

# **INTER LABORATORY TESTING SCHEME**

**ON**

**“Testing of Chemical parameters  
in Textile Material”**

**TC/ILTS/023/CHEM/2017-18**

**Conducted by**



**Proficiency Testing Provider  
Laboratories**

**TEXTILES COMMITTEE**

**(Ministry of Textiles, Government of India)**

**P. Balu Road, Prabhadevi Chowk,  
Prabhadevi, Mumbai – 400 025.**

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**2017-2018**

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**2017-2018**

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**SCHEME** : INTER LABORATORY TESTING SCHEME -TC/ILTS/23/CHEM/2017-18-  
Testing of Chemical parameters in Textile Materials

**DATE OF ISSUE:** 12<sup>th</sup> Feb,2019

## **CONFIDENTIALITY :**

All the information furnished by the participants 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 participants, the same shall be provided to them directly, after obtaining permission of the concerned participant

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**Disclaimer:** The PT Programmes are meant for evaluation of performance of the participants 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 programmes. Participants 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.

## INDEX

S. No.	Contents	Page No.
1	PT-Provider details	1
2	Index	2
3	Report on Inter Laboratory Testing Scheme	
	Preamble	3
	Textiles Committee	3
	PT-Provider	3
	The Present Programme	4
	Advisory Group	5
	Participants	7
	Proficiency Test Proceedings	7
	Compilation of the Test Results	8
	Determination Assigned Value	9
	Performance Evaluation of Participants	10
General Advise to the Laboratories on the performance	12	
4	<b>Annexure</b> - Performance Evaluation of participants – Test wise	13

S.No.	Table	Page No.
1	ILPT schemes conducted by the PT Provider	4
2	Tests covered in TC/ILTS/23/CHEM/2017-18	5
3	Advisory Group	6
4	Sampling procedure adopted for different purpose	7
5	Assigned Values	9
6	Interpretation of Performance comments	10
7	Outlier Analysis	10
8	List of outliers	12

## Report on Inter Laboratory Testing Scheme (TC/ILTS/23/CHEM//2017-18)

### ➤ Preamble:

Increasing awareness on textile quality and the buyer requirements are forcing textile manufacturers and traders to test textile products from reputed laboratories. Reputation of any laboratory depends upon the result it produces. The test report given by the 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 compare with that of 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 doing an assigned task/testing including 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 as also, participate in Inter Laboratory Comparison (ILC) and/or Inter Laboratory Proficiency Testing Scheme (ILPT).

Inter laboratory Comparison is defined as' *“Organization, performance and evaluation of tests on the same or similar test items by two or more laboratories in accordance with predetermined conditions.”* 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.

### ➤ Textiles Committee:

Textiles Committee is a statutory organization under the Ministry of Textiles, Government of India, established in the year 1963. The Committee has set up 19 laboratories throughout the country for catering to the testing requirements of the textile trade and industry in different centers. Fourteen laboratories of Textiles Committee are accredited as per ISO/IEC 17025 by National Accreditation Board for testing & calibration Laboratories (NABL), India.

### ➤ PT-Provider:

The Laboratory, Textiles Committee at Mumbai participates in Inter Laboratory Proficiency Testing (ILPT) schemes conducted by different professional bodies like American Standard for Testing and Materials (ASTM), USA, Institute for Inter laboratory Studies (IIS), The Netherlands and NABL, India, from time to time. Apart from this, Textiles committee also conducts Inter Laboratory Comparisons (ILC) schemes by including its own laboratories and inviting other laboratories. 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 ILAC G13 and ISO/IEC 17043. The PT Provider has conducted 23 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 Labs participated
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 and Fabric	13	42
14	TC/ILTS/Chem -1/2012-13	2012-13	Chemical	Fabric & Metal clothing accessories	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/17MECH-3/2015	2015	Mechanical	Fabric	8	24
18	TC/ILTS/18/CHEM -3/2015	2015	Chemical	Fabric	9	51
19	TC/ILTS/19/CHEM -3/2015	2015	Chemical	Fabric	2	30
20	TC/ILTS/20/MECH/2017-18	2017-18	Mechanical	Fabric	7	35
21	TC/ILTS/21/CHEM/2017-18	2017-18	Chemical	Fabric	8	29
22	TC/ILTS/22/MECH/2017-18	2017-18	Mechanical	Fabric	7	28
23	TC/ILTS/23/CHEM/2017-18	2017-18	Chemical	Fabric	8	36

➤ **The Present Program:**

**Design:** In order to assess the re- producibility of the test results being reported by the various textile testing laboratories, a Proficiency Testing Scheme for Chemical testing - **TC/ILTS/023/CHEM//2017-18** was designed. The test parameters thus covered in the present PT Scheme are given in Table – 2.

**Table – 2 : Tests covered in TC/ILTS/23/CHEM/2017-18**

S.No.	Test parameter	Standards suggested
1	Colour fastness to laundering	ISO C06 A1S
2	Colour fastness to laundering	AATCC 61 1A
3	Colour fastness to Rubbing	IS 766
4	Colour fastness to Crocking	AATCC 8
5	Colour fastness to water	IS 767 / ISO 105 E01
6	Colour fastness to perspiration	IS 971 / ISO 105 E04
7	Colour fastness to bleaching	IS 762 Hypochlorite Bleach
8.	Colour fastness to dry cleaning	IS 4802 / ISO D01

While designing the Scheme the following objectives were considered.

- (1) Each accredited participant laboratory should get benefit so that at least one parameter may be covered under the lab's scope of accreditation.
- (2) Both geometry and performance verifying parameters to be included.
- (3) Both trade and industry oriented parameters to be included.
- (4) Test methods of ISO, AATCC, Indian Standards and Validated method may be covered.

To satisfy the above objectives (1) Scope of accreditation of about 50 laboratories were consulted. (2) To enable the participant laboratories in *evaluation of the performance for specific tests or measurements and monitoring laboratories' continuing performance* (Ref: ISO/IEC 17043), (3) To satisfy Trade and industry requirements, performance parameters viz., Colour fastness to laundering with two different standard method, Colour fastness to Rubbing/ Crocking, Colour fastness to water, Colour fastness to perspiration, Colour fastness to bleaching and Colour fastness to dry cleaning tear were included.

➤ **Advisory Group:**

As per the requirements stipulated in ILAC G13 and ISO/IEC 17043, an **Advisory Group** comprising the following experts having the necessary expertise in testing and/or statistics was constituted for designing and operating Proficiency Testing scheme in the field of Mechanical & Chemical testing of textiles (Table – 3):

**Table – 3 : Constitution of Advisory Group**

S.No	Expert	Affiliation	Field of expertise
1.	<b>Mr. Kartikay Dhanda</b> Director (Labs), Textiles Committee, Mumbai	Chairman	Textile testing
2.	<b>Dr. K.S.Muralidhara</b> Joint Director (Lab), Textiles Committee, Mumbai	Member	Textile testing
3.	<b>Mr.K.Selvaraj</b> Joint Director (Lab), Textiles Committee, Mumbai	Member	Textile testing & Statistics
4.	<b>Dr.P.Ravichandran</b> Deputy Director (Lab), Textiles Committee, Mumbai	Member	Textile testing
5.	<b>Mr. S.P. Singh</b> Asst. Director (Lab), Textiles Committee, Jaipur.	Member	Textile testing
6.	<b>Mr. Govind Prasad</b> Asst. Director (EPQA), Textiles Committee, Mumbai	Member	Textile testing
7.	<b>Mr.Venu B</b> Quality Assurance Officer (Lab), Textiles Committee, Kochi	Member	Textile testing & Statistics
8.	<b>Mrs. Sandhyarani Kamble</b> Quality Assurance Officer (Lab) Textiles Committee, Mumbai	Member	Textile testing
9.	<b>Dr. Rajkumar P. Sontakke</b> Jr. Quality Assurance Officer (Lab), Textiles Committee, Mumbai	Member	Textile testing & Statistics

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.

The following documents pertaining to the PT Schemes, “Testing of Mechanical parameters in textile material - TC/ILTS/MECH/20/2017-18 & TC/ILTS/MECH/22/2017-18 and “Testing of Chemical



parameters in textile material - **TC/ILTS/Chem/21/2017-18 & TC/ILTS/Chem/23/2017-18** were vetted by the Advisory Group on 5<sup>th</sup> February 2019:

- (i) Draft Protocol incorporating test parameters covered, suggested test methods, participation fees payable, expected schedule of the scheme, etc
- (ii) Draft instructions to the participants
- (iii) Draft format for reporting the test results

➤ **Participants:**

36 laboratories from **India** and **Sri Lanka** were participated in this scheme.

Laboratories accredited by the following Accrediting Bodies were participated in this scheme:

- (1) National Accreditation Board for testing and calibration Laboratories (NABL), India
- (2) American Association for Laboratory Accreditation (A2LA), USA
- (3) Deutsche Akkreditierungsstelle GmbH (DAKKS), Germany

➤ **Proficiency Test Proceedings:**

The laboratory of Textiles Committee (PT Provider), Mumbai, procured sufficient quantity of fabric (PT item) from a reputed textiles mill for designing and conducting Inter Laboratory Testing Scheme, on the basis of expected number of participants.

**Population of PT items:** On receipt of the procured materials, PT items meant for (i) homogeneity testing, (ii) stability testing, (iii) distribution among the participant laboratories, (iv) additional reserve samples for replacement in case of loss or damage, were prepared. While preparing the PT items for the above, it was ensured that the quantity of each PT item is adequate for the testing of all the parameters included in the scheme. The PT items thus prepared from the material procured were numbered serially. The prepared PT items were packed in polyethylene bags and labeled bearing the PT item identity such that the same are ready for dispatch. Thus a finite population of PT item was produced.

**Sampling of PT items:** Allotments of PT items were done by following appropriate Sampling procedures adopted by using Random Numbers generated by using computer. Sampling procedure for Homogeneity testing, Stability testing and for distribution among participant laboratories are provided in Table – 4:

**Table – 4: Sampling procedure adopted for different purpose**

1	<b>Homogeneity testing,</b>	Systematic random sampling without replacement
2	<b>Stability Testing</b>	Systematic random sampling without replacement from the remaining population after homogeneity testing
3	<b>Distribution to participant laboratories</b>	Simple random sampling without replacement from the remaining population after homogeneity and stability testing.

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.

**Homogeneity testing:** To verify the homogeneity of the population of PT items homogeneity testing was conducted at the laboratory of Textiles Committee at Mumbai for all the test parameters covered in the scheme by adopting 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 was followed for conducting homogeneity testing.

The homogeneity of population was found to be satisfactory based on analysis of variance conducted on the test results obtained in homogeneity testing.

**Stability testing:** In order to verify the stability of the PT items, stability testing was conducted in accordance with ISO 13528, after the lapse of a week from the last date of conducting homogeneity testing. The stability was confirmed by testing the hypothesis that the difference between the average values obtained for each of the test parameters during homogeneity testing and stability testing were insignificant.

**Dispatch of PT items:** The Proficiency Testing items were dispatched to the respective participant laboratories on 13<sup>th</sup> July 2018, along with the following:

- (a) Instructions to the participants in the Inter Laboratory Testing Scheme
- (b) 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 13<sup>th</sup> August 2018.

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 NABL accreditation certificate as a proof of accreditation for the test method adopted (applicable to accredited laboratories only).

The participant laboratories were informed that, in the absence of proof of accreditation, the laboratory's value will not be considered for arriving at "Assigned Value" for the concerned test parameter, although, performance of the laboratory 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.

➤ **Compilation of the Test Results:**

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

In test parameter Colour fastness to dry cleaning as per ISO 105 D01, more than 90% of laboratories reported staining of solvent instead of staining on standard multistrip adjacent fabric. So considering the gross errors staining of solvent on the whole accepted for evaluating the Assigned Values and In change in colour of Print portion the least reporting value among the individual coloured print is considered for overall print portion while computing the reported values.

➤ **Determination Assigned Value:**

To ensure the measurement traceability, only **accredited laboratories** are considered for evaluating the Assigned Values. Thus due weightage is given to the accredited laboratories. However, this weightage is given only when the laboratory has submitted their Scope of accreditation and accredited for the specific test in which the ILPT is conducted.

As in present Proficiency Testing Scheme for Chemical testing i.e. **TC/ILTS/023/CHEM/2017-18** all parameters are Ordinal/Subjective test, so mode of the values reported by Accredited participant laboratories for that test is considered as Assigned Value. The deviation of laboratory result by more than ½ grade compared to Assigned Value is taken as unsatisfactory (outliers) and all other results are taken as satisfactory.

The Assigned Value of both the parameters thus arrived are given in **Table-5**.

**Table 5: Assigned Values**

S. No.	Test	Assigned Value	Uncertainty of Assigned Value	No. of Accredited Laboratories contributed	Total number of participants
1	Colour fastness to laundering (ISO C06 A1S)		½ grading	22	28
	a) Change in Color	1-2			
	b) Staining on Acetate/Cotton/Polyamide Polyester/Acrylic/Wool	4-5/3-4/4/4-5/4-5/4-5			
2	Colour fastness to laundering (AATCC 61 1A)		½ grading	23	29
	a) Change in Color	1.5			
	b) Staining on Acetate/Cotton/Polyamide Polyester/Acrylic/Wool	4.5/3.5/4.5/4.5/4.5/4.5			
3	Colour fastness to Rubbing Dry Wet	4 2-3	½ grading	30	35
4	Colour fastness to Crocking Dry Wet	4 2	½ grading	27	30
5	Colour fastness to water		½ grading	31	33
	a) Change in Color	2-3			
	b) Staining on Acetate/Cotton/Polyamide Polyester/Acrylic/Wool	2/2/2-3/ 2-3/2-3/2			
6	Colour fastness to perspiration		½ grading	33	36
	<b>Acidic</b> a) Change in Color	2-3			
	b) Staining on Acetate/Cotton/Polyamide Polyester/Acrylic/Wool	2/2/2/ 2-3/2-3/2			
	<b>Alkaline</b> a) Change in Color	2-3			
	b) Staining on Acetate/Cotton/Polyamide Polyester/Acrylic/Wool	2-3/2/2-3/ 2-3/2-3/2			
7	Colour fastness to bleaching Change in Color	1-2	½ grading	8	18
8	Colour fastness to dry cleaning		½ grading	23	28
	Change in Color-Basic fabric	4			
	Change in Color- Overall Print of fabric	1-2			
	Staining in Solvent	3-4			

➤ **Performance Evaluation of Participants:**

The performance of the individual laboratory was evaluated by adopting Robust Z score technique given in ISO 13528, For Subjective test the deviation of laboratory result by more than ½ grade compared to Assigned Value is taken as unsatisfactory (and outliers) and all other results are taken as satisfactory.

**Table – 6: Interpretation of Performance comment**

Range	Performance of Laboratory
<b>Subjective Test</b>	
Reported Value – Assigned Value   ≤ ½ grade	Satisfactory
Reported Value - Assigned Value   > ½ grade	Outlier

Overall performance of all the laboratories is good. The Outlier analysis and Parameter-wise outliers are given in Table – 7 and Table – 8 respectively.

**Table – 7: Outlier Analysis**

S. No	Test	No. of Labs Participated	Valid Results	No. of Outliers	% of Outliers
<b>1</b>	<b>Colour fastness to laundering (ISO C06 A1S)</b>				
	Change in Color	28	28	0	0
	Staining on Acetate			0	0
	Staining on Cotton			0	0
	Staining on Nylon			0	0
	Staining on Polyester			0	0
	Staining on Acrylic			0	0
Staining on Wool	1			3.6	
<b>2</b>	<b>Colour fastness to laundering (AATCC 61 1A)</b>				
	Change in Color	29	29	1	3.4
	Staining on Acetate			1	3.4
	Staining on Cotton			0	0
	Staining on Nylon			2	6.9
	Staining on Polyester			1	3.4
	Staining on Acrylic			1	3.4
Staining on Wool	2			6.9	

<b>3</b>	<b>Colour fastness to Rubbing (IS 766)</b>				
	Staining on Cotton (Dry)	35	35	0	0
	Staining on Cotton (Wet)			2	5.7
<b>4</b>	<b>Colour fastness to Crocking (AATCC 8)</b>				
	Staining on Cotton (Dry)	30	30	0	0
	Staining on Cotton (Wet)	30	30	5	16.7
<b>5</b>	<b>Colour fastness to water (IS 767 / ISO 105 E01)</b>				
	Change in Color	33	33	7	21.2
	Staining on Acetate			3	6.1
	Staining on Cotton			1	3.0
	Staining on Nylon			1	3.0
	Staining on Polyester			1	3.0
	Staining on Acrylic			2	6.1
	Staining on Wool			1	3.0
<b>6</b>					
<b>Colour fastness to perspiration (IS 971 / ISO 105 E04)</b>					
<b>Acidic</b>					
Change in Color	36	36	3	8.3	
Staining on Acetate			4	11.1	
Staining on Cotton			2	5.5	
Staining on Nylon			6	16.7	
Staining on Polyester			3	8.3	
Staining on Acrylic			3	8.3	
Staining on Wool			4	11.1	
<b>Alkaline</b>					
Change in Color	36	36	2	5.5	
Staining on Acetate			4	11.1	
Staining on Cotton			3	8.3	
Staining on Nylon			3	8.3	
Staining on Polyester			4	11.1	
Staining on Acrylic			3	8.3	
Staining on Wool			5	13.9	
<b>7</b>			<b>Colour fastness to bleaching (IS 762 Hypochlorite Bleach)</b>		
	Change in Color	18	18	0	0
<b>8</b>	<b>Colour fastness to dry cleaning (IS 4802 / ISO D01)</b>				
	Change in Colour (Basic fabric)	28	28	0	0
	Change in Colour [Overall Print of fabric] (least grade)			4	14.3
	Staining of solvent			4	14.3
<b>Total</b>	<b>237</b>			<b>237</b>	

**Table – 8: List of Outliers**

S. No	Test	No. of Outliers	Outlier Lab codes
1	Colour fastness to laundering (ISO C06 A1S)	1	21C
2	Colour fastness to laundering (AATCC 61 1A)	2	10C,24C
3	Colour fastness to Rubbing	2	7C,25C
4	Colour fastness to Crocking	5	4C,5C,6C,12C,13C
5	Colour fastness to water	10	6C,7C,14C,19C,22C 24C,25,27C,28C,33C
6	Colour fastness to perspiration	18	1C,6C,7C,9C,10C,11C,12C,13C, 14C,19C,21C,22C,27C,28C,33C, 36C, 37C,40C
7	Colour fastness to bleaching	0	
8	Colour fastness to dry cleaning	7	10C,11C,12C,21C,22C,24C,41C
<b>Total</b>		<b>45</b>	

➤ **General Advise to the Laboratories on the performance:**

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

**Annexure**

**PERFORMANCE EVALUATION OF EACH LABORATORY- TEST WISE**

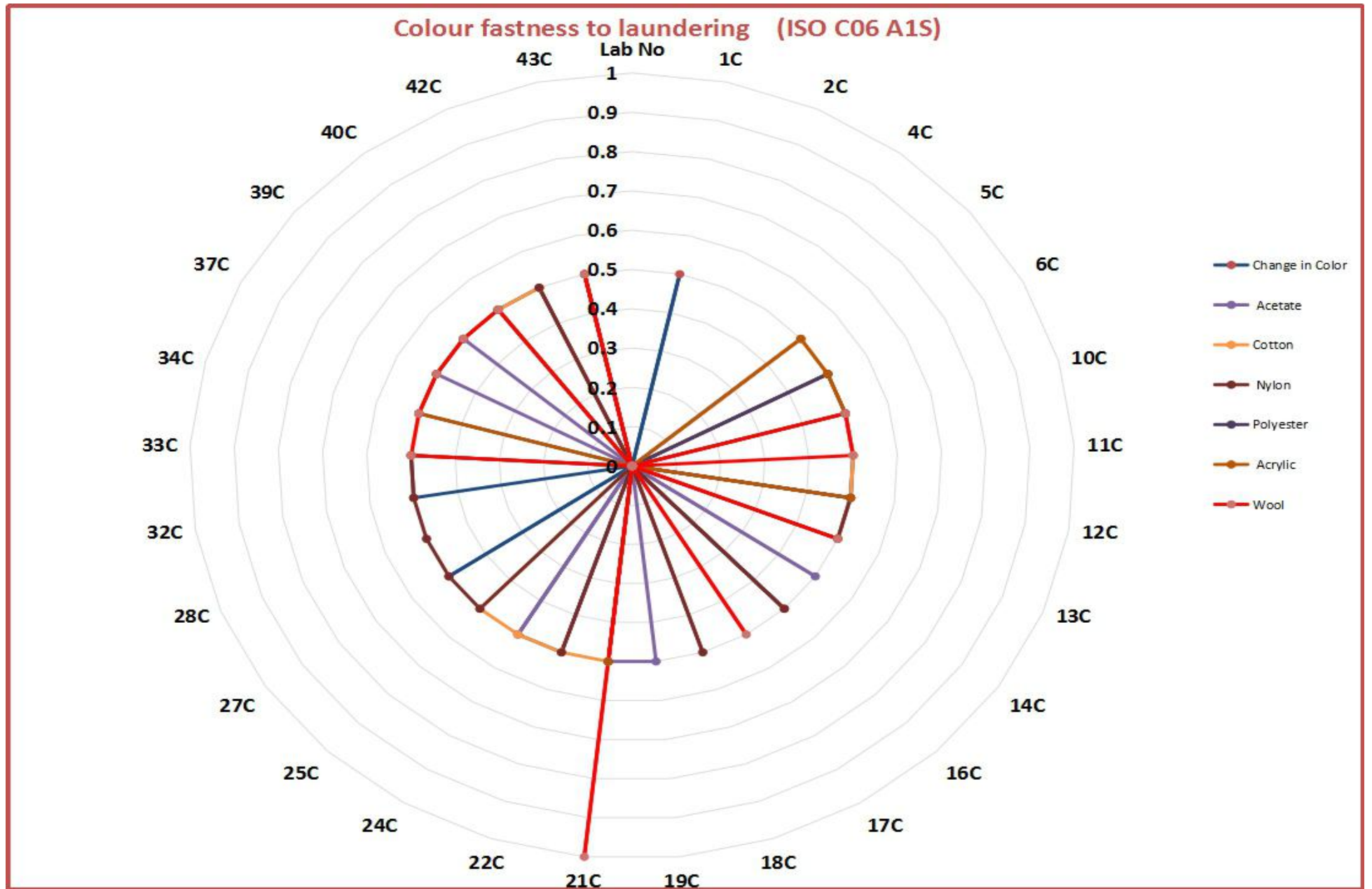
1.Colour fastness to laundering															
	Change in Color	Acetate		Cotton		Nylon		Polyester		Acrylic		Wool			
Assigned Value	1-2	4-5		3-4		4		4-5		4-5		4-5			
Lab No	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Test method
1C	1	0.5	4-5	0	3-4	0	4	0	4-5	0	4-5	0	4-5	0	ISO 105 C06-A1S 2010
2C	1-2	0	4-5	0	3-4	0	4	0	4-5	0	4-5	0	4-5	0	ISO 105 C06-A18:2010
4C	1-2	0	4-5	0	3-4	0	4	0	4-5	0	4-5	0	4-5	0	ISO 105 C06-A1S
5C	1-2	0	4	0.5	3	0.5	4	0	4-5	0	4	0.5	4-5	0	ISO 105 C06 : 2010
6C	1-2	0	4-5	0	3	0.5	3-4	0.5	4	0.5	4	0.5	4-5	0	ISO 105 C06-A1S
10C	2	0.5	4	0.5	3	0.5	4	0	4	0.5	4	0.5	4	0.5	ISO 105 C06-A1S
11C	1	0.5	4	0.5	3	0.5	4	0	4-5	0	4-5	0	4	0.5	ISO 105 C06-A1S 2010
12C	2	0.5	4	0.5	3	0.5	3-4	0.5	4	0.5	4	0.5	4-5	0	ISO 105 C06-A1S
13C	2	0.5	4-5	0	3	0.5	4-5	0.5	4-5	0	4-5	0	4	0.5	ISO 105 C06-A1S 2010
14C	1-2	0	4	0.5	3-4	0	4	0	4-5	0	4-5	0	4-5	0	ISO 105 C06-A1S
16C	1	0.5	4-5	0	3-4	0	4-5	0.5	4-5	0	4-5	0	4-5	0	ISO 105 C06 : 2010
17C	1-2	0	4-5	0	3-4	0	4	0	4-5	0	4-5	0	4	0.5	ISO 105 C06-A1S
18C	1-2	0	4-5	0	3-4	0	4-5	0.5	4-5	0	4-5	0	4-5	0	ISO 105 C06 : 2016-A1S
19C	1-2	0	4	0.5	3-4	0	4	0	4-5	0	4-5	0	4-5	0	ISO 105 C06-A1S
<b>21C</b>	1-2	0	4	0.5	3	0.5	4	0	4	0.5	4	0.5	<b>3-4</b>	<b>1</b>	IS 13025:1991
22C	1	0.5	4-5	0	4	0.5	4-5	0.5	4-5	0	4-5	0	4-5	0	ISO 105 C06-A1S
24C	1	0.5	4	0.5	3	0.5	4	0	4-5	0	4-5	0	4-5	0	ISO 105 C06-A1S
25C	1-2	0	4-5	0	4	0.5	4-5	0.5	4-5	0	4-5	0	4-5	0	ISO 105 C06-A1
27C	2	0.5	4-5	0	3-4	0	4-5	0.5	4-5	0	4-5	0	4-5	0	ISO 105 C06-A1S

1.Colour fastness to laundering															
	Change in Color	Acetate		Cotton		Nylon		Polyester		Acrylic		Wool			
Assigned Value	1-2	4-5		3-4		4		4-5		4-5		4-5			
Lab No	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Test method
28C	1-2	0	4-5	0	3-4	0	4-5	0.5	4-5	0	4-5	0	4-5	0	ISO 105 C06
32C	1	0.5	4-5	0	3-4	0	4-5	0.5	4-5	0	4-5	0	4-5	0	ISO 105 C06-A1S 2010
33C	1	0.5	4-5	0	3	0.5	4-5	0.5	4-5	0	4-5	0	4	0.5	ISO 105 C06-A1S 2010
34C	1-2	0	4-5	0	3	0.5	4	0	4	0.5	4	0.5	4	0.5	ISO 105 C06-A1S
37C	1-2	0	4	0.5	3-4	0	4	0	4	0.5	4	0.5	4	0.5	ISO 105 C06-A1S
39C	1-2	0	4	0.5	3-4	0	4	0	4	0.5	4	0.5	4	0.5	ISO 105 C06-A1S 2010
40C	2	0.5	4-5	0	3	0.5	4	0	4	0.5	4	0.5	4	0.5	ISO 105 C06-A1S
42C	2	0.5	4-5	0	4	0.5	4-5	0.5	4-5	0	4-5	0	4-5	0	ISO 105 C06-A1
43C	1-2	0	4	0.5	3-4	0	4	0	4	0.5	4	0.5	4	0.5	ISO 105 C06-A1S :1994(E)
participants	28		28		28		28		28		28		28		
max	2		4-5		4		4-5		4-5		4-5		4-5		
min	1		4		3		3-4		4		4		3-4		
median (M)	1-2		4-5		3-4		4		4-5		4-5		4-5		

Subjective Test	
Reported Value – Assigned Value   ≤ ½ grade	Satisfactory
Reported Value - Assigned Value   > ½ grade	Outlier



Frequency distribution							
Grade	Change in Color	Staining on adjacent fabric					
		Acetate	Cotton	Nylon	Polyester	Acrylic	Wool
1	7	0	0	0	0	0	0
1-2	15	0	0	0	0	0	0
2	6	0	0	0	0	0	0
2-3	0	0	0	0	0	0	0
3	0	0	11	0	0	0	0
3-4	0	0	14	2	0	0	1
4	0	11	3	16	9	10	10
4-5	0	17	0	10	19	18	17
5	0	0	0	0	0	0	0
participants	28	28	28	28	28	28	28



## 2. Colour fastness to laundering (AATCC 61 1A)

	Change in Color		Acetate		Cotton		Nylon		Polyester		Acrylic		Wool	
Assigned Value	1.5		4.5		3.5		4.5		4.5		4.5		4.5	
Lab No	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value
1C	1	0.5	4.5	0	3.5	0	4.5	0	4.5	0	4.5	0	4.5	0
2C	1.5	0	4.5	0	3.5	0	4	0.5	4.5	0	4	0.5	4.5	0
4C	1.5	0	4.5	0	3.5	0	4.5	0	4.5	0	4.5	0	4.5	0
5C	1.5	0	4.5	0	3.5	0	4	0.5	4.5	0	4.5	0	4	0.5
6C	1.5	0	4.5	0	3	0.5	4.5	0	4.5	0	4.5	0	4.5	0
7C	2	0.5	4.5	0	3.5	0	4	0.5	4	0.5	4	0.5	4	0.5
10C	2.5	1	3.5	1	3	0.5	3	1.5	4	0.5	3.5	1	3	1.5
11C	1	0.5	4	0.5	3	0.5	4	0.5	4.5	0	4.5	0	4	0.5
12C	2	0.5	4.5	0	3.5	0	4.5	0	4.5	0	4	0.5	4.5	0
13C	1.5	0	4.5	0	3.5	0	4.5	0	4.5	0	4	0.5	4.5	0
14C	1.5	0	4	0.5	3.5	0	4	0.5	4.5	0	4.5	0	4.5	0
16C	1.5	0	4.5	0	3.5	0	4.5	0	4.5	0	4.5	0	4.5	0
17C	1.5	0	4.5	0	3.5	0	4	0.5	4.5	0	4.5	0	4	0.5
18C	1.5	0	4.5	0	3.5	0	4.5	0	4.5	0	4.5	0	4.5	0
19C	1.5	0	4	0.5	3.5	0	4	0.5	4.5	0	4.5	0	4.5	0
21C	1	0.5	4.5	0	3	0.5	4	0.5	4	0.5	4	0.5	4	0.5
22C	1	0.5	4.5	0	4	0.5	4.5	0	4.5	0	4.5	0	4.5	0
24C	1.5	0	4	0.5	3	0.5	3.5	1	3.5	1	4	0.5	3.5	1
25C	1	0.5	4.5	0	4	0.5	4.5	0	4.5	0	4.5	0	4.5	0
27C	2	0.5	4.5	0	3.5	0	4.5	0	4.5	0	4.5	0	4.5	0
28C	2	0.5	4.5	0	3	0.5	4	0.5	4.5	0	4.5	0	4.5	0
32C	1.5	0	4.5	0	3	0.5	4	0.5	4	0.5	4.5	0	4.5	0
33C	1.5	0	4.5	0	3.5	0	4.5	0	4.5	0	4.5	0	4	0.5

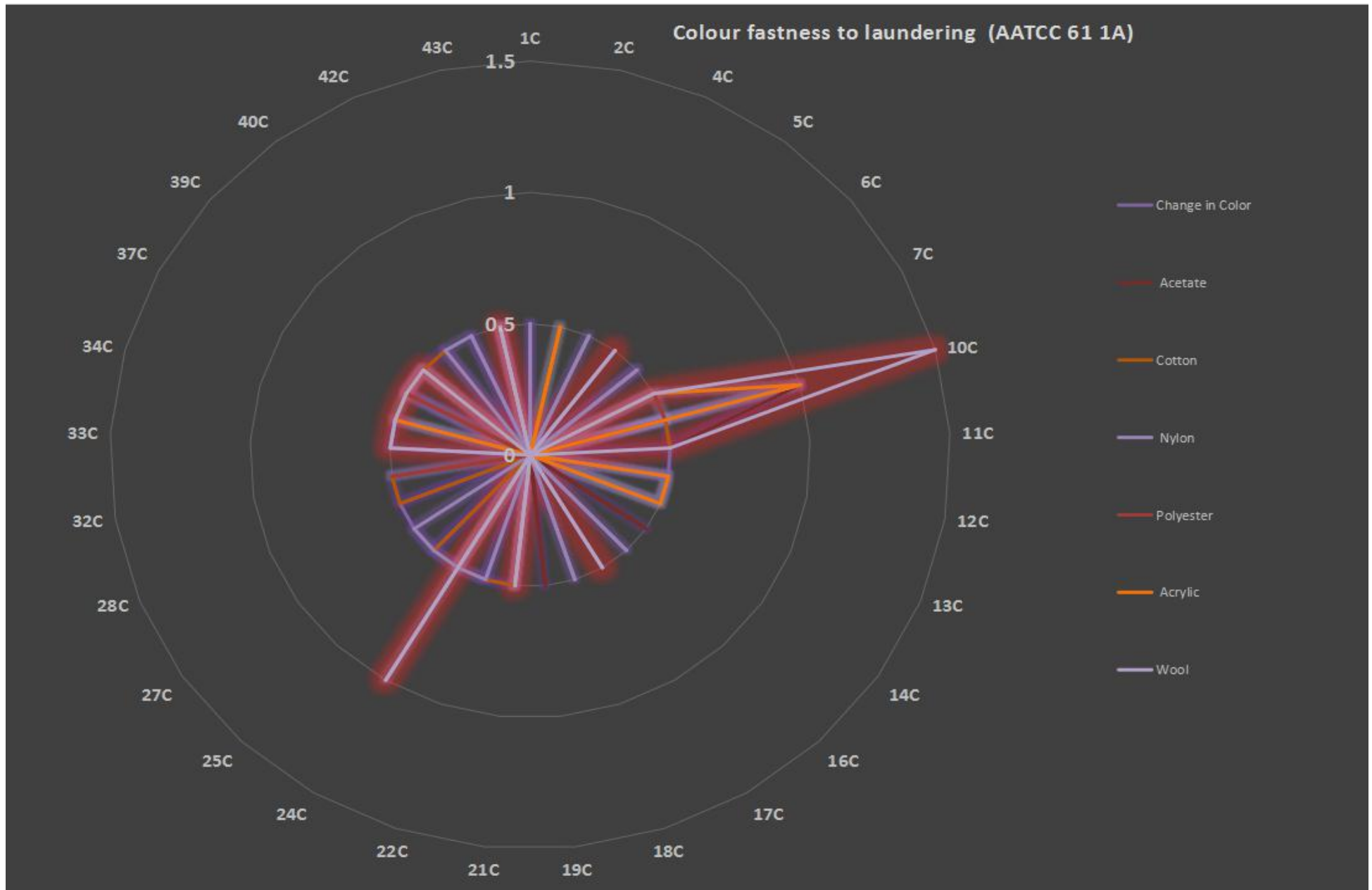
	Change in Color		Acetate		Cotton		Nylon		Polyester		Acrylic		Wool	
Assigned Value	1.5		4.5		3-5		4.5		4.5		4.5		4.5	
Lab No	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value
34C	1.5	0	4.5	0	3.5	0	4.5	0	4.5	0	4	0.5	4	0.5
37C	1.5	0	4	0.5	3	0.5	4	0.5	4	0.5	4	0.5	4	0.5
39C	1.5	0	4	0.5	3	0.5	4	0.5	4	0.5	4	0.5	4	0.5
40C	1.5	0	4.5	0	3	0.5	4.5	0	4.5	0	4.5	0	4.5	0
42C	2	0.5	4.5	0	3.5	0	4.5	0	4.5	0	4.5	0	4.5	0
43C	1.5	0	4	0.5	3	0.5	4	0.5	4	0.5	4	0.5	4	0.5
participants	29		29		29		29		29		29		29	
max	2.5		4.5		4.5		4.5		4.5		4.5		4.5	
min	1		3.5		3.5		3		3.5		3.5		3	
median (M)	1.5		4.5		3.5		4		4.5		4.5		4.5	

### Subjective Test

Reported Value – Assigned Value   ≤ ½ grade	Satisfactory
Reported Value - Assigned Value   > ½ grade	Outlier

### Frequency distribution

Grade	Change in Color	Staining on adjacent fabric					
		Acetate	Cotton	Nylon	Polyester	Acrylic	Wool
1	5	0	0	0	0	0	0
1-2	18	0	0	0	0	0	0
2	5	0	0	0	0	0	0
2-3	1	0	0	0	0	0	0
3	0	0	11	1	0	0	1
3-4	0	1	16	1	1	1	1
4	0	7	2	13	7	10	10
4-5	0	21	0	14	21	18	17

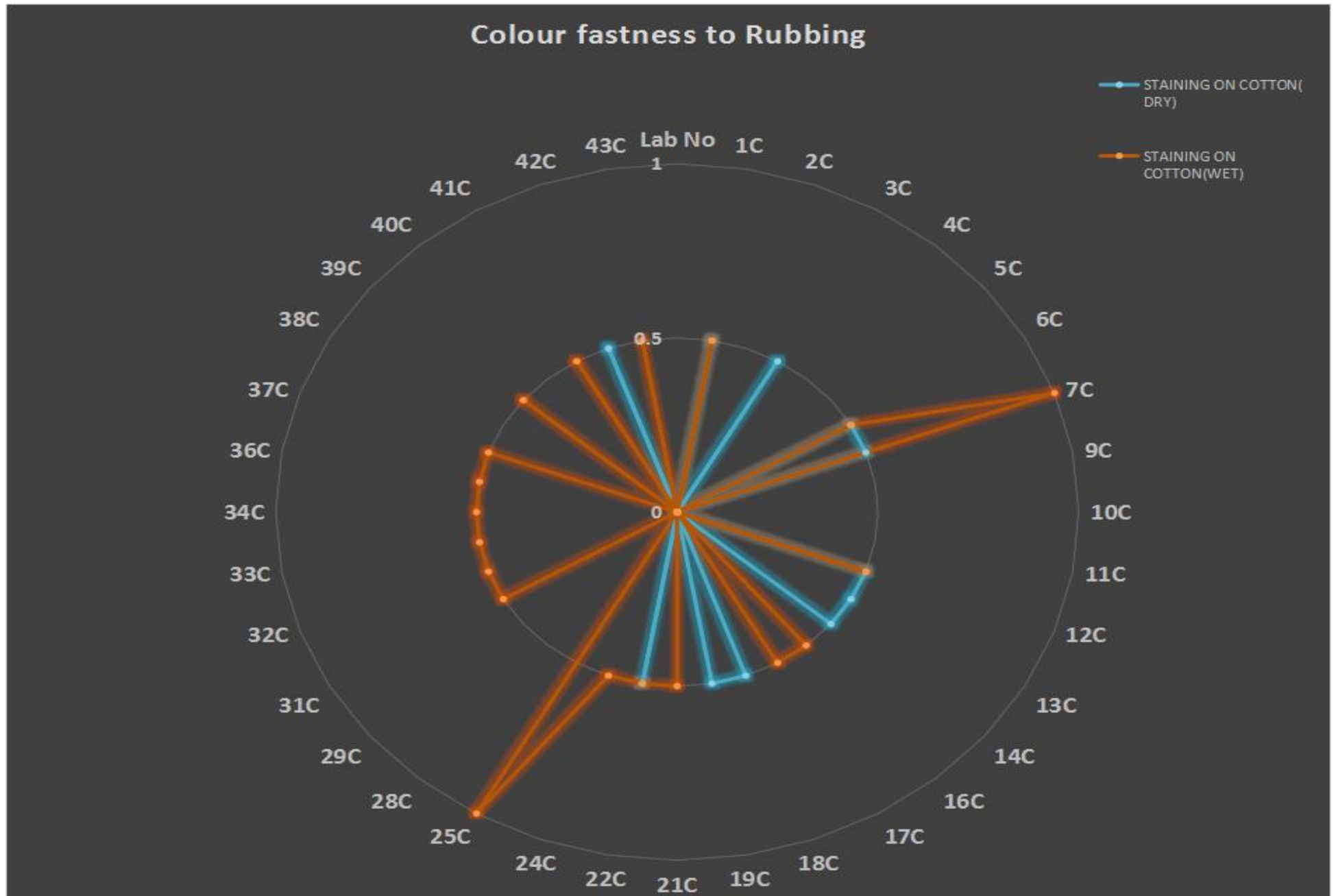


### 3. Colour fastness to Rubbing

		STAINING ON COTTON( DRY)			STAINING ON COTTON(WET)		
Assigned Value		4			2-3		
Lab No	Test Method	Reported Value	Reported Value – Assigned Value	Comments on performance	Reported Value	Reported Value – Assigned Value	Comments on performance
1C	ISO 105 X12:2016	4-5	0.5	Satisfactory	2	0.5	Satisfactory
2C	ISO 105 X12:2016	4	0	Satisfactory	2-3	0	Satisfactory
3C	IS:766-1988	4-5	0.5	Satisfactory	2-3	0	Satisfactory
4C	ISO 105 X12:2016	4	0	Satisfactory	2-3	0	Satisfactory
5C	ISO 105 X12:2016	4	0	Satisfactory	2-3	0	Satisfactory
6C	ISO 105 X12	4-5	0.5	Satisfactory	3	0.5	Satisfactory
7C	IS:766	4-5	0.5	Satisfactory	3-4	1	Outlier
9C	NOT MENTIONED	4	0	Satisfactory	2-3	0	Satisfactory
10C	ISO 105 X12	4	0	Satisfactory	2-3	0	Satisfactory
11C	ISO 105 X12:2016	4	0	Satisfactory	2-3	0	Satisfactory
12C	IS:766	4-5	0.5	Satisfactory	3	0.5	Satisfactory
13C	ISO 105 X12:2016	4-5	0.5	Satisfactory	2-3	0	Satisfactory
14C	ISO 105 X12	4-5	0.5	Satisfactory	2-3	0	Satisfactory
16C	IS:766-1988	4	0	Satisfactory	2	0.5	Satisfactory
17C	ISO 105 X12	4	0	Satisfactory	2	0.5	Satisfactory
18C	IS/ISO 105 X12:2001	4-5	0.5	Satisfactory	2-3	0	Satisfactory
19C	ISO 105 X12	4-5	0.5	Satisfactory	2-3	0	Satisfactory
21C	ISO 105 X12:2016	4	0	Satisfactory	2	0.5	Satisfactory
22C	IS:766	4-5	0.5	Satisfactory	2	0.5	Satisfactory
24C	IS:766:2004	4	0	Satisfactory	2	0.5	Satisfactory
25C	IS:766	4	0	Satisfactory	1-2	1	Outlier
28C	ISO 105 X12	4	0	Satisfactory	2-3	0	Satisfactory
29C	IS:766	4	0	Satisfactory	2-3	0	Satisfactory
31C	IS:766	4	0	Satisfactory	2	0.5	Satisfactory
32C	IS:766-1988 RA2004	4	0	Satisfactory	2	0.5	Satisfactory
33C	IS:766-1988 RA2016	4	0	Satisfactory	2	0.5	Satisfactory
34C	IS:766	4	0	Satisfactory	2	0.5	Satisfactory

36C	IS:766	4	0	Satisfactory	2	0.5	Satisfactory
37C	IS:766	4	0	Satisfactory	2	0.5	Satisfactory
38C	IS:766-1988	4	0	Satisfactory	2-3	0	Satisfactory
39C	IS:766-1988 RA2004	4	0	Satisfactory	2	0.5	Satisfactory
40C	IS:766	4	0	Satisfactory	2-3	0	Satisfactory
41C	IS:766-1988 RA2009	4	0	Satisfactory	2	0.5	Satisfactory
42C	IS:766	4-5	0.5	Satisfactory	2-3	0	Satisfactory
43C	IS:766-1988 RA2009	4	0	Satisfactory	2	0.5	Satisfactory
<b>participants</b>		<b>35</b>			<b>35</b>		
<b>max</b>		<b>4-5</b>			<b>3-4</b>		
<b>min</b>		<b>4</b>			<b>1-2</b>		
<b>median (M)</b>		<b>4</b>			<b>2-3</b>		

Frequency distribution		
Grade	STAINING ON COTTON	
	DRY	WET
1	0	0
1-2	0	1
2	0	15
2-3	0	16
3	0	2
3-4	0	1
4	25	0
4-5	11	0
5	0	0
<b>participants</b>	<b>35</b>	<b>35</b>



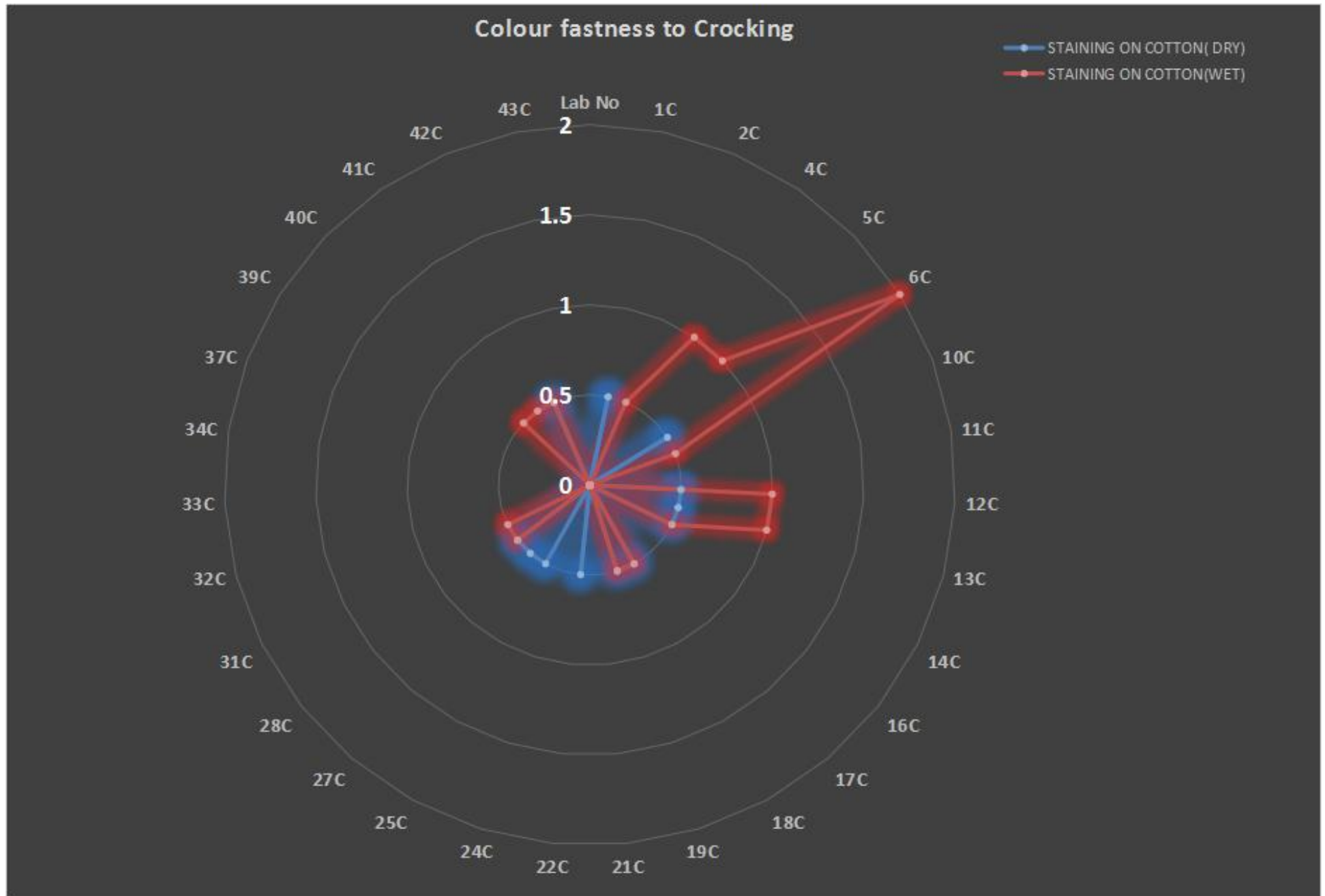


## 4. Colour fastness to Crocking

STAINING ON COTTON( DRY)                      STAINING ON COTTON(WET)							
Assigned Value		4			2.0		
Lab No	Test Method	Reported Value	Reported Value – Assigned Value	Comments on performance	Reported Value	Reported Value – Assigned Value	Comments on performance
1C	AATCC 8:2016	4.5	0.5	Satisfactory	2	0	Satisfactory
2C	AATCC 8:2016	4	0	Satisfactory	2.5	0.5	Satisfactory
4C	AATCC 8	4	0	Satisfactory	3	1	Outlier
5C	AATCC 8:2013	4	0	Satisfactory	3	1	Outlier
6C	AATCC 8	4.5	0.5	Satisfactory	4	2	Outlier
10C	AATCC 8:2007	4	0	Satisfactory	2.5	0.5	Satisfactory
11C	AATCC 8:2016	4	0	Satisfactory	2	0	Satisfactory
12C	AATCC 8	4.5	0.5	Satisfactory	3	1	Outlier
13C	AATCC 8:2016	4.5	0.5	Satisfactory	3	1	Outlier
14C	AATCC 8:2016	4.5	0.5	Satisfactory	2.5	0.5	Satisfactory
16C	AATCC 8:2016	4	0	Satisfactory	2	0	Satisfactory
17C	AATCC 8	4	0	Satisfactory	2	0	Satisfactory
18C	AATCC 8:2016	4.5	0.5	Satisfactory	2.5	0.5	Satisfactory
19C	AATCC 8	4.5	0.5	Satisfactory	2.5	0.5	Satisfactory
21C	AATCC 8:2016	4	0	Satisfactory	2	0	Satisfactory
22C	AATCC 8	4.5	0.5	Satisfactory	2	0	Satisfactory
24C	AATCC 8:2013	4	0	Satisfactory	2	0	Satisfactory
25C	AATCC 8 TM 8	4.5	0.5	Satisfactory	2	0	Satisfactory
27C	AATCC 8:2016	4.5	0.5	Satisfactory	2	0	Satisfactory
28C	AATCC 8	4.5	0.5	Satisfactory	2.5	0.5	Satisfactory
31C	AATCC 8	4	0	Satisfactory	2.5	0.5	Satisfactory
32C	AATCC 8:2016	4	0	Satisfactory	2	0	Satisfactory
33C	AATCC 8:2016	4	0	Satisfactory	2	0	Satisfactory
34C	AATCC 8	4	0	Satisfactory	2	0	Satisfactory
37C	AATCC 8	4	0	Satisfactory	2	0	Satisfactory
39C	AATCC 8:2016	4	0	Satisfactory	2	0	Satisfactory
40C	AATCC 8	4	0	Satisfactory	2.5	0.5	Satisfactory
41C	AATCC 8:2016	4	0	Satisfactory	2.5	0.5	Satisfactory
42C	AATCC 8	4.5	0.5	Satisfactory	2.5	0.5	Satisfactory
43C	AATCC 8:2007	4	0	Satisfactory	2	0	Satisfactory

<b>participants</b>		<b>30</b>			<b>30</b>		
<b>max</b>		<b>4.5</b>			<b>4</b>		
<b>min</b>		<b>4</b>			<b>2</b>		

<b>Frequency distribution</b>		
<b>Grade</b>	<b>STAINING ON COTTON</b>	
	<b>DRY</b>	<b>WET</b>
<b>1</b>	0	0
<b>1-2</b>	0	0
<b>2</b>	0	15
<b>2-3</b>	0	10
<b>3</b>	0	4
<b>3-4</b>	0	0
<b>4</b>	18	1
<b>4-5</b>	12	0
<b>5</b>	0	0
<b>participants</b>	<b>30</b>	<b>30</b>



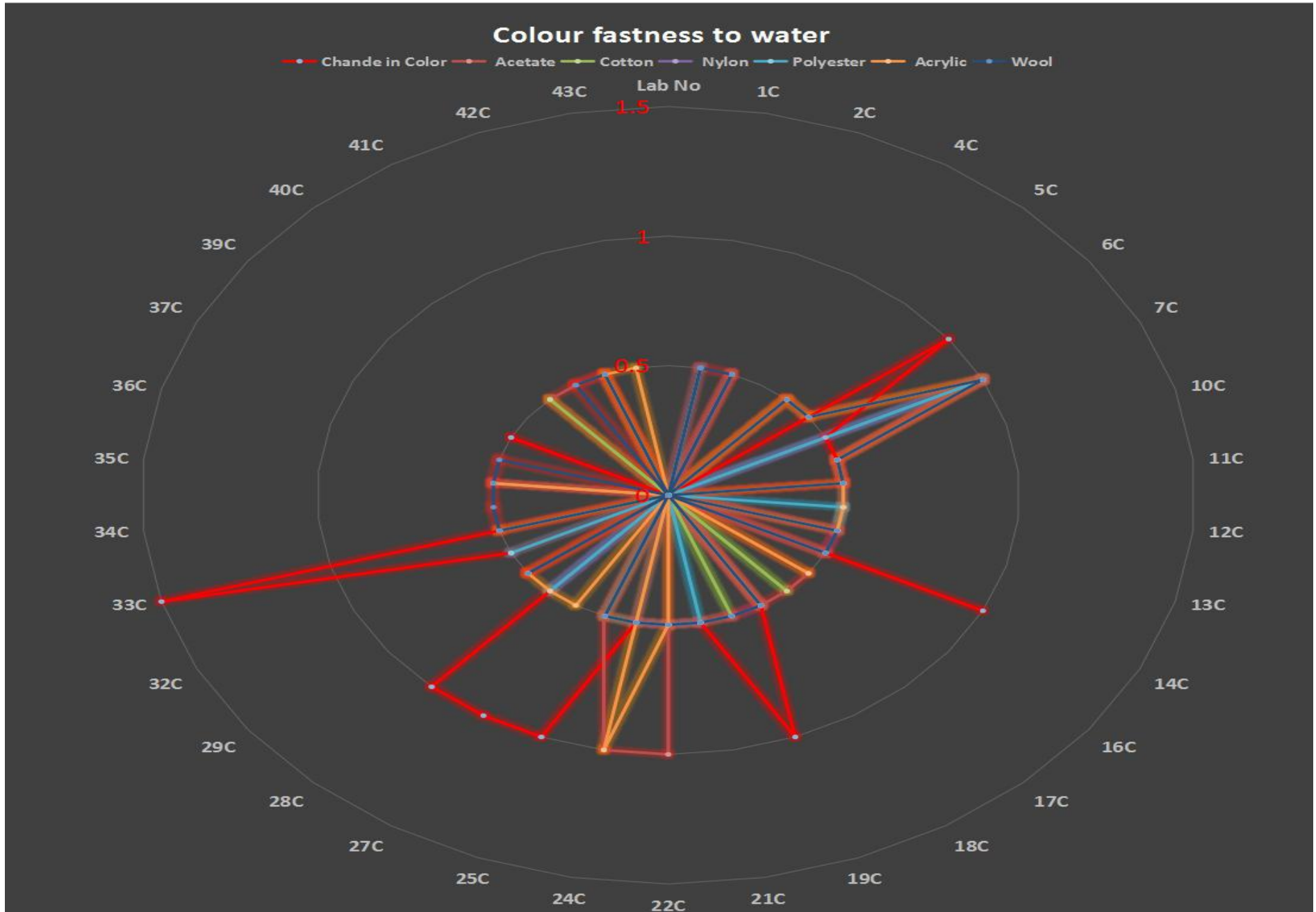
## 5. Colour fastness to water

Assigned Value	2-3		2		2		2-3		2-3		2-3		2		Test Method
	Change in Color	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	
1C	2-3	0	2	0	2	0	2-3	0	2	0.5	2-3	0	1-2	0.5	ISO 105 E01:2013
2C	2-3	0	2-3	0.5	2-3	0.5	3	0.5	2-3	0	2-3	0	2-3	0.5	ISO 105 E01:2013
4C	2-3	0	2	0	2	0	2-3	0	2-3	0	2-3	0	2	0	ISO 105 E01
5C	2-3	0	1-2	0.5	2-3	0.5	2-3	0	2-3	0	2	0.5	1-2	0.5	ISO 105 E01:2013
6C	3-4	1	2	0	2-3	0.5	2-3	0	2-3	0	2	0.5	1-2	0.5	ISO 105 E01
7C	3	0.5	3	1	3	1	3-4	1	3-4	1	3-4	1	3	1	IS 767
10C	3	0.5	2-3	0.5	2-3	0.5	3	0.5	2-3	0	3	0.5	2-3	0.5	ISO 105 E01
11C	2	0.5	1-2	0.5	2-3	0.5	3	0.5	2-3	0	3	0.5	2-3	0.5	ISO 105 E01:2013
12C	2-3	0	2	0	2	0	2	0.5	3	0.5	2	0.5	2	0	ISO 105 E01
13C	2-3	0	1-2	0.5	2	0	2	0.5	2	0.5	2	0.5	1-2	0.5	ISO 105 E01:2010
14C	3-4	1	2	0	2-3	0.5	3	0.5	2-3	0	2-3	0	2-3	0.5	ISO 105 E01
16C	2-3	0	2-3	0.5	2	0	2-3	0	2-3	0	3	0.5	2	0	ISO 105 E01:2013
17C	2-3	0	2-3	0.5	2-3	0.5	2-3	0	2-3	0	2-3	0	2	0	ISO 105 E01
18C	2	0.5	1-2	0.5	2	0	2	0.5	2	0.5	2	0.5	1-2	0.5	ISO 105 E01:2013
19C	3-4	1	2	0	2-3	0.5	3	0.5	2-3	0	2-3	0	2-3	0.5	ISO 105 E01
21C	2	0.5	2	0	1-2	0.5	2	0.5	2	0.5	2-3	0	1-2	0.5	ISO 105 E01:2010
22C	2	0.5	3	1	2-3	0.5	3	0.5	3	0.5	3	0.5	2-3	0.5	IS 767
24C	2	0.5	1	1	1-2	0.5	2	0.5	2	0.5	1-2	1	1-2	0.5	ISO 105 E01:2013
25C	3-4	1	1-2	0.5	2-3	0.5	2-3	0	3	0.5	2-3	0	2-3	0.5	IS 767
27C	3-4	1	2	0	2	0	2-3	0	2-3	0	2	0.5	2	0	BS EN ISO 105 E01: 2013
28C	3-4	1	2	0	2	0	3	0.5	3	0.5	2	0.5	2	0	ISO 105 E01
29C	2-3	0	1-2	0.5	2	0	2-3	0	2-3	0	2	0.5	1-2	0.5	IS 766

Lab No	Change in Color		Acetate		Cotton		Nylon		Polyester		Acrylic		Wool		Test Method
	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	
32C	2	0.5	2	0	2	0	2-3	0	2	0.5	2-3	0	2	0	IS 767
33C	4	1.5	2-3	0.5	2-3	0.5	2-3	0	2-3	0	2-3	0	2-3	0.5	ISO 105 E01:2013
34C	2-3	0	2	0	2	0	2-3	0	2-3	0	2-3	0	2-3	0.5	ISO 105 E01
35C	3	0.5	1-2	0.5	2	0	3	0.5	2-3	0	2	0.5	1-2	0.5	ISO 105 E01
36C	2-3	0	2	0	2	0	2-3	0	2-3	0	2-3	0	1-2	0.5	IS 766
37C	3	0.5	2	0	2	0	2-3	0	2-3	0	2-3	0	2	0	IS 767
39C	2-3	0	2	0	2	0	2-3	0	2-3	0	2-3	0	2	0	IS 767:1988 RA 2009
40C	3	0.5	2-3	0.5	2-3	0.5	2-3	0	2-3	0	2-3	0	2	0	ISO 105 E01
41C	2-3	0	2-3	0.5	2	0	2-3	0	2-3	0	2-3	0	2-3	0.5	ISO 105 E01:2013
42C	3	0.5	1-2	0.5	2-3	0.5	2-3	0	2-3	0	3	0.5	2-3	0.5	ISO 105 E01
43C	2-3	0	2	0	2	0	2-3	0	2-3	0	2	0.5	2	0	ISO 105 E01:2010
participants	33		33		33		33		33		33		33		
max	4		3		3		3-4		3-4		3-4		3		
min	2		1		1-2		2		2		1-2		1-2		
median (M)	2-3		2		2		2-3		2-3		2-3		2		

Subjective Test	
Reported Value – Assigned Value   ≤ ½ grade	Satisfactory
Reported Value - Assigned Value   > ½ grade	Outlier

Frequency distribution							
Grade	Change in Color	Staining on adjacent fabric					
		Acetate	Cotton	Nylon	Polyester	Acrylic	Wool
1	0	1	0	0	0	0	0
1-2	0	8	2	0	0	1	10
2	6	15	17	5	6	10	11
2-3	14	7	13	19	22	16	11
3	6	2	1	8	4	5	1
3-4	6	0	0	1	1	1	0
4	1	0	0	0	0	0	0
4-5	0	0	0	0	0	0	0
participants	33	33	33	33	33	33	33



## 6. Colour fastness to Perspiration (Acidic)

Lab No	Change in Color		Acetate		Cotton		Nylon		Polyester		Acrylic		Wool		Test Method
	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	
1C	2-3	0	2	0	2	0	2	0	2-3	0	2	0.5	1	1	ISO 105 E04:2013
2C	2-3	0	2	0	2	0	2	0	2	0.5	2	0.5	1-2	0.5	ISO 105 E04:2013
3C	3	0.5	2-3	0.5	2-3	0.5	2-3	0.5	2-3	0	2-3	0	2	0	ISO 105 E04:2008(E)
4C	2-3	0	2	0	2	0	2-3	0.5	2-3	0	2-3	0	2	0	ISO 105 E04
5C	2-3	0	1-2	0.5	2	0	2-3	0.5	2-3	0	2	0.5	1-2	0.5	ISO 105 E04:2013
6C	3-4	1	1-2	0.5	2	0	2	0	2-3	0	2	0.5	1-2	0.5	ISO 105 E04
7C	3	0.5	3-4	1.5	3	1	3	1	3-4	1	3-4	1	3	1	IS 971
9C	3	0.5	4	2	2-3	0.5	3	1	3	0.5	3-4	1	3	1	
10C	3	0.5	2-3	0.5	2-3	0.5	3	1	3	0.5	3	0.5	2-3	0.5	ISO 105 E04
11C	2	0.5	2	0	2-3	0.5	2-3	0.5	3	0.5	2-3	0	2-3	0.5	ISO 105 E04:2013
12C	3	0.5	3	1	2	0	2	0	3	0.5	2	0.5	2	0	ISO 105 E04
13C	2-3	0	1-2	0.5	1-2	0.5	2	0	1-2	1	2	0.5	1-2	0.5	ISO 105 E04:2008 RA2014
14C	3	0.5	2	0	2-3	0.5	2-3	0.5	2-3	0	2-3	0	2-3	0.5	ISO 105 E04
16C	2-3	0	2	0	2	0	2-3	0.5	2-3	0	2	0.5	1-2	0.5	ISO 105 E04:2013
17C	2-3	0	2	0	2	0	2	0	2-3	0	2-3	0	1-2	0.5	ISO 105 E04
18C	2	0.5	1-2	0.5	1-2	0.5	2	0	2-3	0	2	0.5	1-2	0.5	ISO 105 E04:2013
19C	3	0.5	2	0	2-3	0.5	2-3	0.5	2-3	0	2-3	0	2-3	0.5	
21C	2	0.5	1	1	1	1	1-2	0.5	1-2	1	1-2	1	1	1	ISO 105 E04 2008
22C	2	0.5	2-3	0.5	2-3	0.5	2-3	0.5	3	0.5	3	0.5	2-3	0.5	IS 971
24C	2-3	0	2	0	2	0	2-3	0.5	3	0.5	2-3	0	2	0	ISO 105 E04:2013
25C	2-3	0	1-2	0.5	2	0	2-3	0.5	3	0.5	2-3	0	2	0	ISO 105 E04
27C	3-4	1	1-2	0.5	1-2	0.5	2	0	2-3	0	2	0.5	2	0	BSEN ISO 105 E04:2013

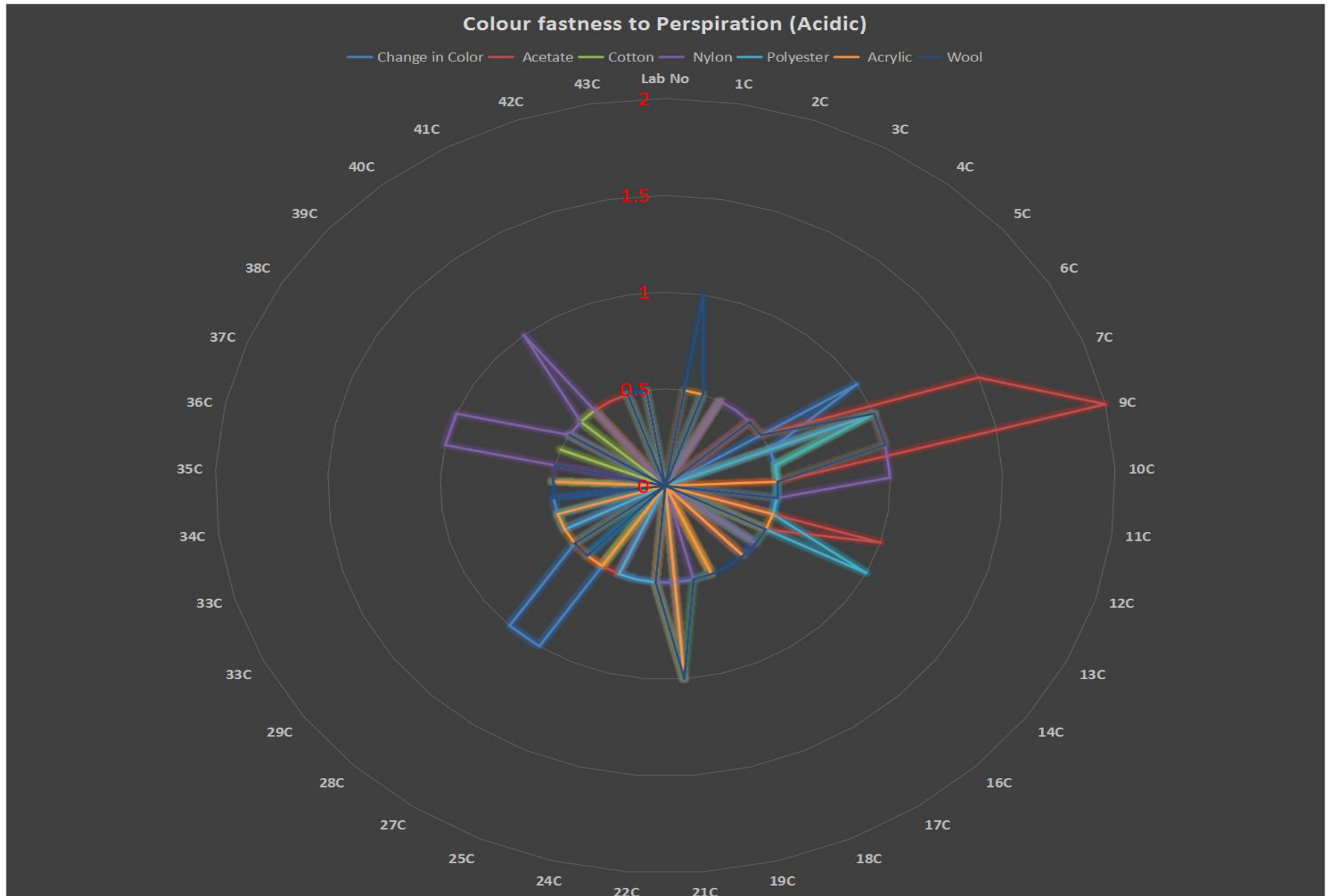


Lab No	Change in Color		Acetate		Cotton		Nylon		Polyester		Acrylic		Wool		Test Method
	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	
28C	3-4	1	1-2	0.5	2	0	2	0	3	0.5	2	0.5	2-3	0.5	ISO 105 E04
29C	3	0.5	1-2	0.5	1-2	0.5	2	0	2-3	0	2	0.5	1-2	0.5	IS 971
32C	2-3	0	2	0	2	0	2-3	0.5	2	0.5	2	0.5	2	0	IS 971:1983 RA 2004
33C	3	0.5	2	0	2	0	2	0	2	0.5	2	0.5	2	0	ISO 105 E04:2013
34C	2	0.5	2	0	2	0	2	0	2-3	0	2-3	0	1-2	0.5	ISO 105 E04
35C	2-3	0	1-2	0.5	1-2	0.5	2	0	2	0.5	2	0.5	1-2	0.5	ISO 105 E04
36C	2-3	0	2-3	0.5	2	0	3	1	2-3	0	2-3	0	1-2	0.5	IS 971
37C	2-3	0	2	0	2-3	0.5	3	1	2-3	0	2-3	0	2	0	IS 971
38C	3	0.5	1-2	0.5	2	0	2-3	0.5	2	0.5	2	0.5	1-2	0.5	IS 971
39C	2-3	0	2	0	2-3	0.5	2-3	0.5	2-3	0	2-3	0	2	0	IS 971:1983 RA 2004
40C	2-3	0	2-3	0.5	2-3	0.5	3	1	2-3	0	2-3	0	2	0	ISO 105 E04
41C	2-3	0	2-3	0.5	2	0	2	0	2-3	0	2-3	0	2	0	ISO 105 E04:2013
42C	3	0.5	1-2	0.5	1-2	0.5	2	0	2-3	0	2-3	0	2-3	0.5	ISO 105 E04
43C	2-3	0	2	0	2	0	2	0	2	0.5	2	0.5	1-2	0.5	BSEN ISO 105 E04:2013
participants	36		36		36		36		36		36		36		
max	3-4		4		3		3		3-4		3-4		3		
min	2		1		1		1-2		1-2		1-2		1		
median (M)	2-3		2		2		2		2-3		2-3		2		

### Subjective Test

$ \text{Reported Value} - \text{Assigned Value}  \leq \frac{1}{2} \text{ grade}$	Satisfactory
$ \text{Reported Value} - \text{Assigned Value}  > \frac{1}{2} \text{ grade}$	Outlier

Frequency distribution							
Grade	Change in Color	Staining on adjacent fabric					
		Acetate	Cotton	Nylon	Polyester	Acrylic	Wool
1	0	1	1	0	0	0	2
1-2	0	11	6	1	2	1	13
2	5	15	18	16	6	16	12
2-3	17	6	10	13	19	15	7
3	11	1	1	6	8	2	2
3-4	3	1	0	0	1	2	0
4	0	1	0	0	0	0	0
4-5	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
participants	36	36	36	36	36	36	36
max	3-4	4	3	3	3-4	3-4	3
min	2	1	1	1-2	1-2	1-2	1
median (M)	2-3	2	2	2-3	2-3	2-3	2



## 6. Colour fastness to Perspiration (Alkaline)

Assigned Value	2-3		2-3		2		2-3		2-3		2-3		2		Test Method
	Change in Color	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	
1C	2	0.5	3	0.5	2	0	2-3	0	2-3	0	2-3	0	2	0	ISO 105 E04:2013
2C	2-3	0	2-3	0	2	0	2-3	0	2-3	0	2-3	0	2	0	ISO 105 E04:2013
3C	3	0.5	3	0.5	2	0	2-3	0	2-3	0	2-3	0	2-3	0.5	ISO 105 E04:2008(E)
4C	2	0.5	2-3	0	2	0	2-3	0	2-3	0	2-3	0	2-3	0.5	ISO 105 E04
5C	2	0.5	2-3	0	2	0	2-3	0	2-3	0	2-3	0	2	0	ISO 105 E04:2013
6C	3-4	1	2-3	0	2	0	2-3	0	2-3	0	2-3	0	2	0	ISO 105 E04
7C	2-3	0	4	1.5	3	1	3-4	1	3-4	1	3-4	1	3-4	1-2	IS 971
9C	2-3	0	4	1.5	3	1	3-4	1	3-4	1	3-4	1	3	1	
10C	3	0.5	2-3	0	2	0	3	0.5	3	0.5	3	0.5	2-3	0.5	ISO 105 E04
11C	2	0.5	3	0.5	2-3	0.5	3	0.5	3	0.5	3	0.5	3	1	ISO 105 E04:2013
12C	3	0.5	2	0.5	2	0	2	0.5	2	0.5	2	0.5	2	0	ISO 105 E04
13C	2-3	0	2	0.5	1-2	0.5	2	0.5	2	0.5	2-3	0	2	0	ISO 105 E04:2008 RA2014
14C	3	0.5	3	0.5	2	0	3	0.5	3	0.5	3	0.5	3	1	ISO 105 E04
16C	2-3	0	2-3	0	2	0	2-3	0	2-3	0	2-3	0	2	0	ISO 105 E04:2013
17C	2-3	0	2-3	0	2	0	2-3	0	2-3	0	2-3	0	2	0	ISO 105 E04
18C	2	0.5	2-3	0	2	0	2-3	0	2-3	0	2-3	0	2-3	0.5	ISO 105 E04:2013
19C	3	0.5	3	0.5	2	0	3-4	1	3	0.5	3	0.5	3	1	
21C	2	0.5	3	0.5	1	1	2-3	0	2	0.5	2-3	0	2	0	ISO 105 E04 2008
22C	2	0.5	4	1.5	2	0	3	0.5	3-4	1	3-4	1	2-3	0.5	IS 971
24C	2-3	0	2-3	0	2	0	2-3	0	3	0.5	3	0.5	2-3	0.5	ISO 105 E04:2013
25C	2	0.5	2-3	0	2	0	2-3	0	3	0.5	2-3	0	2	0	ISO 105 E04

Lab No	Change in Color		Acetate		Cotton		Nylon		Polyester		Acrylic		Wool		Test Method
	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	
27C	3-4	1	2-3	0	1-2	0.5	2	0.5	3	0.5	2-3	0	2	0	BSEN ISO 105 E04:2013
28C	3	0.5	2-3	0	1-2	0.5	2-3	0	3-4	1	3	0.5	2-3	0.5	ISO 105 E04
29C	2-3	0	2	0.5	1-2	0.5	2-3	0	2-3	0	2	0.5	1-2	0.5	IS 971
32C	2-3	0	2-3	0	2	0	2-3	0	2-3	0	2-3	0	2-3	0.5	IS 971:1983 RA 2004
33C	3	0.5	3-4	1	2-3	0.5	3	0.5	3	0.5	3	0.5	2-3	0.5	ISO 105 E04:2013
34C	2	0.5	2-3	0	2	0	2	0.5	2-3	0	2-3	0	2	0	ISO 105 E04
35C	2-3	0	2	0.5	1-2	0.5	2-3	0	2	0.5	2	0.5	1-2	0.5	ISO 105 E04
36C	2-3	0	2-3	0	2	0	2-3	0	2-3	0	3	0.5	2	0	IS 971
37C	2-3	0	3	0.5	2	0	3	0.5	3	0.5	3	0.5	2	0	IS 971
38C	2-3	0	2	0.5	2	0	2-3	0	2-3	0	2	0.5	2	0	IS 971
39C	2-3	0	2-3	0	2	0	2-3	0	2-3	0	2-3	0	2-3	0.5	IS 971:1983 RA 2004
40C	2-3	0	2-3	0	2	0	2-3	0	3	0.5	3	0.5	2-3	0.5	ISO 105 E04
41C	2	0.5	2-3	0	1-2	0.5	2	0.5	2-3	0	2	0.5	2	0	ISO 105 E04:2013
42C	3	0.5	3	0.5	2	0	2-3	0	3	0.5	3	0.5	1-2	0.5	ISO 105 E04
43C	2-3	0	2	0.5	2	0	2-3	0	2	0.5	2	0.5	1-2	0.5	BSEN ISO 105 E04:2013
participants	36		36		36		36		36		36		36		
max	3-4		4		3		3-4		3-4		3-4		3-4		
min	2		2		1		2		2		2		1-2		
median (M)	2-3		2-3		2		2-3		2-3		2-3		2		

### Subjective Test

| Reported Value – Assigned Value | ≤ ½ grade

Satisfactory

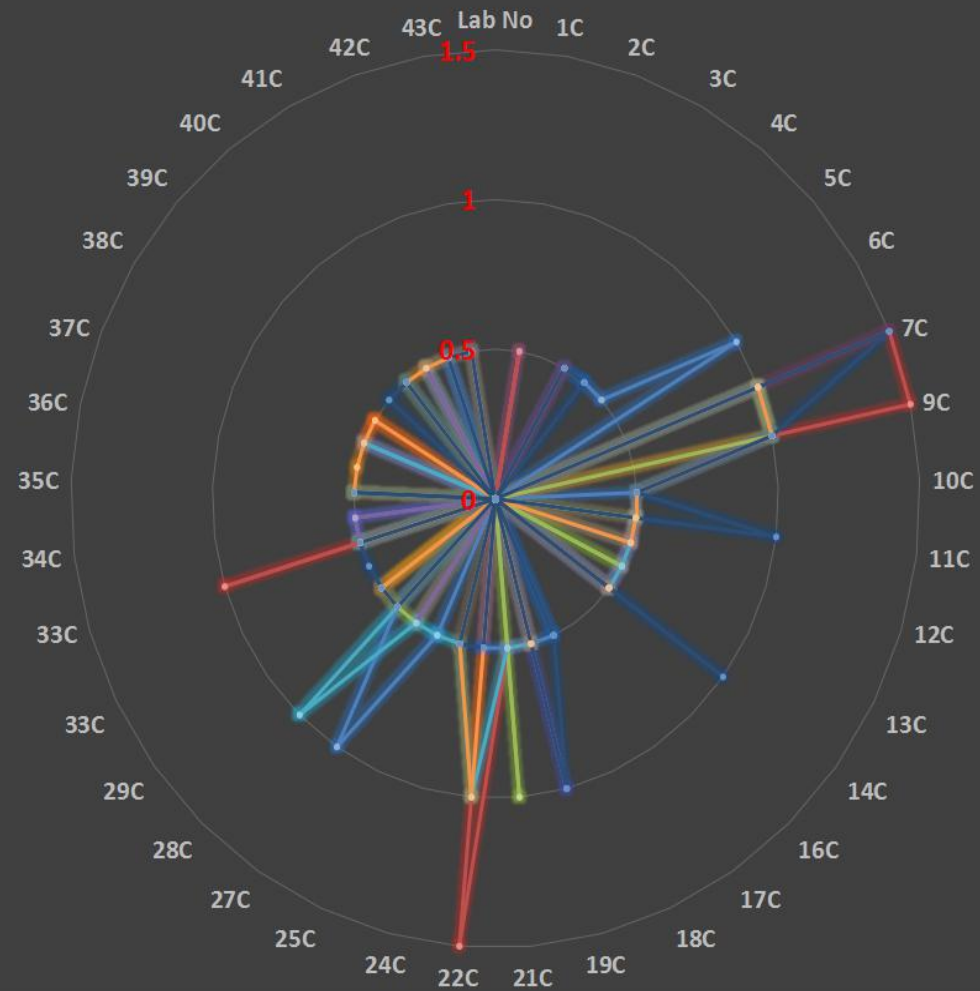
| Reported Value - Assigned Value | > ½ grade

Outlier

Frequency distribution							
Grade	Change in Color	Staining on adjacent fabric					
		Acetate	Cotton	Nylon	Polyester	Acrylic	Wool
1	0	0	1	0	0	0	0
1-2	0	0	6	0	0	0	4
2	10	6	25	5	5	6	16
2-3	16	18	2	22	16	16	11
3	8	8	2	6	11	11	4
3-4	2	1	0	3	4	3	1
4	0	3	0	0	0	0	0
4-5	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
participants	36	36	36	36	36	36	36

### 6. Colour fastness to Perspiration (Alkaline)

Change in Color Acetate Cotton Nylon Polyester Acrylic Wool



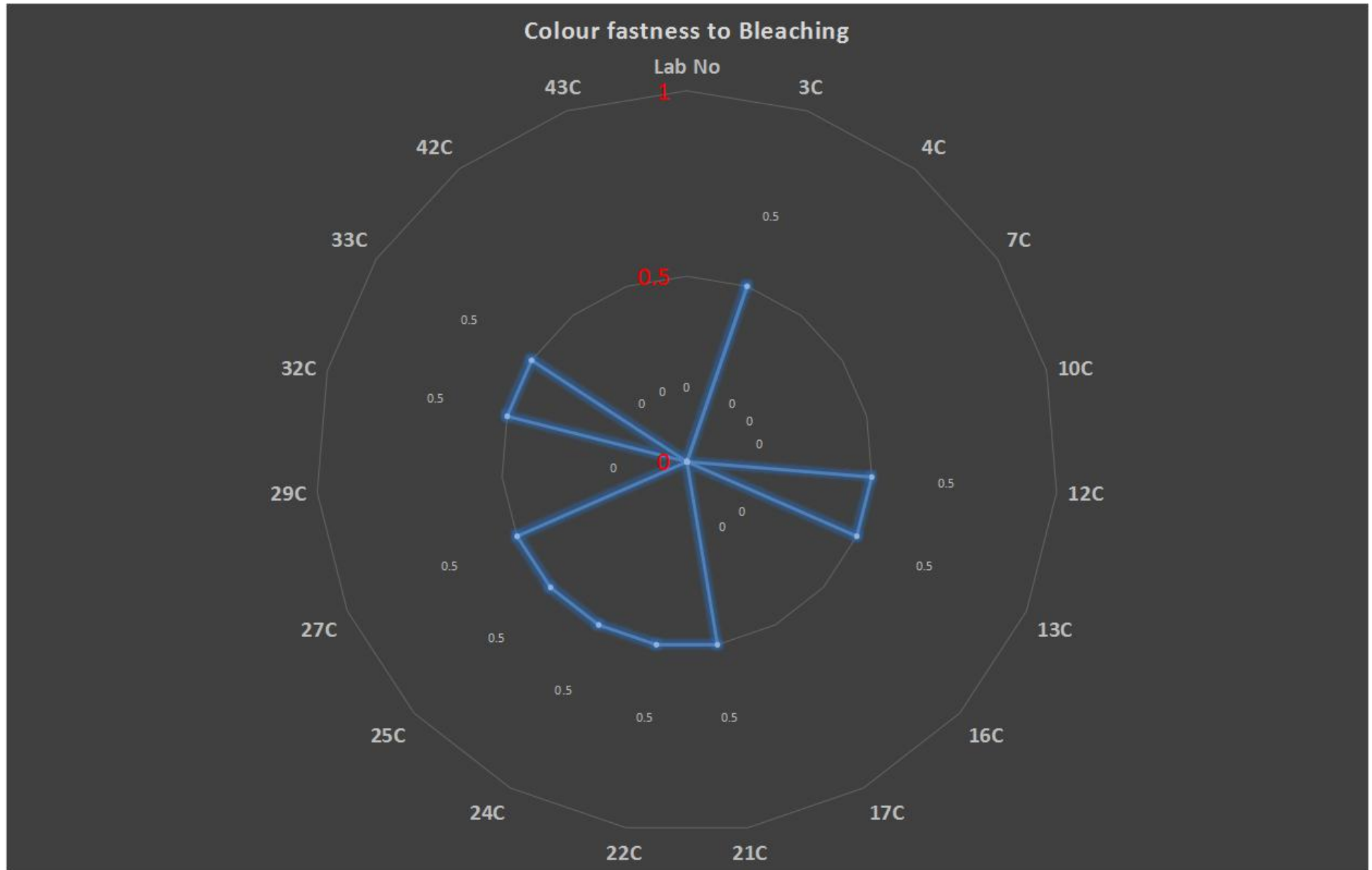
## 7. Colour fastness to Bleaching

Assigned Value		Change in Colour		
		1-2		
Lab No	Test Method	Reported Value	Reported Value – Assigned Value	Comments on performance
3C	IS:762-1988	2	0.5	Satisfactory
4C	ISO 105 NO.1:1993	1-2	0	Satisfactory
7C		1-2	0	Satisfactory
10C	ISO 105 NO.1	1-2	0	Satisfactory
12C	IS:762	2	0.5	Satisfactory
13C	IS:762	1	0.5	Satisfactory
16C	IS:762-1988	1-2	0	Satisfactory
17C	IS:762	1-2	0	Satisfactory
21C	IS:762-1988	1	0.5	Satisfactory
22C	IS:762	1	0.5	Satisfactory
24C	IS:762-1997	1	0.5	Satisfactory
25C	IS:762	1	0.5	Satisfactory
27C	ISO 105 NO.1:1993	2	0.5	Satisfactory
29C	IS:762	1-2	0	Satisfactory
32C	IS:762	2	0.5	Satisfactory
33C	IS:762:1988 RA 2009	1	0.5	Satisfactory
42C	IS:762	1-2	0	Satisfactory
43C	IS:762:1998-RA 2004	1-2	0	Satisfactory
<b>participants</b>		<b>18</b>		
<b>max</b>		<b>2</b>		
<b>min</b>		<b>1</b>		
<b>median (M)</b>		<b>1-2</b>		

### Frequency distribution

Grade	Change in Colour
1	6
1-2	8
2	4
2-3	0
3	0
3-4	0
<b>participants</b>	<b>18</b>





## 8. Colour fastness to Dry cleaning

8. Colour fastness to Dry cleaning							
		Change in Colour (Basic fabric)		Change in Colour [Overall Print of fabric] (least grade)		Staining of solvent	
Assigned Value		4		1-2		3	
Lab No	Test Method	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value	Reported Value	Reported Value – Assigned Value
2C	ISO 105 2010	4	0	1-2	0	3	0
4C	ISO 105 D01	4	0	1	0.5	3-4	0.5
5C	ISO 105 D01:2010	4	0	1	0.5	3	0
10C	ISO 105 D01	4	0	3	1.5	3	0
11C	ISO 105 D01:2010	4	0	3	1.5	3	0
12C	ISO 105 D01	4	0	1	0.5	4	1
13C	IS 4802 1988RA2016	4	0	1-2	0	3-4	0.5
16C	ISO 105 D01:2010	4	0	1-2	0	2-3	0.5
17C	ISO 105 D01	4	0	1-2	0	2-3	0.5
18C	ISO 105 D01:2010	4-5	0.5	1-2	0	3-4	0.5
21C	IS 4802	4	0	1-2	0	4	1
22C	ISO 105 D01	4	0	4	2.5	4-5	1.5
24C		4	0	2	0.5	4	1
25C	ISO 105 D01	4	0	2	0.5	2-3	0.5
27C	ISO 105 D01:2010	4-5	0.5	1	0.5	3	0
28C	ISO 105 D01	4	0	1-2	0	3	0
29C	IS 4802	4	0	1	0.5	3-4	0.5
31C	ISO 105 D01	4-5	0.5	1-2	0	3-4	0.5
32C		4	0	1	0.5	3-4	0.5
35C		3-4	0.5	1-2	0	3	0
33C	ISO 105 D01:2010	4-5	0.5	1	0.5	3	0
36C	IS 4802	4	0	2	0.5	3	0
34C	ISO 105 D01	4	0	2	0.5	3	0
37C	IS 4802	4	0	1-2	0	3-4	0.5
40C	ISO 105 D01	4	0	1-2	0	3	0
41C		4	0	2-3	1	3-4	0.5
42C	NOT MENTIONED	4-5	0.5	2	0.5	3	0
43C	ISO 105 D01:2010	4	0	1-2	0	3	0
Participants		28		28		28	
max		4-5		4		4-5	
min		3-4		1		2-3	
median (M)		4		1-2		3	
<b>Subjective Test</b>							
Reported Value – Assigned Value   ≤ ½ grade						Satisfactory	
Reported Value - Assigned Value   > ½ grade						Outlier	

<b>Frequency distribution</b>			
<b>Grade</b>	<b>Change in Colour (Basic fabric)</b>	<b>Change in Colour [Overall Print of fabric] (least grade)</b>	<b>Staining of solvent</b>
<b>1</b>	<b>0</b>	<b>7</b>	<b>0</b>
<b>1-2</b>	<b>0</b>	<b>12</b>	<b>0</b>
<b>2</b>	<b>0</b>	<b>5</b>	<b>0</b>
<b>2-3</b>	<b>0</b>	<b>1</b>	<b>3</b>
<b>3</b>	<b>0</b>	<b>2</b>	<b>13</b>
<b>3-4</b>	<b>1</b>	<b>0</b>	<b>8</b>
<b>4</b>	<b>22</b>	<b>1</b>	<b>3</b>
<b>4-5</b>	<b>5</b>	<b>0</b>	<b>1</b>
<b>participants</b>	<b>28</b>	<b>28</b>	<b>28</b>

