The Statistical Analyzed Report of the Round Robin Test

(Deodorant/ISO 17299-1～5)

20th November, 2019

APEC Project SCSC 01 2018T

Capacity Building on Testing Methods for Functionality Finishing on Textile

Products and Certification Methods within the APEC Region

INDEX

1. Foreword

This round robin tests have been conducted according to ISO/IEC 17025:2017" General requirements for the competence of testing and calibrations laboratories", and ISO/IEC 17043:2010 "Conformity Assessment-General requirements for proficiency testing"

2. Purpose of the Round Robin Test

APEC project SCSC 01 2018T-Capacity Building on Testing Methods for Functionality Finishing on Textile Products and Certification Methods within the APEC Region has been conducted according to the APEC Project Proposal from August 2018 to December 2019.

In this project, following 4 functionality finishing testing method standards (ISO 20743, ISO 17299-1 to 5, ISO 13629-1, ISO 18184) have been explained.

And, these round robin tests were carried out to confirm whether the participants obtained sufficient skill and knowledge of those ISO standards to harmonize the testing methods in the APEC region, in 3 seminars, 1st seminar in Washington DC, 2nd seminar in Jakarta, and 3rd seminar in Taipei city.

3. Testing Standards

Round robin tests were carried out on the following 2 standards within above 4 standards.

> ISO 20743: Textile-Determination of antibacterial activity of textile products"
Test method: 8.1 Absorption method
Quantitative measurement: plate count method
Test strain: *Staphylococcus aureus* (WDCM code 00193)

> ISO 17299 -1~5:2014: Textile-Determination of deodorant property"
Test method: Part2: Detector tube method
Test odour: Ammonia (NH_3)

4. Executing Agency

This round robin tests have been carried out by Japan Textile Evaluation Technology council (JTETC) and its members.

Test specimens were made by KURABO Industries ltd.

Test results of antibacterial test were statistical analyzed by KE'KEN Textile Testing & Certification Center.

And, test results of deodorant test were statistical analyzed by BOKEN Quality Evaluation Institute.

5. Testing Program Scheme

This round robin tests have been carried out according to the scheme of proficiency test in ISO/IEC 17043:2010.

6. Participating Laboratory

15 laboratories from 5 APEC members participated in this round robin test for antibacterial test.

But, 2 laboratories from 2 APEC members did not submit their data sheets of the test results in dead line of the submitting.

Therefore, statistical analysis was calculated excluding those data.

And, the passwords applied by laboratories are listed instead of the names of laboratories in this report.

7. Method of Statistical Analysis and Evaluation

Statistical analysis was performed according to ISO/IEC 17043:2010 and ISO 13528 "Statistical methods for use in proficiency testing by interlaboratory comparisons".

So, as robust statistical technique, Z score is calculated by median and normalized interquartile range (NIQR) to evaluate testing result as following.

$|Z| \leq 2$: Satisfactory
$2 < |Z| < 3$: Questionable
$|Z| \geq 3$: Unsatisfactory

8. Testing Specimen

Testing Specimen for antibacterial finished (black color)

Size: 30cm/30cm
Material: polyester 65%/cotton 35%
Yarn Count: 45/45
Fabric Density: 136/inch / 72/inch
Processing conditions and equipment: following table

Table：Processing conditions and equipment of testing Specimen

Process		Equipment	Processing conditions
Spinning		Ring spinning frame	
Weaving		Air-jet loom	
Preparation	Singeing	Continuous range	The flame of the gas burner
	Desizing		Enzyme and oxidative desizing Steam treatment：98℃ × 30 min
	Scouring and Bleaching		35%H_2O_2 / NaOH aq. Steam treatment：98℃ × 30 min
	Mercerizing	Mercerizing machine	NaOH aq.
Dyeing		Continuous dyeing machine	Dipping – Dry – Fix – wash - Dry
Finishing	Pad-dry-cure method	Tenter machine	・Antibacterial agent Quaternary ammonium salt ・Deodorizing agent Metal salt Drying：125℃ × 2 min

9. Schedule

>Deadline for application: 24 July, 2019
>Delivery of Test Specimens: In August, 2019
>Deadline for submission of Test Result: 30 September, 2019
>Publication of Test Results Report: In November, 2019
>Study of Test Results: 20-21 November, 2019 In the 4th seminar in Shanghai

10. Test Results and Statistical Analysis

10.1 Test results reported by participating laboratories

Annex A-1 shows test results reported from participating laboratories.
Variations in the number of digits in data are the results of faithfully transcribing figures submitted by each of the participating laboratories.
All laboratories met requirements of odour concentration stipulated in ISO17299-2.

10.2 Summary of test results

The cells in the z-score judging column containing "$" indicate "unsatisfactory," in which the absolute value of the z-score is no less than 3. The cells containing

"!" indicate "questionable" with the absolute value of the z-score greater than 2 and less than 3.
Annex A-2 shows the histogram of test results, and Annex A-3 shows the bar chart for z-scores , Annex A-4 shows the test condition.

10.3 Evaluation of statistical analysis results
The test results (odour reduction rate) of all participating laboratories (N=13) were evaluated, based on the z-score, to find that two laboratories had the z-score for its odour reduction rate indicating "unsatisfactory". One laboratory returned "questionable" evaluation.
The smallest z-score was -3.85 (odour reduction rate of 94) and the largest z-score was 3.85 (odour reduction rate of 98). The median odour reduction rate for all participating laboratories was 96, with the normalized interquartile range of 0.52.

11. Summary of the Results and Technical considerations.
11.1 Results and adequacy of test specimens' homogeneity confirmation test
Annex B shows the results of homogeneity confirmation test on test specimens used in the round-robin test.
The overview of the homogeneity confirmation test, conducted this time, is as follows: The center part of processed cloth prepared was divided into 100 equal portions. Ten pieces were randomly chosen and sent to a pre-selected laboratory for testing. Since ISO17299-2 stipulates the use of the mean of odour reduction rate taken from three locations, the laboratory was asked to supply repeating data from three locations for analysis.

ISO13528 Annex B confirms sufficient homogeneity if:
"Standard deviation between specimens " Ss $\leq$ 0.3 $\times$ Standard deviation of proficiency test σ

In this study, Ss=0.18 and the results of the round-robin test was σ =1.00, indicating that the standard deviation between specimens was smaller than 0.3 times the standard deviation of proficiency test (0.3).
It was therefore confirmed after the round-robin test that the test specimens were homogeneous.

11.2 Summary and considerations of the proficiency test
(1) Laboratory No.7, which has a high odour reduction rate, and laboratories No.4, which has a low odour reduction rate, were rated as "unsatisfactory." Laboratory No.6, which has a low odour reduction rate, was rated as "questionable."

(2) The histogram for test results (all 13 laboratory data) was the highest at 95.5

and 96.4, which are near the median value (96), and declined almost symmetrically to both sides. It was therefore decided that the data was in a state close to normal distribution, and put to statistical analysis.

12. Conclusion

Although there were some deviations in the test method, but the test results of this round robin test were generally good.

And, the purpose of this round robin test, which is confirmation whether the participants obtained sufficient skill and knowledge of ISO standards in the seminars to harmonize the testing methods in the APEC region, has been achieved.

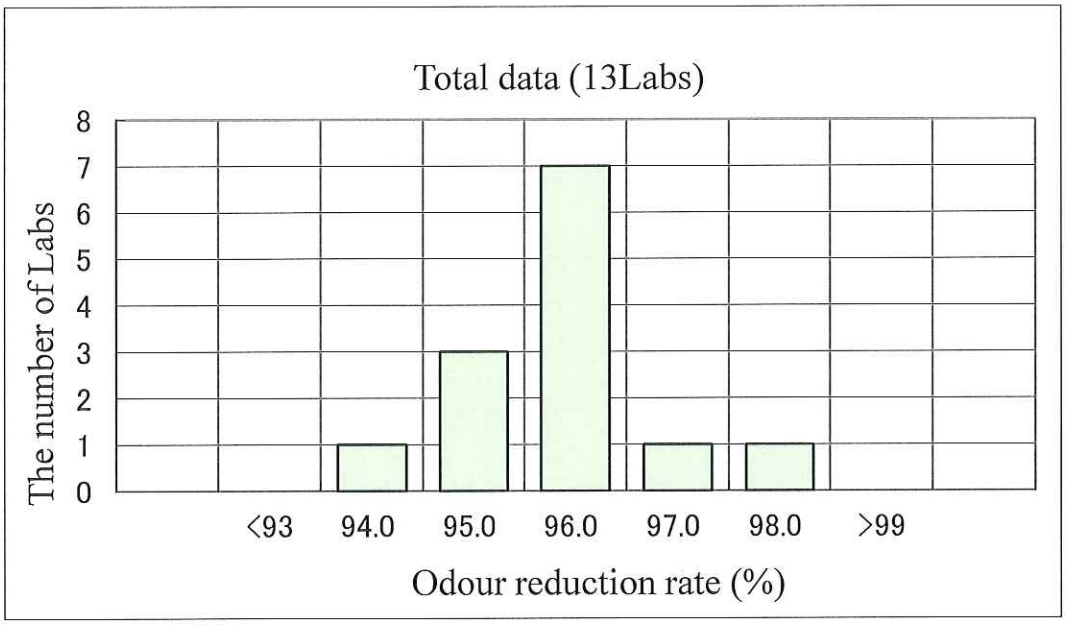
Annex A-1 Test Results, Statistical Analysis and z-score

No	Password	Ammonia mastergas concentration	Without test specimen				Test specimen						
			Odour gas concentration				Odour gas concentration				Odour reduction rate	z-score	Judgment
			µl/l (ppm)			Average (B)	µl/l (ppm)			Average (A)			
1	22670321	100	100.0	100.0	100.0	100.0	5.0	5.0	5.0	5.0	95	−1.93	
4	19600914	100	88.0	86.0	92.0	88.7	3.5	3.0	3.5	3.3	96.3	0.58	
5	6d553157	100.0	87.5	87.5	87.5	87.5	3.2	3.5	3.8	3.5	96	0.00	
6	00000105	100.0	80.0	80.0	80.0	80.0	5.0	5.0	4.5	4.8	94	−3.85	$
7	3tky1b9k	100.0	86.7	86.7	86.7	86.7	3.2	3.2	3.2	3.2	96	0.00	
8	20190619	105.0	95.0	95.0	95.0	95.0	5.0	5.0	5.0	5.0	94.7	−2.51	!
9	kaken309	100.0	80.0	81.0	82.0	81.0	1.8	2.0	2.0	1.9	98	3.85	$
10	8tahuie8	100.0	85.3	86.7	84.0	85.3	3.3	3.0	3.0	3.1	96	0.00	
15	62002179	100	90.0	90.0	90.0	90.0	3.0	3.0	3.0	3.0	97	1.93	
17	49c45k43	100.0	70.0	70.0	70.0	70.0	3.5	3.5	3.0	3.3	95.3	−1.35	
19	072g437t	100	92.0	88.0	90.0	90.0	4.0	4.0	4.0	4.0	96	0.00	
20	NQECOSAK	100.0	92.0	90.0	93.0	91.7	4.5	3.5	4.0	4.0	95.6	−0.77	
30	MenkenOs	98	85.0	84.0	86.0	85.0	4.0	3.5	4.0	3.8	96	0.00	
number of result			–	–	–	13	–	–	–	–	13		
median			–	–	–	87.50	–	–	–	–	96.00		
first quartile			–	–	–	85.00	–	–	–	–	95.30		
third quartile			–	–	–	90.00	–	–	–	–	96.00		
interquartile range			–	–	–	5.00	–	–	–	–	0.70		
normalised interquartile range			–	–	–	3.71	–	–	–	–	0.52		
robust coefficient of variation (%)			–	–	–	4.2	–	–	–	–	0.5		
minimum			–	–	–	70.00	–	–	–	–	94.00		
maximum			–	–	–	100.00	–	–	–	–	98.00		
range			–	–	–	30.00	–	–	–	–	4.00		

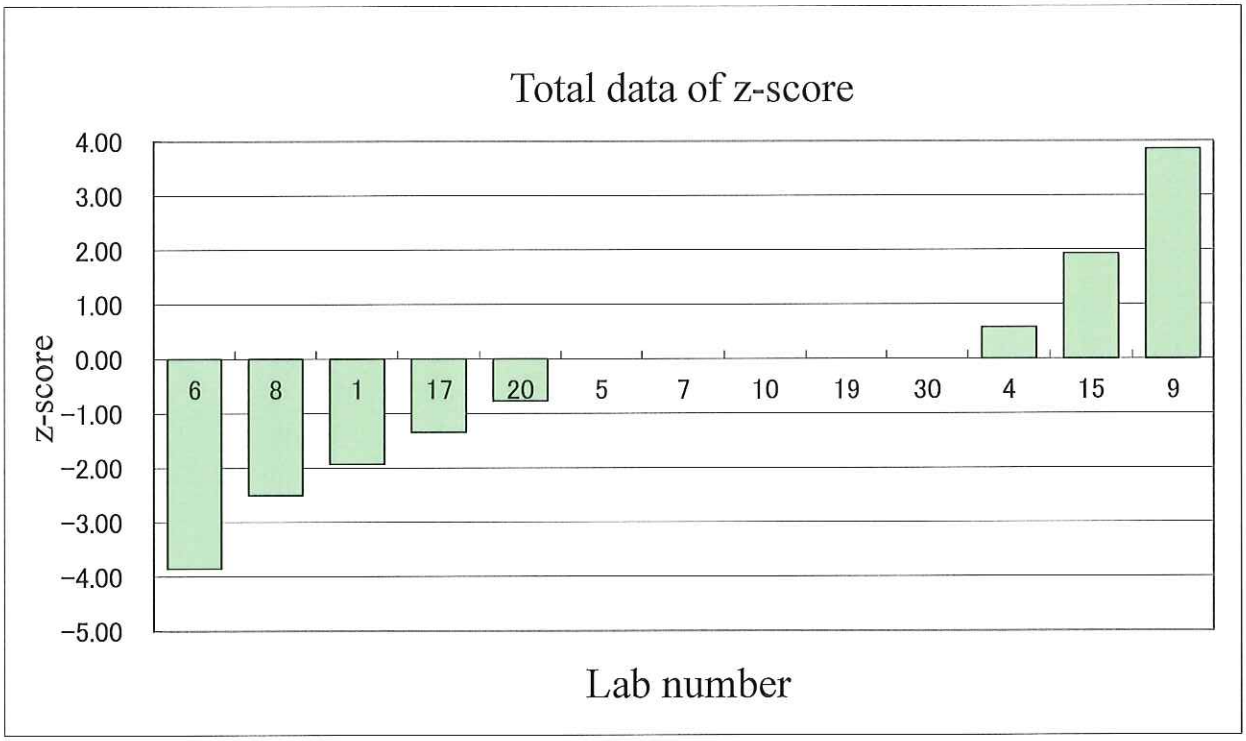
NOTE The results were transcribed as submitted.

Average (reference)	95.84
Standard deviation (reference)	1.00

Annex A-2 The histogram of test results



Annex A-3 The bar chart for z-score



Annex B

Homogeneity evaluation results for test specimens

1. Test data

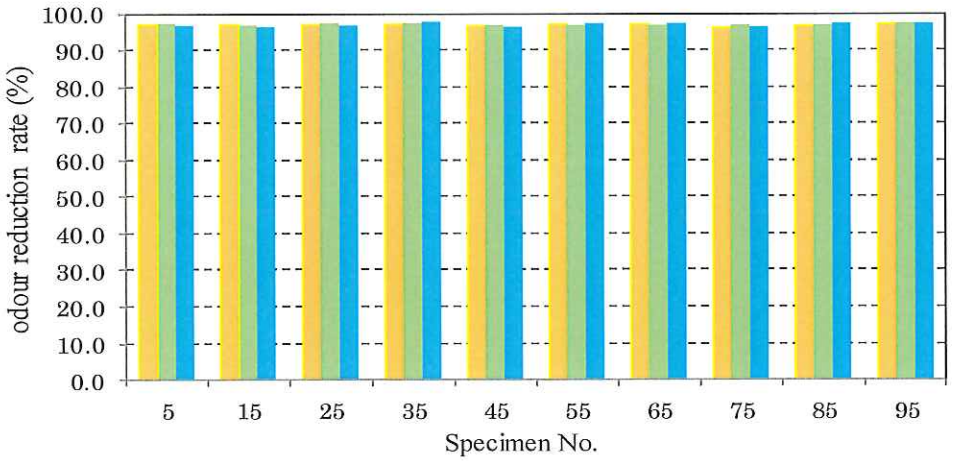
- A deodorant test (ISO17299-2, Detector tube method) was carried out on ten specimens, chosen from test specimens, at the Laboratory 1. [Table 1] shows the results.
  [Figure 1] shows a graph for examining data dispersion.

[Table 1]

Odour reduction rate					Wt (Range among test areas)
Specimen №	N1	N2	N3	Xt (Mean of specimens)	
5	97.1	97.1	96.7	97.0	0.4
15	97.1	96.7	96.4	96.7	0.7
25	97.1	97.1	96.7	97.0	0.4
35	97.1	97.1	97.8	97.3	0.7
45	96.7	96.7	96.4	96.6	0.3
55	97.1	96.7	97.1	97.0	0.4
65	97.1	96.7	97.1	97.0	0.4
75	96.4	96.7	96.4	96.5	0.3
85	96.7	96.7	97.4	96.9	0.7
95	97.1	97.1	97.1	97.1	0.0
Sx(Standard deviation of mean of specimens)				0.24	-
Sw(Standard deviation within specimens)=$\sqrt{}$ ($\Sigma Wt^2/30$)					0.28
Ss(Standard deviation between specimens)=$\sqrt{}$ ($Sx^2-Sw^2/3$)					0.18
t =1、2、・・・・10					-
Ss = 0.18 ≦ 0.3 × σ =0.3 × 1.00 = 0.3 (σ= 1.00 is the standard deviation of odour reduction rate described in Annex A-1 (1).)					

The odour reduction rate for N1~N3 was calculated as { (B of the mean) – (A for N1~N3)}/ (B of the mean).

[Figure 1]



2. Confirmation of the homogeneity of spent test specimens based on ISO13528 rules.
[Table 2] shows the ISO13528 rules.

[Table 2]

Rules shown in ISO13528
$Ss \leqq 0.3 \times \sigma \Rightarrow$ Homogenous
Ss : Standard deviation between specimens
σ : Standard deviation of proficiency testing

As shown in [Table 1], the standard deviation between specimens (Ss = 0.18) was smaller than 0.3 times the standard deviation of proficiency testing ($\sigma = 1.00$), confirming that the test specimens are homogenous.

END

August 2019

Annex C

APEC PROJECT SCSC 01 2018T

Notification for Round Robin Tests

Thank you for your participation for Round Robin Tests.

Please note the following before carry out the tests.

1. Following has been sent from us.

- ■ This Notification
- ■ Procedures for Round Robin Test (for antibacterial test / for deodorant test)
- ■ Data Sheets (for antibacterial test / for deodorant test)
- □ Testing specimens (antibacterial finished (Black)/ deodorant finished (dark blue)
- □ Control specimen(White) (only for antibacterial test)

* You can download "■"items documents from the following website of JTETC.
http://www.sengikyo.or.jp/english/sek.php?eid=00010

2. Testing Standard

(A) ISO 20743:2013_Textile-Determination of antibacterial activity of textile products

Test method: 8.1 Absorption method

Quantitative measurement: Annex C; plate count method

Testing strain: *Staphylococcus aureus* (WDCM code 00193)

(B) ISO 17299-1~5:2014_Textile Determination of deodorant property

Test method: Part2; Detector tube method

Testing odour: 7.1.1 Ammonia (NH_3)

□ If you take another method form above one, please note that on the Data Sheets.

3. Submission of Test Results (Data Sheets)

(A) How to submit

By e-mail to following address

To) Mr. N. Suso suso@sengikyo.or.jp

(B) Deadline for submission

30 September, 2019

(C) Others

If you have any question, please contact following person.

To) Ms. S Nishikawa (antibacterial test) b s-nishikawa@jwif.org

To) Mr. K. Kawabata (deodorant test) k-kawabata@boken.or.jp

CC) Mr. N. Suso suso@sengikyo.or.jp

4. Report Statistically analyzed of Round Robin Test data

You can see this report on the following website of JTETC in November, 2019.

http://www.sengikyo.or.jp/english/sek.php?eid=00010

Annex D

APEC PROJECT SCSC 01 2018T

Data sheet of round robin test for deodorant(ISO17299-2)

APEC Member Economy	
Laboratory (Organization)	
Participant (Operator nam	
Your Password	

Test Date

	Without test specimen			Test specimen		Odour reduction rate (%)
n	odour gas concentration μ l/l (ppm)	average μl/l (ppm)	n	odour gas concentration μl/l (ppm)	average μl/l (ppm)	
1			1			
2			2			
3			3			

Ammonia mastergas concentration	μl/l (ppm)

* Please check the corresponding condition and fill in the blank.

Q1 Diluent gas

	Dry air
	Nitorogen gas

Q2 Preparation of the odour gas

	mastergas method
	other method

Q3 Apparatus of odour gas(3L) inserted

	Air pump
	other apparatus ( )

Q4 Sample size

	cm× cm
	other ( )

Q5 Supplier of Detector tube

Q6 Material of Plastic bag

*any deviation of this ISO standard

Annex E

APEC PROJECT SCSC 01 2018T

Procedures for Round Robin Test
~ detector tube method ~

1, Introduction of Detector tube method

2, Reagents and Materials and apparatus

3, About test procedure

Introduciton of Detector tube method(ISO17299-2)

ISO 17299-2 describes a method using a detector tube as a concentration measuring device.The detector tube is a well-known odour sensor used for measurement of environmental odour chemical concentration in the field.

Detector tubes could be available commercially.
This is a very simple and inexpensive testing method if the detector tubes can be obtained.

Please refer ISO17299-2 when you conduct this round robin test.

Test environment

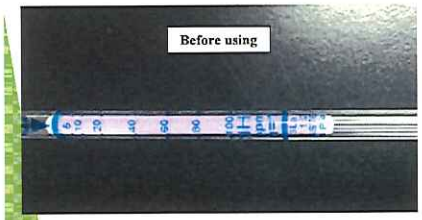
Testing environment and sample conditioning

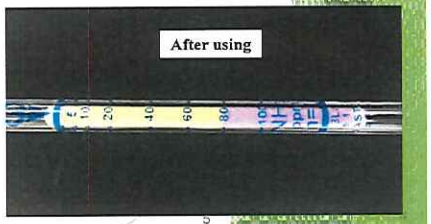
The testing environment shall be kept at a temperature of 20℃ and relative humidity of 65% in accordance with ISO139.
The samples are conditioned under the same condition for at least 24h.

Terms and definitions

3.1 detector tube

device used for the gas concentration measurement test, which is a glass tube filled by grainy chemicals which react to the odour chemicals and change colour in proportion with the concentration of testing chemical.





Principle

4 Principle

Concentration of gaseous odour component chemicals of gas in containers with or without a test specimen after a designated contacting time is measured by using detector tubes.

The odour deduction rate of chemical concentration is calculated from the concentration data with a specimen and without a specimen.

Reagents

5.1 Ammonia water(NH_3)

reagent with a concentration of 28% in water.

5.5 Diluent gas

dry air obtained from the mixture cylinder of nitrogen gas and oxygen gas with a purity of at least 99,99%, or nitrogen gas from the nitrogen gas cylinder with a purity of at least 99.99%

Materials and apparatus

6 Materials and apparatus

6.1 Detector tube

the measuring ranges of the tubes are given as the following with an accuracy of ±5%

- for ammonia: 0.2µl/l to 200µl/l
- for acetic acid:0.25µl/l to 50µl/l
- for methyl mercaptan : 0.5µl/l to 10µl/l
- for hydrogen sulfide:0.5µl/l to 6µl/l

B.1 Supplier information (by ISO17229-2 informative)

Note: This information is given for the convenience of users of this part of ISO17299 and does not constitute an endorsement by ISO of these detector tubes.

a) Gastec: https://www.gastec.co.jp/en/
b) Komyo Rikagaku Kogyo K.K: http://www.komyokk.co.jp/kweb/top_page.do?je=1
c) Draeger: https://www.draeger.com/en-us_us/Applications/Products/Mobile-Gas-Detection/Draeger-Tubes-and-CMS/Draeger-Tubes/Short-term-Tubes

Materials and apparatus

6.2 Plastic bag

with a volume of 1l,5l and 50l , made of vinyl fluoride film, polyester, polyester laminated film, polyvinyl alcohol film, etc

6.3 Air pump

capable of drawing air with a flow rate of 0,2l/ml and 5l/ml with the attached flow meter. If the attached flow meter is not available, the integrating flow meter shall be used.

6.5 Syringe

made of a glass cylinder with a capacity of 0.5ml and 100ml.

6.6 Airtight stopper

Preparation of the testing gas

7 Preparation

7.1 Preparation of the testing gas

The test for each odour component chemical is performed separately. Prepare each odour component chemical just before the test.

Please prepare ammonia master gas with reference to 7.1.1.

Note; Other gas preparation methods , such as use of standard gas generation Instrument (e.g. parmeator or cylinder) are also usable.

7.1.1.2 Confirmation of ammonia master gas concentraion

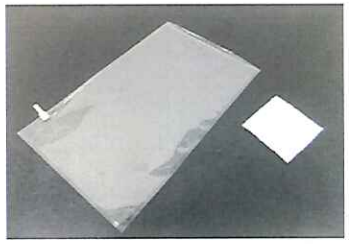
7.1.1.2.1 Insert 3L of the master gas into a 5L plastic bag by using an air pump. Take the 100ml gas sample from the bag by using the 100ml syringe. Measure the gas concentration by using the detector tube.

7.1.2.2 Confirm that gas concentration is in the range of 100μl±5μl

7.1.1 Ammonia…100μl±5μl
7.1.2 Acetic acid…30μl/l±3μl
7.1.3 Methyl mercaptan…8μl/l±0.8μl
7.1.4 Hydrogen sulfide…4μl/l±0.4μl

Preparation of specimen

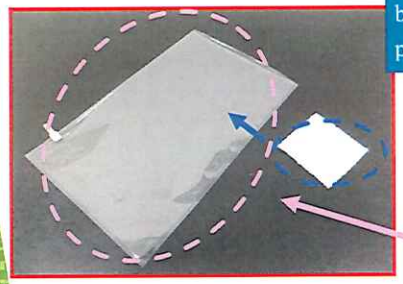
Kind of sample	Dimension or mass specimen
Fabrics(woven ,knit , nonwoven) and tapes	100cm^2±5cm^2



Test procedure

9.2 Condition the samples under the same conditions(temperature of 20℃ and relative humidity of 65%) as for testing for at least 24h.

10 Test procedure



10.2.1 Insert the specimen.
Place the specimen in the three plastic bags, one by one and spread it as much as possible.

10.1 Prepare six plastic bags with a Volume of 5L.

Test procedure

10.2.1.2
Seal the plastic in which the specimen was placed for testing,by using a heat seal or seal tape.

10.2.2
Deaerate from the bag as much as possible by an aspirator or a vacuum pump.

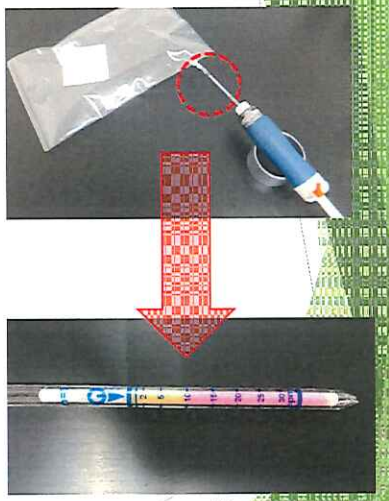
10.2.3
Insert 3L of the odour component testing gas into plastic bags.

Test procedure

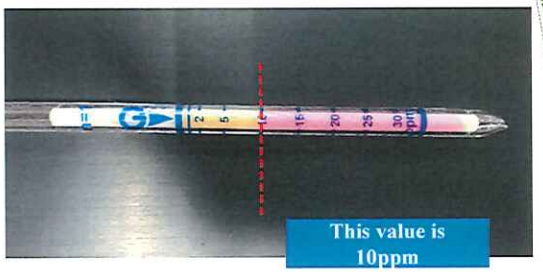
10.2.4
Place the plastic bag in a still condition **for 2h.**

10.2.5
Extract 100ml of the testing gas from the 3 bags which specimen by using the 100ml syringe.

10.2.6
Pass the extracted testing gas through the detector tube; then, read the scale at the discoloration point.



Test procedure



This value represents the concentration of odour component chemicals after contacting time with specimen.

10.2.7
Take an average of three odour gas concentration data with a specimen (after 2hour), which is denoted as A.

Odour reduction rate calculation

10.3 Test without a specimen

10.3.1 This is a control test with the same testing procedure except without a specimen.

10.3.2

Take an average of 3 odour gas concentration data without a specimen (after 2hour), which is denoted as B.

11 Odour reduction rate calculation

Caluculate the odour reduction rate according to Formula

$$ORR = (B - A) / B \times 100\%$$

1

Annex F APEC SCSC 01 2018T 5-6/Jun./2019

Capacity Building on Testing Methods for Functionality Finishing on Textile Products and Certification Method within the APEC Region

3rd SEMINAR
in Taipei,Chinese Taipei

How to make the test sample of Round robin tests.

1

2

CONTENTS

2

3

1.The kind of antibacterial and a deodorant agents
1.1. About antibacterial agent

Antibacterial agent(抗菌剤)

The chemical substance made by artificial composition

Antibiotics(抗生物質)

The chemical substance which a microbe formed

Antibacterial processing

JIS L 1902 — control a bacterial increase on the fiber by decreasing bacteria

⬇

ISO 20743
Textiles-Determination of antibacterial activity of textile products

3

4

1.The kind of antibacterial and a deodorant agents
1.2. Classification of antibacterial agents
(1) Classification by the purpose

Antibacterial agents

- Environmental antibacterial agents
  ⇒for microbes in environment
- Living body antibacterial agents
  ⇒for the microbe which infected a person.

Antibacterial processing of the fiber
= Environmental antibacterial

4

5

Antibacterial agents

Environmental	Living Body
Alcohol (60～85%Ethanol , Isopropanol)	
Phenolic compounds (Hexachlorophene, Chlorhexidine etc.)	
Positive ion surfactant	
Quatemary ammonium salt compaund	(Benzalkonium chloride)
Formaldehyde	3% Hydrogen peroxide
Ethylene oxide gas	Iodophors (Povidone iodine)

5

6

1.The kind of antibacterial and a deodorant agents
1.2. Classification of antibacterial agents
(2) Classification by the material

Inorganic compounds	Organic compounds
=Type=	=Type=
・Metal Ions Compounds	・Chemical compounds
・Photo catalyst (TiO_2)	・Natural products

6

7

1.The kind of antibacterial and a deodorant agents
1.2. Classification of antibacterial agents
(2) Classification by the material

Inorganic compounds	Organic compounds
=Type=	=Type=
・Metal Ions Compounds	・Chemical compounds
・Photo catalyst (TiO_2)	・Natural products

Characteristics of inorganic compounds

◆Good point
- ・stable at the high temperature
- ・wide antibacterial spectrum

◆Weak Point
- ・Antibacterial effect of the quantity of agents is lower than an organic compounds.

7

8

1.The kind of antibacterial and a deodorant agents
1.2. Classification of antibacterial agents
(2) Classification by the material

Inorganic compounds	Organic compounds
=Type=	=Type=
・Metal Ions Compounds	・Chemical compounds
・Photo catalyst (TiO_2)	・Natural products

Characteristics of organic compounds

◆Good point
- ・chemical compound ⇒cheap, high effect (small quantities)
- ・natural product ⇒ many generally safe things

◆Weak Point
- ・low heat resistance
- ・antibacterial spectrum is small
- ・resistant bacteria may emerge

As for the antibacterial processing of textiles, a lot of antibacterial agents of the organic chemical compounds are used from cost, stability.

8

9

Characteristics of antibacteriaj agents

Antibacterial agents			Heat Stable	Antibacterial spectrum	Cost performance
Inorganic	Metal ions	Ag, Cu, Zn	◎	○	△
		Carrier ・Zeolite (Silicate) ・Apatite (Phosphate)		◎	
	Photo catalyst	TiO_2			
Organic	Chemical compound	Phenol-based	△~○	○	◎
		Quaternary ammonium salt			
		Biguanide-based			
	Natural product	Animal-delived (Chitosan)	△	○	△
		Plant-delived (Catechin)		△~○	
		Microorganism-delived (Polylysine)		○	

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2. Textile production process

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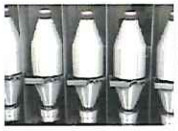
Natural fiber

Cotton

Wool

Silk

Synthetic fiber



Polyester Acryl etc.

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2. Textile production process

2.1. From raw cotton to yarn

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2.1. From raw cotton to yarn

(1) Opening and picking process（混打綿）

It is performed in fore-spinning process of the spinning.
After mixing the different cotton lump of the kind, and untying a cotton lump using a beater (body of rotation), and having removed cotton lump impurities, it is done by the belt-shaped fiber assembly called the lap.

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2-1. From raw cotton to yarn

(2) Carding process（梳綿工程）

The sheet-shaped lap processed in the mixing and blowing process is combed using the carding machine to separate the fibers and remove fine dust and short fibers. Remaining long fibers are aligned nearly parallel and collected to be processed into the string-shaped "carded sliver."

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2-1. From raw cotton to yarn

(3) Combing （精梳綿工程）

The carded sliver is further combed to remove short fibers and dust that could not be removed in the carding process. Fibers are then arranged parallel to obtain uniform combed sliver. This process is essential to manufacture uniform, high-quality yarn.

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2-1. From raw cotton to yarn

(4) Drawing（練条工程）

Six to eight slivers after the carding or combing process are gathered and elongated to six to eight times their original length using a drawing machine to straighten and remove uneven thickness from the fibers. This process transforms fibers into string-like "drawn sliver."

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2-1. From raw cotton to yarn

(5) Roving（粗紡工程）

Since the drawn sliver is too thick to produce yarns directly, it is further elongated using a roving machine. Twisting is first applied to fibers in this process to obtain the green yarn, which is wound onto a bobbin.

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2-1. From raw cotton to yarn

(6) Spinning（精紡工程）

In the fine spinning process, the last of the main spinning processes, the green yarn resulting from the roving process is further elongated to obtain a desired thickness and then twisted. The final product, or the finished yarn, is wound on a bobbin.

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2-1. From raw cotton to yarn

(7) Winding（巻返工程）

The winding process involves rewinding the finished yarn onto bobbins into the cheese or cone according to its purpose.

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2. Textile production process

2-2. From yarn to textile

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2-2. From yarn to textile

(1) Warping（整経工程）

Ref. KUROSE CO.LTD.

Cheese/cones are set on a warping machine to wind the predetermined length and number of yarns onto the predetermined number of warping beams under constant tension.

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2-2. From yarn to textile

(2) Sizing（糊付工程）

Ref. T-Tech Japan Corp.

Because the hairiness of the yarn affects the weaving, It is necessary to decrease the hairiness of the yarn.
The warping beams of the required number of warps of the final textile are piled up for rewinding on beams after sizing and drying.

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2-2. From yarn to textile

(3) Drawing-in（経通工程）

Ref. MARUMATSU SHOKUFU Co,.Ltd.

Drawing-in
To prepare for setting beams on a loom, warps are routed in the order of droppers, healds and guide bars.

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2-2. From yarn to textile

(4) Weaving（製織工程）

Prepared beams are set on a looming frame to weave a textile in the following five motions:
1. Shedding: two groups of warps are opened to let the weft pass through.
2. Picking: The weft is inserted between two groups of warps.
3. Beat-up: Pushing the newly inserted yarn back into the fell using reed.
4. Let-off: The warp yarns are unwound from the warp beam.
5. Take-up: The woven fabric is wound on the cloth beam.

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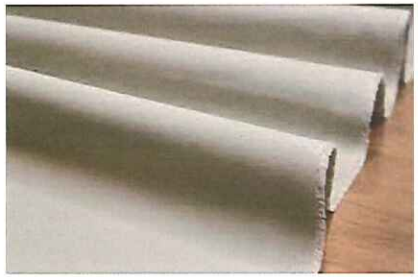
2. Textile production process

2-3. Dyeing, finishing process of cotton fabrics



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2-3. Dyeing, finishing process of cotton textile

Preparation process	Stainability and dimensions stability improve when remove an unnecessary ingredient (pectin, wax, sizing agent etc.) attaching to a gray fabric.
Dying process	Mainly, Dye of the cotton fiber is reaction and VAT dye. As for the adherence of the dye of the cotton fiber, the reaction dye occurs by chemical bond and the VAT dye occurs by physical adsorption.
Finishing process	This process is control a texture of the fiber with a softener and give various functions by function agents

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Preparation process of cotton textile

Singeing

To remove paste

Refinement

Bleaching

Mercerized

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Preparation process Singeing

Hairiness of the textile surface is removed by the flame of the gas burner.

Before

After

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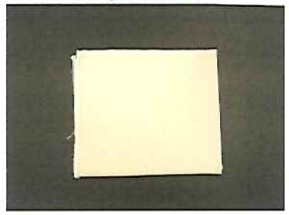
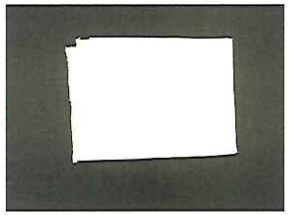
Preparation process To remove paste, Refinement, Bleaching

To remove paste, refinement, bleaching.
Cotton textiles usually perform these processes consecutively.

Gray fabric



After bleaching



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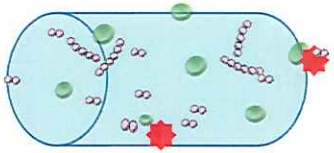
Antibacterial processing method of the fiber

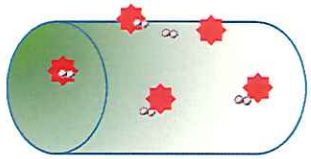
Kneaded Method



Antibacterial agent

Killing of the bacteria

Post processing Method



Bacteria

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About a round robin test

Purpose
Each testing institution of the participation economy carries out round robin test for antibacterial and a deodorant.
The test data is performed a statistical analysis of and knows the performance of each testing institution.
In addition, the result is informed each testing institution of and assumes it an examination document.

Examination	Antibacterial and Deodorant Test
Test sample	Textile of the Cotton ／PET mixed spinning A) Quatenary ammonium salt-based agent D) Surfactant-based agent
Test method	A method established in SEK mark certification standard
Test target	A) *S.aureus* D) ammonia

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Homogeneity is required on the sample textile.

The sample textile which we made will be holding a test of the homogeneity. At first we divide a center part of the textile into 100 parts and pull out 10 points at random from that.

We carry out an examination about ten points of samples in a Japanese testing institution.

The data are performed a statistical analysis of and use the test samples that homogeneity was confirmed for a round robin test.

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20 November 2019

Japan Textile Evaluation Technology Council (JTETC)