

INTER LABORATORY TESTING SCHEME

ON

"Testing of Chemical parameters in Textile Material"

TC/ILTS/19/CHEM-4/2015

Designed and Conducted by



**Proficiency Testing Provider
Laboratories**

TEXTILES COMMITTEE

Ministry of Textiles, Government of India

P. Balu Road, Prabhadevi Chowk,

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2015

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SCHEME :INTER LABORATORY TESTING SCHEME -TC/ILTS/019/CHEM-4/2015 - Testing of Chemical parameters in Textile Materials

DATE OF ISSUE: 19th February 2016

CONFIDENTIALITY :

All the information furnished by the participant laboratories shall be kept confidential by the PT Provider and the same shall not be revealed to others. However, if the accrediting body, for example NABL, requests the PT provider to furnish the performance of any of the participant laboratories, the same shall be provided to them directly, after obtaining permission of the concerned participant laboratory

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Disclaimer: The PT Schemes are meant for evaluation of performance of the participating laboratory for the specified tests undertaken in the programme only and are voluntary in nature. Further, it is clarified that reasonable care has been taken to meet the requirement of ISO/IEC 17043:2010, while designing and conducting the Schemes. Participating laboratories are expected to exercise due diligence while carrying out the tests and meet all safety, statutory and accreditation body's requirements. PT Provider and Textiles Committee will not be responsible for any claim/damages arising out of participating in this programme

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Report on Inter Laboratory Testing Scheme

Preamble:

Increasing awareness on textile quality and the buyer requirements are forcing textile manufacturers and traders to test quality of textile products from reputed laboratories. Reputation of any laboratory depends upon the result it produces. The test report given by any laboratory should be precise, accurate, repeatable and reproducible. This means, a set of results obtained within a laboratory by testing a representative sample at any time interval should be comparable. And also, the result obtained over testing a representative sample in any laboratory should be comparable with that of any other laboratory and fall within the statistical tolerance limit. In other words, the laboratory should be able to generate comparable results by performing the same test

The repeatability and reproducibility of any test result involves the laboratory's competence in conducting the test which involves the testing equipment, the skill and knowledge of technical manpower working in the laboratory, the testing conditions and test method adopted. In this pursuit, the laboratory has to meet a requirement of maintaining its own management system as per ISO/IEC 17025:2005, to participate in Inter Laboratory Comparison (ILC) and/or Inter Laboratory Proficiency Testing Scheme (ILPT)

Inter laboratory Comparison is defined by ISO/IEC 17043 as, Evaluation of participant performance against pre-established criteria by means of inter laboratory comparisons. The goal of the Inter-laboratory Comparisons (ILC) is to provide verification of each participating laboratory's technical capability by obtaining a measurement that agrees with all other Laboratories using different make & model of testing equipment and man-power. The requirement for inter laboratory comparisons remains in place today, and has been further entrenched into metrology management systems by its incorporation in the requirements of ISO/IEC 17025:2005

Textiles Committee:

Textiles Committee is a statutory body under the Ministry of Textiles, Government of India, established in the year 1963 vide an act of parliament. The Committee has set up 16 laboratories throughout the country for catering to the testing requirements of the textile trade and industry. Fourteen laboratories of Textiles Committee are accredited as per ISO/IEC 17025:2005 by National Accreditation Board for testing & calibration Laboratories (NABL), India. Laboratory at Mumbai is the first in India to get accredited in the field of Textile Testing. All the laboratories of Textiles Committee have facilities to test mechanical and chemical test parameters. Nine laboratories of Textiles Committee have Eco testing facilities. By virtue of the Act, Textiles Committee develops many test standards and also adopts many national and international standards for testing purpose.



PT-Provider:

The Laboratory, Textiles Committee at Mumbai conducts as PT Provider, Inter Laboratory Proficiency Testing (ILPT) schemes for the benefit of Textile Testing laboratories. The national accreditation agency, NABL nominated laboratory of Textiles Committee at Mumbai, as nodal agency for two ILPT schemes. The German Standards body, *Physikalisch-Technische Bundesanstalt (PTB), Germany* recognized the schemes conducted by Textiles Committee and sponsored some laboratories of SAARC countries under its Quality Infrastructure Development Project (QIDP) in SAARC countries. Apart from India, laboratories from Bangladesh, Sri Lanka, Nepal, China, Hong Kong, Vietnam and USA also participate in the ILPT schemes conducted by Textiles Committee

In order to offer ILPT schemes professionally as a PT Provider, the laboratory of Textiles Committee at Mumbai has implemented the Management System in accordance with the requirements stipulated in ISO/IEC 17043: 2010. The PT Provider has conducted 19 schemes since 2007. The details are given in **Table – 1**

Table – 1 ILPT schemes conducted by the PT Provider

S.No	Identity of the ILPT	Year	Field	PT items	No. of test parameters	No. of participants
1	TC/ILTS/MECH/01/07	2007	Mechanical	Fibre, Yarn & Fabric	17	70
2	TC/ILTS/CHEM/02/07	2007	Chemical	Fabric	13	70
3	TC/ILTS/MECH/03/08	2008	Mechanical	Fabric	11	60
4	TC/ILTS/CHEM/04/08	2008	Chemical	Fabric	10	60
5	TC/ILTS/MECH/05/09	2009	Mechanical	Fabric	11	50
6	TC/ILTS/MECH/06/09	2009	Mechanical	Yarn	12	31
7	TC/ILTS/MECH/07/09	2009	Mechanical	Fibre	15	14
8	TC/ILTS/CHEM/08/09	2009	Chemical	Fabric	7	51
9	TC/ILTS/CHEM/09/09	2009	Chemical	Fabric	4	45
10	TC/ILTS/CHEM/10/09	2009	Chemical	Fabric	2	20
11	TC/ILTS/MECH/11/10-11	2010-11	Mechanical	Fabric	10	65
12	TC/ILTS/CHEM/12/10-11	2010-11	Chemical	Fabric	10	70
13	TC/ILTS/Mech-1/2012-13	2012-13	Mechanical	Yarn&Fabric	13	42
14	TC/ILTS/Chem-1/2012-13	2012-13	Chemical	Fabric and clothing accessory	12	56
15	TC/ILTS/15/Mech-2/2014	2014	Mechanical	Fabric	8	50
16	TC/ILTS/16/Chem-2/2014	2014	Chemical	Fabric	8	45
17	TC/ILTS/17/Mech-3/2015	2015	Mechanical	Cotton Fibre, Sewing Thread	8	24
18	TC/ILTS/18/Chem-3/2015	2015	Chemical	Fabric	9	51
19	TC/ILTS/19/Chem-4/2015	2015	Chemical	Extract and Fabric	2	30



The Present Programme:

Design: In order to assess the reproducibility of the test results being reported by the various textile testing laboratories, this Proficiency Testing Scheme for Chemical testing - TC/ILTS/19/CHEM-4/2015 was designed. The test parameters covered in the present PT Scheme and suggested test methods are given in Table – 2. However, participants were required to use the test method which is routinely adopted for the testing of regular samples. Hence, laboratories could adopt any equivalent standard or validated in-house method which is equivalent to the suggested standards.

Table – 2 : Tests covered in TC/ILTS/19/CHEM-4/2015

S.No	TC / ILTS / 019 / CHEM-4 / 2015	Standards suggested
1	Banned Aryl Amines	IS 15570* or Equivalent
2	Formaldehyde	ISO 14184-1



Advisory Group:

As per the requirements stipulated in ISO/IEC 17043:2010, an **Advisory Group** comprising the following internal and external experts having the necessary expertise in testing of Textiles and/or statistics was constituted

Table – 3 : Constitution of Advisory Group

S.No	Expert	Affiliation	Field of expertise
1	Shri.KartikayDhanda, Director (Laboratories), Textiles Committee, Mumbai –400 025	Chairman	Textile testing
2	Dr.K.S.Muralidhara, Joint Director (Laboratories), Textiles Committee, Mumbai –400 025	Member	Textile testing
3	Shri. S.G. Pathi, Joint Director (Laboratories), Textiles Committee, Mumbai –400 025	Member	Textile testing
4	Shri.K.Selvaraj, Deputy Director (Laboratories), Textiles Committee, Mumbai–400 025 Assessor (ISO/IEC 17025), NABL.	Member	Textile testing
5	Shri. S.P.Singh, Asst. Director (Laboratories), Textiles Committee, Kanpur-208005 Assessor (ISO/IEC 17025), NABL	Member	Textile testing
6	Shri. M.S.Shyamsundar, Quality Assurance Officer, (Laboratories) Textiles Committee, Tirupur–641602, Assessor (ISO/IEC 17025), NABL	Member	Textile testing & Statistics
7	Dr. P.V. Varadarajan Principal Scientific Officer (Rtd), CIRCOT, Mumbai Assessor (ISO/IEC 17025), NABL	External Technical Expert	Textile testing

The terms of reference of the Advisory Group were as follows:

- a) Planning requirements
- b) Identification and resolution of any difficulties expected in the preparation and maintenance of homogeneous proficiency test items, or in the provision of stable assigned value for a proficiency test item;
- c) Preparation of detailed instructions for participants
- d) Comments on any technical difficulties raised by participants
- e) Provision of advice in evaluating the performance of participants
- f) Comments on the results and performance of participants as a whole and, where appropriate, groups of participants or individual participants;
- g) Provision of advice for participants (within limits of confidentiality), either individually or within the report;
- h) Responding to feedback from participants; and
- i) Planning or participating in technical meetings with participants.
- j) Arbitration of any dispute(s) between participating laboratory(ies) and the PT provider



Participants:

In all 30 laboratories were participated in this scheme



Proficiency Test Proceedings:

Design:

- (1) **Amines:** On the basis of acquired experience on Stability and feasibility of homogeneously applied on fabric, of the three banned Amines viz., **4 Aminobiphenyl, Benzidine and 3,3 Dimethylbenzidine** were selected for the scheme. However, due to non availability sufficient length of fabric on which homogeneous presence of these selected Amines, the scheme was designed to evaluate the Analysis Competency of participants in **identifying and quantifying the amines from a given 'extract'**. It is emphasized that the scope of this PT is limited to evaluate the Analysis Competency of participants in identifying and quantifying the amines and does not cover the competency of extraction of amines from fabric/textile material. Though the PT Provider prepared the 'extracts' with known value, evaluation is carried out only on the basis of 'consensus' of participants.
- (2) **Formaldehyde:** Quantification of formaldehyde content in a given fabric. That is PT provider declare that the fabric contain formaldehyde. The scope of this PT is to evaluate the Analysis Competency of participants in extracting and quantifying the Formaldehyde from the given fabric.

Preparation of PT items:

- (1) **Aryl Amines:** Initially 9 solutions were prepared using each of the 3 amines viz., **4 Aminobiphenyl, Benzidine and 3,3'Dimethylbenzidine** in 3 different concentrations. From the above 9 solutions it is possible to make 63 mixtures having different concentrations of amines. However, only 3 mixtures each contain 2 amines in different concentrations and only one mixture of all the 3 amines but different concentration were prepared. After ascertaining the recovery of amines to the known concentration for all these (9+4=)13 solutions in trial runs, 3 solutions were selected for the ILPT Scheme. They were (1) solution contain only 4 Aminobiphenyl , (2) solution contain 4 Aminobiphenyl and 3,3 Dimethylbenzidine and (3) solution contain 4 Aminobiphenyl, Benzidine and 3,3 Dimethylbenzidine. Based on expected number of participants, requirement of homogeneity & stability testing and unforeseen loss in transit sufficient number of vials were prepared for each of the three solutions, labeled and stored in deep freezer.
- (2) **Formaldehyde:** Formaldehyde applied on fabric. Based on expected number of participants, requirement of homogeneity & stability testing and unforeseen loss in transit sufficient number of samples were prepared. Each sample fabric was packed in a self sealing polythene bag and the bag wrapped with aluminium foil and labeled so that the samples are stable.

Allotments of PT items:

Allotments of PT items were done by following appropriate Sampling procedures adopted by using Random Numbers generated by computer, for Homogeneity testing, Stability testing and for distribution among participants. The remaining part of the population was kept as reserve for replacement in case of loss or damage. Henceforth, the allotted PT items can be referred as *sample*. For the amines test vials having solutions containing (1) only 4 Aminobiphenyl (2) 4 Aminobiphenyl and 3,3 Dimethylbenzidine only were distributed to participants. Vials containing all the three amines were not distributed.

Homogeneity testing:

To verify the homogeneity of the prepared PT items homogeneity testing was conducted at the laboratory of Textiles Committee at Mumbai, for the test parameters covered in the scheme by adopting any one of the suggested methods. However, while conducting performance evaluation of the participants, the “between- samples SD” calculated during homogeneity testing by a particular method was used for calculating “SD of PT assessment” for different methods adopted by the participants, as the inherent variation in the sample (degree of non homogeneity) is independent of the test method adopted. The procedure given in ISO 13528:2005 was followed for conducting homogeneity testing

Dispatch of PT items:

The Proficiency Testing items were dispatched to the respective participant laboratories on 16th October 2015, along with the following:

- (a) Form for Acknowledging the receipt of PT items
- (b) Instructions to the participants in the Inter Laboratory Testing Scheme
- (c) Form for reporting test results by the participants in the Inter Laboratory Testing Scheme

The participant laboratories were requested to send the test results by 4th November, 2015. However, as per request of participants and administrative reasons results were accepted after the due date.

The participant laboratories were also requested to

- Treat the samples in the same manner as regularly tested samples and accordingly, codify the samples such that the technical staff testing them are not aware that they are meant for PT purposes;
- Adopt the latest test method which is routinely used by the laboratory for the testing of regular samples which may be any standard or validated in-house method;
- Forward (i) copy of the in-house method adopted (if applicable) for testing any parameter and also (ii) specify the standard method against which the validation has been done; and,
- Forward photo copy of Scope of accreditation certificate as a proof of accreditation for the test method adopted (applicable to accredited laboratories only).

The participants were informed that, in the absence of proof of accreditation, the participant's value will not be considered for arriving at "Assigned Value" for the concerned test parameter, although, performance of the participant will be evaluated for this parameter. Further, it was also informed that the test results that may be inappropriate for statistical evaluation, for example, gross errors, miscalculations and transpositions may be excluded for calculation of summary statistics and performance evaluation of participants.

Testing dates of PT items:

PT Provider took special care in packing the PT items, storage and transportation so that the values to be measured will not change till the completion of the PT Scheme. Further, appropriate instructions also communicated to participants on verification of the condition of PT items on receipt, packing and storage. Over and above, the participants instructed to carry out the tests within the period 26th to 28th October 2015.

Compilation of the Test Results:

In order to maintain the confidentiality of the participants of the PT Scheme, the individual participants were given Code numbers which are generated by using computer. Subsequently, the test results reported by the participants were tabulated and statistically analyzed for the basic statistics viz., Mean, Median, Mode, Maximum, Minimum, Standard Deviation, etc., While doing so, test results were checked for inappropriate for statistical evaluation, for example, gross errors, miscalculations and transpositions

Determination Assigned Value:

To ensure the measurement traceability, only **accredited participants** are considered for evaluating the Assigned Values. Thus due weightage is given to the accredited participants. That is, this weightage is given only when the participant had submitted their Scope of accreditation along with test results and accredited for the specific test in which the ILPT is conducted. However, when sufficient number of accredited participants is not available for any test, Assigned Value is derived from the consensuses from all participants for that parameter.

Initially, the robust average and the standard deviation of values reported by the accredited laboratories (in respective tests) were determined for each parameter in accordance with the procedure given in ISO 13528: 2005. Subsequently, robust Z Score were calculated on the basis of the above. The test results of those laboratories which were found to be outliers (Z score more than +3 or less than -3) were deleted and Robust Average of the remaining expert laboratories was again calculated. This Robust average is treated as the assigned value for the concerned parameter

The Assigned Value of both the parameters thus arrived are given in **Table-4**.

Table 4: Assigned Values

S.No.	Test	Assigned Value	Robust SD of Assigned Value (ppm)	Uncertainty of Assigned Value (ppm)	No. of Labs contributed for Assigned Value	Total No. of Accredited Labs available for the	Total number of participants ^(*)
1a	Identification of Aryl Amines						
	Group-1	4 Aminobiphenyl	NA	NA	6	6	9
	Group-2	4 Aminobiphenyl, 3,3 Dimethylbenzidine	NA	NA	8	8	11
1b	Quantification of Aryl Amines						
	Group-1 : 4 Aminobiphenyl	22.6ppm	0.4	0.2	5	6	7
	Group-2: 4 Aminobiphenyl, 3,3 Dimethylbenzidine	20.7ppm 11.9ppm	2.1 0.9	1.1 0.4	6 7	7 7	10
2	Free and Hydrolized Formaldehyde	279.2ppm	15.0	4.4	18	21	24

(*)Total participants reported valid results in the respective method. NA: Not Applicable

Determination of Standard Deviation for Proficiency Assessment (σ):

The robust average and the robust standard deviation (σ_1) of all qualified values reported by the participants were calculated for each of the test separately in accordance with the procedure given in ISO 13528:2005. Subsequently, the “between-samples standard deviation (S_s)” of homogeneity testing data was compared with the standard deviation of all the participants. If $S_s \leq 0.3 \sigma_1$, then the sample is considered as homogenous and the robust standard deviation of all the participants is treated as Standard Deviation for Proficiency Testing. That is $\sigma = \sigma_1$

If $S_s > 0.3 \sigma_1$, then the sample is considered as heterogeneous and Standard Deviation for Proficiency Assessment is calculated by adding allowance for heterogeneity of the sample as stipulated in ISO 13528:2005, by using the formula

$$\sigma = \sqrt{\sigma_1^2 + S_s^2}$$

Performance Evaluation of Participants:

The performance of the individual participant was evaluated by adopting Robust Z score technique given in ISO 13528:2005, as per the following formula:

$$Z = \frac{x - X}{\sigma}$$

where x is the test result reported by the individual participant; X is the Assigned Value and σ is the standard deviation of the Proficiency Assessment. Test wise performance evaluation is given in Annexure.

Interpretation of Performance Comment:

Table – 5: Interpretation of Performance comment

Range	Performance of Laboratory
$ Z - \text{Score} \leq 2$	Satisfactory
$2 < Z - \text{Score} < 3$	Straggler
$ Z - \text{Score} \geq 3$	Outlier

Outliers and Stragglers:

Overall performance of all the participants is good. Stragglers and Outliers are very rare and far. It is worthy to appreciate that no outliers are there in the case of Formaldehyde and 2/3rd (ie., 16 out of 24) participants' $|Z - \text{Score}| \leq 1$ though the Standard deviation is 37.7mg/kg. [AV:279.2 mg/kg. Coefficient of Variation =13.5%] The Outlier and Straggler Analysis is given in **Table – 6**. The list of Stragglers and Outliers are given in **Table – 7**.

General Advise to the participants on the performance:

If a participant is found to be “**Outlier**”, necessary corrective action should be taken after thorough investigation of the root cause of the problem.

Table – 6: Outlier and Straggler Analysis

S.No.	Test	No. of Participants	Valid Results	% of valid Results	No. of Stragglers	% of Stragglers	No. of Outliers	% of Outliers
1a	Identification of Aryl Amines							
	Group-1	9	9	100	NA	NA	0	0.0
	Group-2	11	11	100	NA	NA	0	0.0
1b	Quantification of Aryl Amines							
	Group-1 : 4 Aminobiphenyl	7	7	100	0	0.0	2	28.6
	Group-2: 4 Aminobiphenyl	10	10	100	0	0.0	1	10.0
	3,3 Dimethylbenzidine	10	10	100	1	10.0	0	0.0
2	Free and Hydrolized Formaldehyde	24	24	100	3	30.0	0	0.0

Remark: Two Participants identified Aryl amine but did not quantified in Group-1. Similarly, one Participant identified Aryl amines but not quantified in Group-2.

Table – 7: List of Outliers and Stragglers

S.No.	Test	Stragglers	Outliers
1a	Identification of Aryl Amines		
	Group-1	NA	Nil
	Group-2	NA	Nil
1b	Quantification of Aryl Amines		
	Group-1 : 4 Aminobiphenyl	Nil	19012, 19030
	Group-2: 4 Aminobiphenyl	Nil	19018
	3,3 Dimethylbenzidine	19003	Nil
2	Free and Hydrolized Formaldehyde	19003, 19010, 19029	Nil

PERFORMANCE EVALUATION OF EACH PARTICIPANT- TEST WISE

1. Identification and Quantification of Aryl Amines

1a. Identification of Amines

Group 1 Assigned Value: 4-Aminobiphenyl

Participant Code	Test Method adopted	Reported Value	Performance Remark
19004	EN 14362-1:2012	4-Aminobiphenyl	Satisfactory
19011	EN 14362-1:2012	4-Aminobiphenyl	Satisfactory
19012	IS 15570:2005	4-Aminobiphenyl	Satisfactory
19015	BSEN 14362-1:2012	4-Aminobiphenyl	Satisfactory
19016	In House	4-Aminobiphenyl	Satisfactory
19020	In House	4-Aminobiphenyl	Satisfactory
19023	EN 14362-1:2012	4-Aminobiphenyl	Satisfactory
19025	ENISO 14362-1:2012	4-Aminobiphenyl	Satisfactory
19030	EN 14362-1:2012	4-Aminobiphenyl	Satisfactory
Total Participants		9	

Group 2 Assigned Value: 4-Aminobiphenyl , 3,3' Dimethylbenzidine

Participant Code	Test Method adopted	Reported Value		Performance Remark
		Amine - 1	Amine - 2	
19003	EN 14362-1:2012	4-Aminobiphenyl	3,3' Dimethylbenzidine	Satisfactory
19006	ISO 14362-1:2012	4-Aminobiphenyl	3,3' Dimethylbenzidine	Satisfactory
19009	IS 15570:2005	4-Aminobiphenyl	3,3' Dimethylbenzidine	Satisfactory
19013	EN 14362-1:2012	4-Aminobiphenyl	3,3' Dimethylbenzidine	Satisfactory
19014	EN 14362-1:2012	4-Aminobiphenyl	3,3' Dimethylbenzidine	Satisfactory
19017	EN 14362-1:2012	4-Aminobiphenyl	3,3' Dimethylbenzidine	Satisfactory
19018	EN 14362-1:2012	4-Aminobiphenyl	3,3' Dimethylbenzidine	Satisfactory
19021	EN 14362-1:2012	4-Aminobiphenyl	3,3' Dimethylbenzidine	Satisfactory
19022	In House	4-Aminobiphenyl	3,3' Dimethylbenzidine	Satisfactory
19024	EN 14362-1:2012	4-Aminobiphenyl	3,3' Dimethylbenzidine	Satisfactory
19027	IS 15570:2005	4-Aminobiphenyl	3,3' Dimethylbenzidine	Satisfactory
Total Participants		11		

Remark: The following participants did not submit results.

Group 1	Group 2
19019	19007
19002	19008
19028	19001
---	19029

1b. Quantification of Aryl Amines

4 Aminobiphenyl-[Group 1]

Participant Code	Reported value (ppm)	Test method adopted	Z- Score	Performance Remark
19004	22.1	EN 14362-1:2012	-0.50	Satisfactory
19011	22.6	EN 14362-1:2012	0.00	Satisfactory
19012	29.8	IS 15570:2005	7.20	Outlier
19015	23.0	BSEN 14362-1:2012	0.40	Satisfactory
19023	22.8	EN 14362-1:2012	0.20	Satisfactory
19025	22.6	ENISO 14362-1:2012	0.00	Satisfactory
19030	28.2	EN 14362-1:2012	5.60	Outlier

Number of participants	7
Maximum	29.8 ppm
Minimum	22.1 ppm
Mean	24.44 ppm
Standard Deviation	3.16 ppm
Median	22.80 ppm

Remark: Participants 19016 and 19020 identified the amines but not quantified.

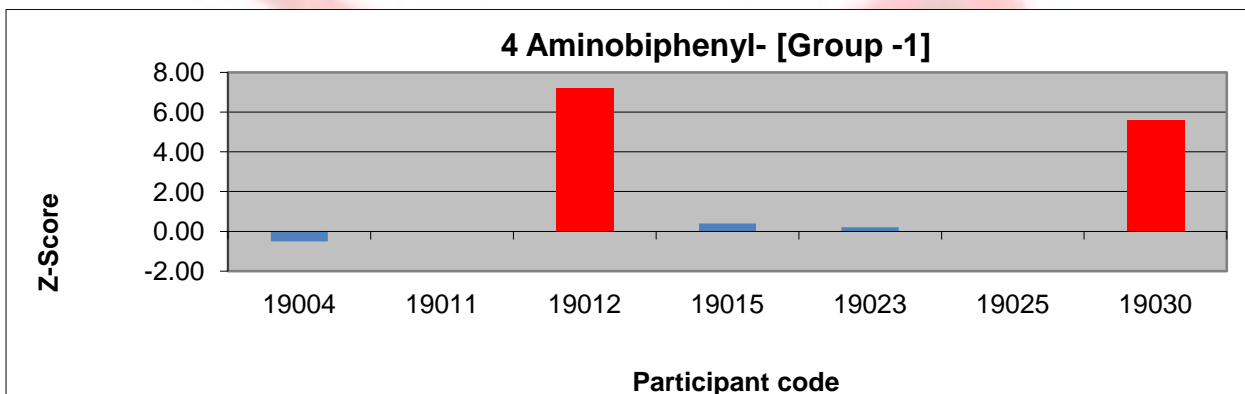
SUMMARY

Robust Average =	22.83ppm
Robust SD for all valid participants (σ_1) =	0.39ppm

Between sample SD of Homogeneity testing (S_S) =	0.9218ppm
SD for PT Scheme with allowance for the heterogeneity if any (σ) =	1.00ppm

Heterogeneity Accounted

Assigned Value (X) =	22.6ppm
SD of PT Scheme(σ) =	1.0ppm



4 Aminobiphenyl [Group – 2]

Participant Code	Reported value (ppm)	Test method adopted	Z- Score	Performance Remark
19003	19.0	EN 14362-1:2012	-0.75	Satisfactory
19006	19.0	ISO 14362-1:2012	-0.75	Satisfactory
19009	19.4	IS 15570:2005	-0.56	Satisfactory
19013	19.7	EN 14362-1:2012	-0.43	Satisfactory
19014	23.4	EN 14362-1:2012	1.25	Satisfactory
19017	21.5	EN 14362-1:2012	0.39	Satisfactory
19018	11.0	EN 14362-1:2012	-4.38	Outlier
19021	19.3	EN 14362-1:2012	-0.61	Satisfactory
19024	21.7	EN 14362-1:2012	0.48	Satisfactory
19027	22.6	IS 15570:2005	0.89	Satisfactory

Number of participants	10
Maximum	23.4 ppm
Minimum	11.0 ppm
Mean	19.66 ppm
Standard Deviation	3.44 ppm
Median	19.56 ppm

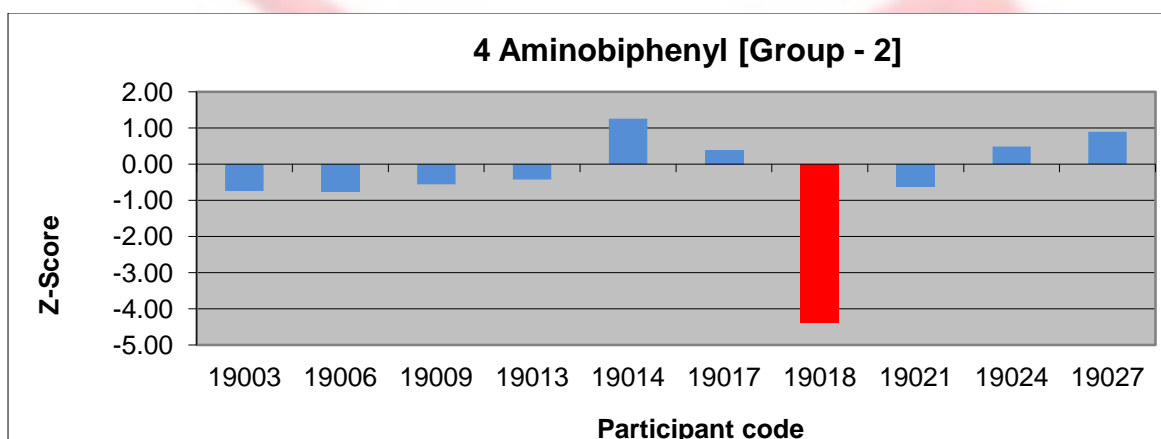
SUMMARY

Robust Average =	20.15 ppm
Robust SD for all valid participants (σ_1) =	1.94 ppm

Between sample SD of Homogeneity testing (S_s) =	1.0380 ppm
SD for PT Scheme with allowance for the heterogeneity if any (σ) =	2.20 ppm

Heterogeneity Accounted

Assigned Value (X) =	20.7ppm
SD of PT Scheme(σ) =	2.2ppm



Remark: Participant 19022 identified the amines but not quantified.

3,3Dimethylbenzidine (ppm) [Group – 2]

Participant Code	Reported value (ppm)	Test method adopted	Z- Score	Performance Remark
19003	10.0	EN 14362-1:2012	-2.05	Straggler
19006	12.2	ISO 14362-1:2012	0.32	Satisfactory
19009	12.7	IS 15570:2005	0.82	Satisfactory
19013	11.3	EN 14362-1:2012	-0.65	Satisfactory
19014	11.3	EN 14362-1:2012	-0.65	Satisfactory
19017	13.6	EN 14362-1:2012	1.83	Satisfactory
19018	11.6	EN 14362-1:2012	-0.32	Satisfactory
19021	11.8	EN 14362-1:2012	-0.11	Satisfactory
19024	12.8	EN 14362-1:2012	0.97	Satisfactory
19027	11.9	IS 15570:2005	0.00	Satisfactory

Number of participants	12
Maximum	12.2 ppm
Minimum	10.0 ppm
Mean	11.30 ppm
Standard Deviation	1.36 ppm
Median	11.30 ppm

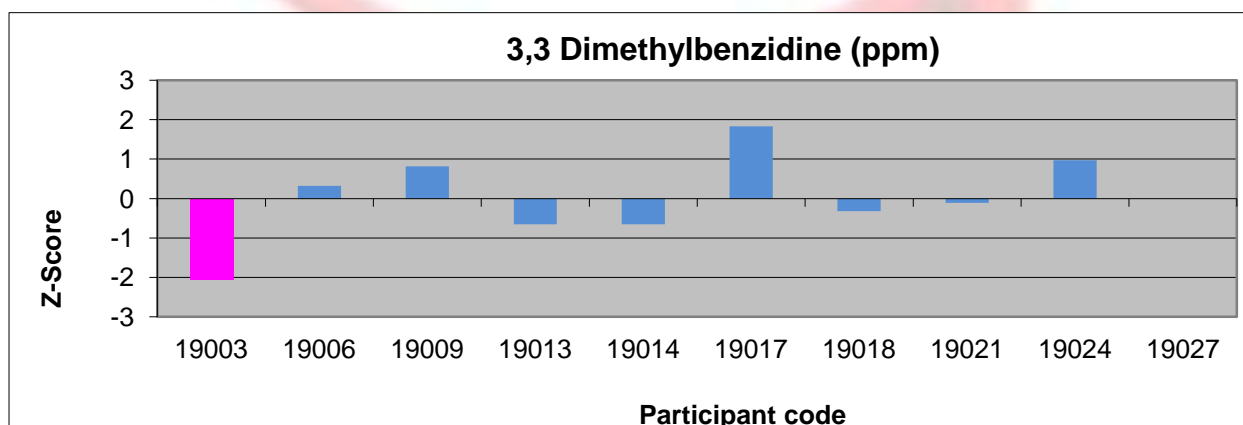
SUMMARY

Robust Average =	11.93 ppm
Robust SD for all valid participants (σ_1) =	0.87 ppm

Between sample SD of Homogeneity testing (S_s) =	0.3237 ppm
SD for PT Scheme with allowance for the heterogeneity if any (σ) =	0.93 ppm

Heterogeneity Accounted

Assigned Value (X) =	11.9 ppm
SD of PT Scheme(σ) =	0.9 ppm



Remark: Participant 19022 identified the amines but not quantified.

2. Free and Hydrolysed Formaldehyde (ppm or mg/kg)

Participant Code	Reported value (mg/kg)	Test method adopted	Z- Score	Performance Remark
19002	238.6	ISO 14184-1:2011	-1.08	Satisfactory
19003	360.0	ISO 14184-1:2011	2.14	Straggler
19004	286.4	ISO 14184-1:2011	0.19	Satisfactory
19005	298.0	ISO 14184-1:2011	0.50	Satisfactory
19006	287.5	ISO 14184-1:2011	0.22	Satisfactory
19007	207.0	ISO 14184-1:2011	-1.92	Satisfactory
19009	289.4	ISO 14184-1:2011	0.27	Satisfactory
19010	375.8	ISO 14184-1:2011	2.56	Straggler
19011	275.0	BSENISO 14184-1:2011	-0.11	Satisfactory
19013	229.0	ISO 14184-1:2011	-1.33	Satisfactory
19014	289.0	ISO 14184-1:2011	0.26	Satisfactory
19015	272.2	BSENISO 14184-1:2011	-0.19	Satisfactory
19017	315.0	ISO 14184-1:2011	0.95	Satisfactory
19018	240.3	ISO 14184-1:2011	-1.03	Satisfactory
19020	253.4	ISO 14184-1:2011	-0.68	Satisfactory
19021	282.9	ISO 14184-1:2011	0.10	Satisfactory
19022	261.6	ISO 14184-1:2011	-0.47	Satisfactory
19023	279.0	ISO 14184-1:2011	-0.01	Satisfactory
19024	281.8	ISO 14184-1:2011	0.07	Satisfactory
19025	280.0	ISO 14184-1:2011	0.02	Satisfactory
19026	260.3	ISO 14184-1:2011	-0.50	Satisfactory
19027	227.1	ISO 14184-1:2011	-1.38	Satisfactory
19029	194.9	IS 14543-1:1998 (RA 2013)	-2.24	Straggler
19030	295.7	ISO 14184-1:2011	0.44	Satisfactory

Number of participants	24
Maximum	375.8
Minimum	207.0
Mean	276.89
Standard Deviation	38.08
Median	279.50

SUMMARY

Robust Average =	274.16 mg/kg
Robust SD for all valid participants (σ_1) =	29.67 mg/kg

Between sample SD of Homogeneity testing (S_S) =	23.2637 mg/kg
SD for PT Scheme with allowance for the heterogeneity if any (σ) =	37.70 mg/kg

Heterogeneity Accounted

Assigned Value (X) =	279.2 mg/kg
SD of PT Scheme(σ) =	37.7 mg/kg

