Photocatalyst fluid

AB-1

(Anti-bacterial, Antiviral type)

26. Oct .2021

丸昌産業株式会社
MARUSYO SANGYO CO.,LTD.

1. Description

AB-1 can be show high anti-bacterial and antiviral effect by photocatalyst and antimicrobial at indoor

Character	➢ High transparency coated film ➢ Water based fluid ➢ Dry out times is fast ➢ Used several inorganic material surface ➢ Used safety material for human body
Appearance	Buff white-yellow
Fluid type	Water based fluid (not DG)
Main component	TiO2 and antimicrobial
Dry temperature	At normal temperature
Dry out time	Over 24 hours (Atmosphere 20degC)
Application method	Spray gun or brash, roller
Spread quantities	15 - 25 g / 1 sq m
Appearance of dry out	Transparency
Durability	2 – 3 years
Antibacterial and antiviral effect	Bacillus coli: Staphylococcus aureus Pseudomonas aeruginosa Enterococcus faecalis **SARS-CoV-2** And other

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Kaken Test Center GENERAL INCORPORATED FOUNDATION
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Kaken Test Center is formerly named as "Japan Synthetic Textile Inspection Institute Foundation(JSTIIF)".

Test Report No. : OS-15-084262

Date : April 4, 2016

TEST REPORT

Requested : MARUSYO SANGYO Co.,Ltd.
Test Sample : Metal Plate 1 Sample
Test Items : Antibacterial activity
Received : March 28, 2016

This is to report that the results of laboratory test applied on the sample are as follows:

1. Test Results

1. *Staphylococcus aureus*

Sample name	Common logarithm for the number of bacteria		Antibacterial activity value
	Immediately after inoculation	After 24h incubation	
M-Clean Type:AB-1	—	<-0.20	>4.7
Control sample*	4.01	4.53	—

2. *Escherichia coli*

Sample name	Common logarithm for the number of bacteria		Antibacterial activity value
	Immediately after inoculation	After 24h incubation	
M-Clean Type:AB-1	—	<-0.20	>6.1
Control sample*	4.05	5.94	—

3. *Pseudomonas aeruginosa*

Sample name	Common logarithm for the number of bacteria		Antibacterial activity value
	Immediately after inoculation	After 24h incubation	
M-Clean Type:AB-1	—	<-0.20	>4.0
Control sample*	4.34	3.81	—

(To be continued on No.2/2)

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TEST REPORT

(continued from No.1/2)

4. *Enterococcus faecalis*

Sample name	Common logarithm for the number of bacteria		Antibacterial activity value
	Immediately after inoculation	After 24h incubation	
M-Clean Type:AB-1	—	<-0.20	>4.6
Control sample*	4.28	4.47	—

* The polyethylene film was used as a control sample.

2. Test Method: JIS Z 2801:2010,5., Modified

Test Bacteria : *Staphylococcus aureus* NBRC 12732
Escherichia coli NBRC 3972
Pseudomonas aeruginosa NBRC 3080
Enterococcus faecalis NBRC 3989

3. Sample:

Sample Omitted

Kaken Test Center General Incorporated Foundation
Osaka Laboratories
Biological Test Laboratory

Inspector : 中薗根秀明
T.Nakasone

Period.

Kaken Test Center
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KISTEC02-183C01

Issue date : Sep. 10th, 2020

MESSRS: MARUSYO SANGYO CO.,LTD.
(Address: 171,Tajima, Sano, Tochigi, 327-0031, JAPAN)

Determination of antiviral activity using bacteriophage

Kanagawa Institute of Industrial Science and Technology(KISTEC)
3-2-1 Sakado, Takatsu-ku, Kawasaki, Kanagawa, 213-0012, JAPAN
President Kunio Suzuki

Testing laboratory: KISTEC, Tonomachi Branch,
Research and Development Department
(3-25-13 Tonomachi, Kawasaki-ku, Kawasaki, Kanagawa, 210-0821, JAPAN)

Authorizer signature
Researcher

1. Test conditions

a) Reference to this test method :ISO 18071:2016 and ISO 27447:2019 (glass adhesion method)

b) Characterization of the treated and non-treated specimens :

- Type : Wall cloth
- Size : 50 mm × 50 mm (Square)
- Treated specimen name: AB-1
- Non-treated specimen name : Non-treated cloth

c) n=1

d) Disinfection of specimen : No disinfection

e) Type of test strains number :

- Bacteriophage strain: Bacteriophage Qβ (NBRC20012)
- Host bacteria strain: *Escherichia coli* (NBRC106373)
- Bacteriophage strain: Bacteriophage ϕ6 (NBRC105899)
- Host bacteria strain: *Pseudomonas syringae* (NBRC14084)

f) Reaction conditions:

- Temperature: room temp.
- Reaction time: 4 h

g) Type and size of cover glass : TEMPAX glass, 60 mm × 60 mm

h) Test date: July 1st, 2020

2. Result

Bacteriophage Qβ	Virus Titer (pfu/sample)*1		V: Antiviral activity*3
	0 h	Room Temp. 4 h	
Non-treated cloth	1.7E+06	1.1E+06	-
AB-1	-	<2.0E+03*2	2.7

Titer of bacteriophage in test suspension :5.6×10^6 pfu/ml

Quantity of inoculated test suspension : 0.3 ml/specimen

*1 "E+06" represents "$\times10^6$".

*2 Detection limit was 2.0E+03 pfu/sample, because bacteriophage Qβ revoverd solution from sample inhibited the growth of host bacteria.

*3 Reference value due to modified ISO test method

Antiviral activity: [V=log(B)-log(C)]

B: number of virus titer of non-treated specimen,

C: number of virus titer of treated specimen

Remark: This report is the translated version based on KISTEC02-183C01 in English.

Japan Textile Products Quality and Technology Center

TEST REPORT

15th October 2021

APPLICATION

Test applicant : MARUSYOSANGYO CO., LTD.
Test sample : M-Clean AB-1(MT-1) coated cloth
Test item : Antiviral Activity Test for Textile Product
Date of application : 3rd June 2021

TEST METHOD

Antiviral activity of the test sample is tested mainly based on JIS L 1922 「Textiles -- Determination of antiviral activity of textile products」

○The Summary of Antiviral Activity Test for Textile Products

- Virus strain : Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2); JPN/TY/WK-521 (Distributed from National Institute of Infectious Diseases, Japan)
- Host cell : VeroE6/TMPRSS2 JCRB1819
- Growth medium : Dulbecco's modified Eagle's medium (low-glucose) ; DMEM (SIGMA, Cat#D6046)
  Minimum Essential Medium Eagle ; EMEM (SIGMA, Cat#M4655)
- Fetal Bovine Serum (FBS) (NICHIREI, Cat#174012)

- Control specimen : The Cotton 100% woven fabric without fluorescent brighteners or other finish sourced from JTETC
- Antiviral test specimen : M-Clean AB-1(MT-1) coated cloth
- Wash-out solution : 1/10 SCDLP diluted with 2% FBS-containing DMEM
- Contacting time : 2 h at the temperature of 25 ℃
- Measurement of viral infectivity titer : Plaque assay
- Sterilization method of test specimen : Not done

○Antiviral activity test

1. Preparation of test virus suspension
1-1. Drain a growth medium from a flask with cultured VeroE6/TMPRSS2 in the monolayer.
1-2. Wash the surface of the cultured cells with EMEM and drain the medium.
1-3. Inoculate SARS-CoV-2 suspension on the surface of cell in the flask and spread to the whole surface.
1-4. Put the flask in the CO_2 incubator at 37 ℃ and keep it for 1 h to adsorb the virus to the cells.
1-5. Add the appropriate amount of EMEM to the flask.
1-6. Put the flask in the CO_2 incubator at the temperature of 37 ℃ for 1 to 3 days to multiply SARS-CoV-2.
1-7. Observe the cytopathic effect under an inverted microscope and judge the multiplication of the virus. If the multiplication of the virus is confirmed, then, Centrifuge the multiplied virus suspension by using the centrifuge at 4 ℃ and 1,000 ×g for 15 min.

Japan Textile Products Quality and Technology Center

TEST RESULT

○Result of antiviral activity test

Virus strain : SARS-CoV-2; JPN/TY/WK-521

(Distributed from National Institute of Infectious Diseases, Japan)

Test virus suspension : 1.4×10^7 PFU/mL

Test Sample		Common logarithm value of Infectivity titer (PFU / vial) (Note 2)			Reduction value 【M】 (Note 4)	**Antiviral activity value (Mv)** (Note 3)
			Common logarithm	Common logarithm average		
Control specimen (Note 1)	Immediately after inoculation 【lg(Va)】	n1	6.40	6.28	0.8	
		n2	6.28			
		n3	6.18			
	After contacting for 2h 【lg(Vb)】	n1	5.40	5.46		
		n2	5.51			
		n3	5.48			
M-Clean AB-1(MT-1) coated cloth	After contacting for 2h 【lg(Vc)】	n1	< 3.30	< 3.30	—	≧ 3.0
		n2	< 3.30			
		n3	< 3.30			

(Note 1) The cotton 100% woven fabric without fluorescent brighteners or other finish sourced from JTETC is used for "control specimen".

(Note 2) PFU : plaque forming units (Note 3) Antiviral activity value (Mv) = $\lg(V_a) - \lg(V_c)$

(Note 4) Reduction value (M) = $\lg(V_a) - \lg(V_b)$ (Judgement of test effectiveness: $M \leq 1.0$)

○Result of control test

Virus strain : SARS-CoV-2; JPN/TY/WK-521

(Distributed from National Institute of Infectious Diseases, Japan)

Test virus suspension : 6.0×10^4 PFU/mL

Test Sample	Cytotoxic effect	Cell sensitivity to virus	Judgement of control test
		Common logarithm average of Infectivity titer (PFU/mL) (Note 2)	
Control specimen (Note 1)	negative	2.77	
M-Clean AB-1(MT-1) coated cloth	negative	2.72	satisfied

Remark:

Test sample didn't show cytotoxic effect and the significant reduction of cell sensitivity to virus by diluting "Wash-out virus suspension" 10 times with 2% FBS-containing DMEM.

【Conditions for control test】

Cytotoxic effect : negative

Cell sensitivity to virus :

lg(Infectivity titer (PFU/mL) of control specimen) − lg(Infectivity titer (PFU/mL) of treated specimen) ≤0.5

Functionality test : Antiviral test

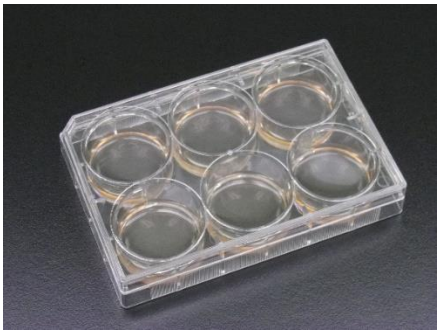
JIS L 1922：Plaque assay

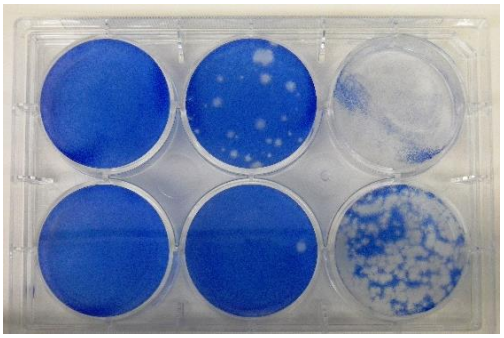
This is the most common method among the antiviral tests for textile products, also applied to the testing method for SEK mark of Japan Textile Evaluation Technology Council.

Similar Abroad Standard：ISO 18184

【Overview】

Inoculate virus solution on a test sample with antiviral finishes and a control sample (cotton standard cloth) to be compared, then make contact between the fabric and virus for a certain time. After contact, the number of viruses on the sample are determined by plaque assay. Calculate the antiviral activity value by comparing the number of viruses between the test sample and the control sample.





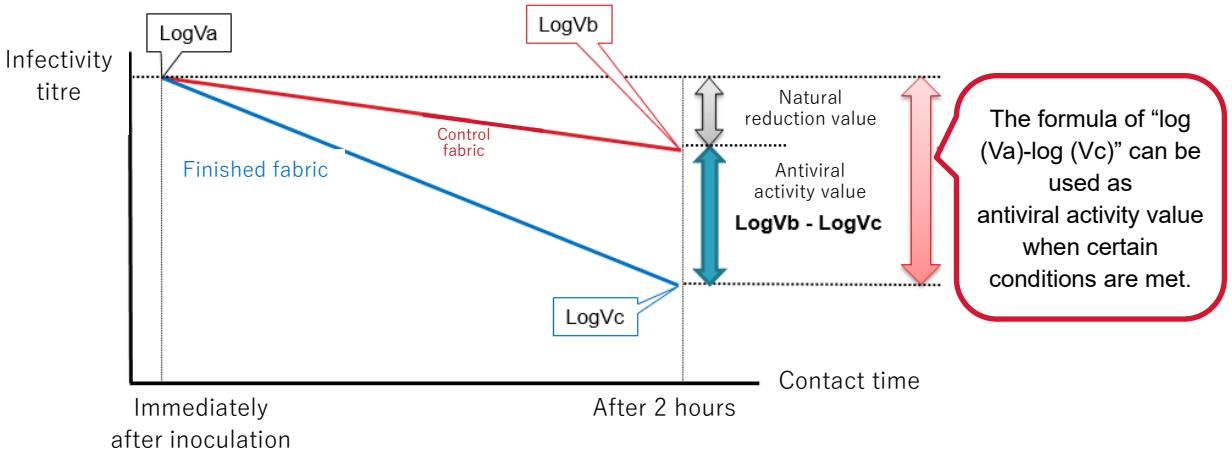
【Evaluation / Reference value】

Evaluate according to antiviral activity value【Mv】.

Formula for activity value	Standard	Reference value	Description of the effect
Antiviral activity value [Mv] LogVb – LogVc (LogVa – LogVc)*1	JIS*2	3.0＞[Mv]≧2.0	Good effect
		[Mv]≧3.0	Excellent effect
	SEK	[Mv]≧3.0	—

*1：Formulas that can be used when certain conditions are met.

*2：Reference standard



Reception for Antiviral test

Japan
Biochemical Group.
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JFRL

Japan Food Research Laboratories
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http://www.jfrl.or.jp/

No. 20031056001-0201 1/1
Date issued: March 24, 2020

CERTIFICATE OF ANALYSIS

Client: MARUSYOSANGYO CO., LTD.
171 Tajimacho, Sanoshi, Tochigi, 3270031, Japan.

Sample name: Photocatalyst M-Clean, AB-1

Received date: March 13, 2020

This is to certify that the following result(s) have been obtained from our analysis on the above-mentioned sample(s) submitted by the client.

Test Result(s)

Test Item	Result	QL	N	M
Specifications for Implements, Containers and Packaging <Synthetic Resin>	.....	.....	1	
General standards	.....	.....		
Materials test	.....	.....		
Cadmium and lead	.....	.....		
Cadmium	Result not obtained	.....	2	
Lead	Result not obtained	.....	2	
Elution test	.....	.....	3	
Heavy metal	Conformable	.....		
Quantity of $KMnO_4$ consumed	Conformable (Not more than 0.5 μg/ml)	.....		

QL: Quantitation limit N: Notes M: Method

Notes

1: Notification No. 370 (1959) "Specifications and Standards for Foods, Food Additives, etc.," issued by the Ministry of Health and Welfare. Type: used at the temperature not exceeding 100 ℃.

2: The result was not obtained because of obstacles originated from the sample.

3: The sample spread on a glass plate was used for the test.

JAPAN FOOD RESEARCH LABORATORIES

Signed for and on behalf of JFRL

T. Arai — Mar. 24, 2020

Takeko Arai — Date

Section of Analysis Documentation