.
2 labs in THAILAND
1 lab in THE NETHERLANDS
1 lab in TUNISIA
6 labs in TURKEY
1 lab in U.S.A.
2 labs in UNITED KINGDOM
5 labs in VIETNAM

## APPENDIX 5

**Abbreviations**:

| | |
|---|---|
| C | = final test result after checking of first reported suspect test result |
| D(0.01) | = outlier in Dixon's outlier test |
| D(0.05) | = straggler in Dixon's outlier test |
| G(0.01) | = outlier in Grubbs' outlier test |
| G(0.05) | = straggler in Grubbs' outlier test |
| DG(0.01) | = outlier in Double Grubbs' outlier test |
| DG(0.05) | = straggler in Double Grubbs' outlier test |
| R(0.01) | = outlier in Rosner's outlier test |
| R(0.05) | = straggler in Rosner's outlier test |
| W | = test result withdrawn on request of participant |
| ex | = test result excluded from statistical evaluation |
| n.a. | = not applicable |
| n.e. | = not evaluated |
| n.d. | = not detected |

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