Japan Textile Products Quality and Technology Center

TEST REPORT

29th January 2021

APPLICATION

Test applicant : Mitsubishi Electric Corporation
Test sample : Plasma Quad
Test item : Antiviral activity test
Date of application : 24th December 2020

TEST METHOD

○ Summary of antiviral activity test

- 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) (SIGMA, Cat#173012)
- Test sample : Plasma Quad
- Virus inoculation : Place 0.005 mL of test virus suspension at one point on the surface of the test carrier (stainless plate)
- Contact time : 6 h, 12 h, 24 h
- Test condition : 23 ℃, 26%RH in the safety cabinet
- Wash out solution : 1/10 SCDLP diluted with 2% FBS-containing DMEM
- Measurement of viral infectivity titer : Plaque assay

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○Outline of antiviral activity test

Picture.1 Test carrier (element)

Picture.2 Installation of test carrier

Picture.3 Installation of test carrier

Picture.4 Hold with energization

Picture.5 Conformation of energization

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○ Antiviral activity test in suspension

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 °C 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 °C 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 °C and 1,000 g for 15 min.

1-8. Take the supernatant suspension from the centrifugal tube after the centrifugation. This is to be the test virus suspension.

2. Test procedure

1. Place 0.005 mL of test virus suspension at 3 points (n=3) on the surface of the stainless part of the element. (Pic.1)
2. Allow the virus inoculum to dry under ambient conditions in the safety cabinet for about 10min. This is to be the test carrier.
3. Place the dried test carrier on the electric base. (Pic.2)
4. Hold with energization in the safety cabinet for the required contact time.
   For the control test, hold without energization in the safety cabinet for the required contact time. (Pic.3, 4, 5)
5. Upon completion of the contact time, immediately add 1.0mL of wash out solution to the carrier and recover the virus.
6. Prepare a series of 10-fold dilutions of recovered virus suspension by using 2% FBS-containing DMEM. Measure the viral infectivity titer per 0.1mL of recovered virus suspension by plaque assay and calculate the viral infectivity titer per test carrier.

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TEST RESULT

○Results of antiviral activity test

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

(Distributed from National Institute of Infectious Diseases, Japan)

Test virus suspension : 2.1×10^5 PFU/ml

Common logarithm of ideal value of virus infectivity titer per test carrier : 6.02

Test carrier		Common logarithm of Infectivity titer (PFU/carrier) per test carrier		
		Common logarithm		Common logarithm average
With energization	Immediately after drying	n1	5.86	5.88
		n2	5.87	
		n3	5.92	
	After 6 h	n1	3.04	3.10
		n2	2.91	
		n3	3.34	
	After 12 h	n1	2.56	2.64
		n2	2.63	
		n3	2.73	
	After 24 h	n1	2.50	2.31
		n2	2.27	
		n3	2.15	

Test carrier		Common logarithm of Infectivity titer (PFU/carrier) per test carrier		
		Common logarithm		Common logarithm
Without energization * Control test	Immediately after drying	n1	5.86	5.88
		n2	5.87	
		n3	5.92	
	After 6 h	n1	4.43	4.53
		n2	4.58	
		n3	4.59	
	After 12 h	n1	3.77	3.65
		n2	3.43	
		n3	3.76	
	After 24 h	n1	2.53	2.60
		n2	2.58	
		n3	2.69	

* Common logarithm value of Limit of Quantification : < 1.0

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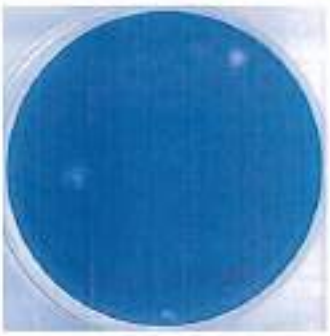
<Reference date>

○Plaque assay

Plaque formation per 0.1mL of recovered virus suspension after 6 h contacting.

Test condition	Dilution rate of recovered virus suspension		
	$\times 10^0$	$\times 10^1$	$\times 10^2$
Without energization After 6 h			
With energization After 6 h			

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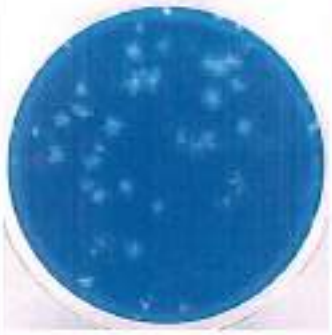
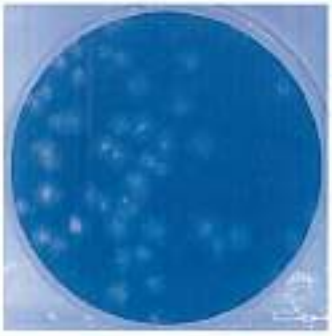
Plaque formation per 0.1mL of recovered virus suspension after 12 h contacting.

Test condition	Dilution rate of recovered virus suspension		
	$\times 10^0$	$\times 10^1$	$\times 10^2$
Without energization After 12 h			
With energization After 12 h			

Plaque formation per 0.1mL of recovered virus suspension after 24 h contacting.

Test condition	Dilution rate of recovered virus suspension		
	$\times 10^0$	$\times 10^1$	$\times 10^2$
Without energization After 24 h			
With energization After 24 h			

* Test results in this test report are only for samples received from the applicant and not for the whole lot.

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TEST RESULT (Informative)

○Real-time RT-PCR measurement of recovered virus suspension

- Virus strain : SARS-CoV-2; JPN/TY/WK-521
  (Distributed from National Institute of Infectious Diseases)
- Real-time PCR device : Thermal Cycler Dice® Real Time System Ⅲ (TaKaRa)
- Detection Kit : SARS-CoV-2 Detection Kit －N1 set－ (Code NCV-301; Lot# 038200)
  (TOYOBO CO.,LTD. Biotech support Department)

Mix 6 μL of recovered virus suspension with 3 μL of pretreatment solution and heat at 95 ℃ for 5min. Then, add 40 μL of RT-PCR reaction solution. After reverse transcription reaction and denaturation step, PCR was performed for 45 cycles.

Test carrier		Ct	
		With energization	Without energization
Test carrier	After 6 h	21.85	22.11
	After 12 h	23.61	22.00
	After 24 h	24.68	22.29

Note:

Test condition; Without energization

On plaque assay the virus infectivity titer of SARS-CoV-2 showed a decrease over time whereas a decrease in the amount of virus RNA correlative with the decrease in the virus infectivity was not observed. Natural deactivation over time up to 24 h shows no damage to virus RNA. (Fig.2)

Test condition; With energization

A decrease in the amount of virus RNA was not observed after 6 h, but the amount of virus RNA tented to decrease after 12 h and 24 h. (Fig.3) A part of RNA was damaged, probably due to contact with the electric device.

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Sample List

ID	Type	Name	Color
1	UNKN	With energization _6h	
2	UNKN	With energization _12h	
3	UNKN	With energization _24h	
4	UNKN	Without energization _6h	
5	UNKN	Without energization _12h	
6	UNKN	Without energization _24h	
7	NTC	Wash out solution for negative control	

Amplification Plots

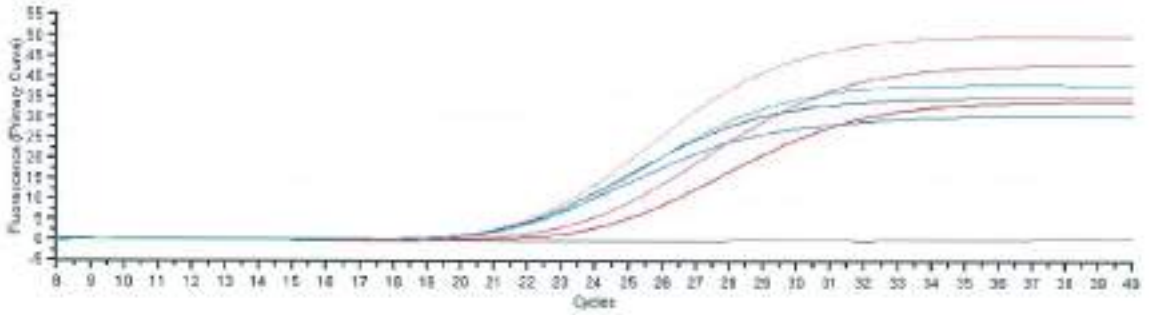

Fig.1. Amplification Plots; With/Without energization

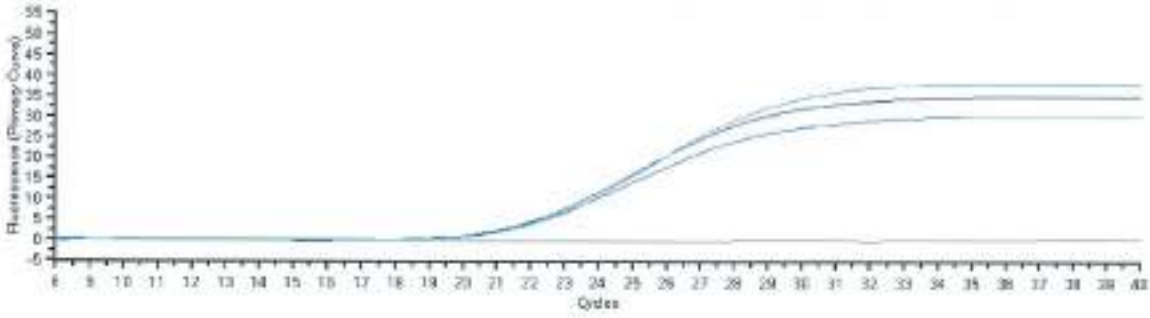

Fig.2. Amplification Plots; Without energization

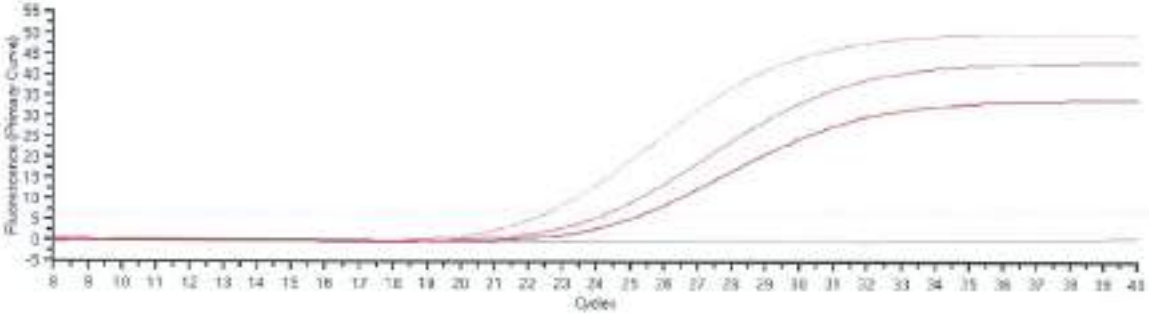

Fig.3. Amplification Plots; With energization

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<Reference date>

○Real-time RT-PCR measurement of virus suspension used in this test

- Virus strain : SARS-CoV-2; JPN/TY/WK-521
  (Distributed from National Institute of Infectious Diseases)
- Virus suspension : $>10^8$ PFU/ml
- Real-time PCR device : Thermal Cycler Dice® Real Time System Ⅲ (TaKaRa)
- Detection Kit : SARS-CoV-2 Detection Kit －N1 set－ (Code NCV-301; Lot# 038200)
  (TOYOBO CO.,LTD. Biotech support Department)

○Result

As the results of real-time RT-PCR measurement, an amplification of viral RNA in virus suspension used in this test was confirmed (Fig.1).

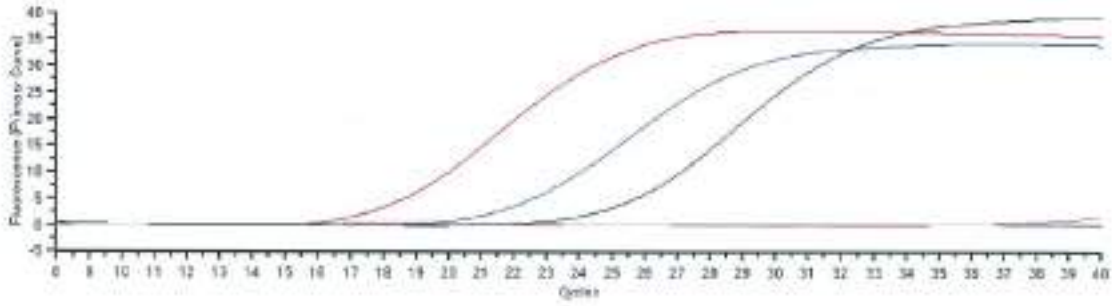

Fig.1. Real-time RT-PCR amplification plot

Red line shows the 10^{-2} dilution of virus suspension with PBS.
Blue line shows the 10^{-3} dilution of virus suspension with PBS.
Black line shows the 10^{-4} dilution of virus suspension with PBS.
Pink line shows the negative control; EMEM.

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Test Report

Kitasato Research Center for Environmental Science

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MITSUBISHI ELECTRIC CO.

Test Report

To investigate the removal efficacy of

"Air conditioner with disinfecting function",

on airborne bacteria

(25 m^3 space)

KRCES－Bio. Test Report No. 2016_0118

August 2, 2016

Approved by : Toshihiro Itoh

Toshihiro Itoh, Chief Director

Kitasato Research Center for Environmental Science

1-15-1, Kitasato, Minami, Sagamihara, Kanagawa 252-0329, Japan

1. Test objectives

Removal efficiency of the air purifier, "Air conditioner with disinfecting function" in a 25 m³ test chamber for airborne bacteria was investigated in this study. (Evaluation method for the removal efficiency was referring to Annex D "The removal efficiency evaluation test for airborne virus" in Japan Electrical Manufacturers' Association standard JEM 1467 "household air cleaner".)

2. Client

Name: Mitsubishi Eectric Corporation Shizuoka Works
RAC Advanced Development Section Room Air Conditioner Dept.
Address: 3-18-1 Oshika, Suruga-ku, Shizuoka 422-8528, Japan

3. Test laboratory

Name :Kitasato Research Center for Environmental Science
Address:1-15-1 Kitasato, Minami-ku, Sagamihara-shi, Kanagawa 252-0029, Japan

4. Test perind

July 28, 2016~August 1, 2016

5. Test device

"Air conditioner with disinfecting function" (Model number : MSZ-LN series, Mode: High operation, Air flow rate :13.5 m³/min. Disinfecting function : ON) ・・・ Photo A

Photo A. "Air conditioner with disinfecting function"

6. Test condition

1) Natural reduction as a negative control ; periodical changes in bacterial count were monitored when the test bacteria suspension was sprayed into the chamber with the test device off.

2) Test device ; periodical changes in bacterial count were monitored when the test bacteria suspension was sprayed into the chamber with the test device on(Fan speed was high).

7. Test bacteria

Staphylococcus aureus NBRC 12732

8. Reagents, devices, and materials

1) Main reagents

- Tryptic Soy Ager (Difco, TSA medium)
- Sodium chloride (Wako, special grade)
- Sodium thiosulfate (Wako, 1st grade)

2) Main devices and equipments

- Test chamber (25 m^3: 3.3×3.5×2.2 m, Amenity Technology)
- Circulation fan (Yamazen, BS-B-25)
- Laser particle counter (Kanomax Japan, MODEL 3886)
- Thermo-hygrometer (T&D, TR-72Ui)
- Nebulizer (Collison Nebulizer, BGI, CN-31I)
- Glass impinger (specially ordered)
- Membrane filter (A045R047A, Advantec)
- Incubator (MIR-153, MIR-553, Sanyo)

9. Method

1) Test system

The test system was shown on Figs A , B and Photo B . The test device, the circulation fan, the laser particle counter and the thermo-hygrometer were put in the test chamber. Two holes were made at the side panel of the test chamber. The nebulizer for spraying bacterial suspension was connected to the one hole and the glass midget impinger for collecting airborne bacteria was connected to the other hole.

According to the test procedure described on Table A and B. The test device was put in a 25 m³ test chamber and the bacterial suspension was sprayed with nebulizer for 10 minutes into the chamber while the circulation fan was operated. After 2 minutes circulation of the air, the bacterial aerosol was collected into the impinger (time 0) and then the fan was turned off. Immediately after turning off the fan, the test device was turned on and the aerosol was collected after 60, 120 and 180 minutes.

As a control (natural reduction of airborne bacteria), the same test was performed under the condition that the test device was turned off.

2) Test bacterium

Cryopreserved test bacteria were pre-cultured and then sub-cultured at 36±2 ℃ for 22 hours on TSA. Colonies formed on TSA were scraped off and suspended in sterilized ion-exchange water. Bacterial count of the suspension was adjusted to about 10^9 CFU/mL by Spectrophotometer

3) Spray of bacterial suspension

The test bacterial suspension (10^9 CFU/mL) was sprayed into the test chamber by the glass nebulizer for 10 minutes at a liquid rate of 0.2 mL/min. The pressure of the air discharged from the compressor was set at 1.0 kg/cm² and the air flow rate was set to 6.5 L/min.

4) Collection of airborne bacteria

The air in the chamber was sampled at 10 L/min for 2 minutes (total 20 L) to the midget glass impinger containing 20 mL of sterilized saline with 0.015 % sodium thiosulfate to collect the airborne bacteria (bacterial aerosol).

5) Bacterial count

Decimal dilutions of the each collected bacterial suspension were prepared with saline. One mL of the each dilution or the original suspension was mixed with TSA medium to make an agar plate. Ten mL the collected bacterial suspension in the impinger were filtered through the membrane filter. The remainder of the suspension was also filtrated. Each resultant filter was transferred onto the surface of TSA medium. These medium were incubated at 36±2 ℃ for 48 hours. After the incubation, colonies were counted and the number of bacteria in 20 L of air was calculated.

6) Evaluation method for the removal efficiency

This test was carried out using Annex D of JEM 1467 as a reference. In JEM 1467, achieving 2.0-digit reduction in 90 minutes is required to conclude that the test sample is effective.

The evaluation of a removal efficacy was carried out using the method described below, because this test device is not correspond to household air purifier and bacteria was used instead of virus in this test.

The approximate equation was calculated based on the time-dependent changes of airborne bacteria (logarithmic representation) and the inclination of the approximate equation was obtained. This inclination represents an amount of change in the number of bacteria per minute. Net inclination[*1] was calculated by subtracting the inclination of control from that of "Test device". Net LRV was calculated from the value of net inclination,[*2] and the removal efficacy of airborne bacteria was judged based on net LRV.

The test sample's efficacy was evaluated using the following formulae.

[*1] Net inclination = Inclination of "Test device" − Inclination of control

[*2] Net LRV = −{ Net inclination × Test time (min) }

[*3] $$\text{Reduction rate}(\%) = \left(1 - \frac{1}{10^{(\text{Net LRV})}}\right) \times 100\ (\%)$$

Test samples with 2.0 or higher net LRV for airborne bacteria were judged to be efficient in this test (Reffering to the removal efficiency of Annex D in the JEM 1467).

10. Results

Bacterial count of the sprayed suspension was 2.3×10^9 CFU/mL.

Bacterial counts of the collected samples were shown on Table 1 and Fig 1.

LRV and Net LRV (reduction rate) were calculated from the airborne virus number at each time, and shown in Table 2 and Fig 2.

In this test, Net LRV (reduction rate) of the test device for airborne bacteria was 2.22 (99.39%) at 180 minutes.

11. Reference data

In addition, the number of particle, temperature and humidity in the test chamber were shown as a reference data.

12. Comment

In this test, the net LRV calculated by subtracting a control value was more than 2.0 that is judged to have a removed efficacy of the device on airborne bacteria at 162 minutes. Therefore, the removal efficacy of this device was recognized.

Table1. Removal performance on airborne bacteria (CFU/20 L-air)

Test condition	Time(min)			
	0	60	120	180
① Natural reduction (Control)	180,000	230,000	260,000	170,000
② Test device	450,000	87,000	13,000	2,800

※Test device : "Air conditioner with disinfecting function"
(Model number : MSZ-LN series, Mode : High operation, Air flow rate : 13.5 m^3/min, Disinfecting function : ON)

※Test bacteria : *Staphylococcus aureus* NBRC 12732

※Test space : 25 m^3

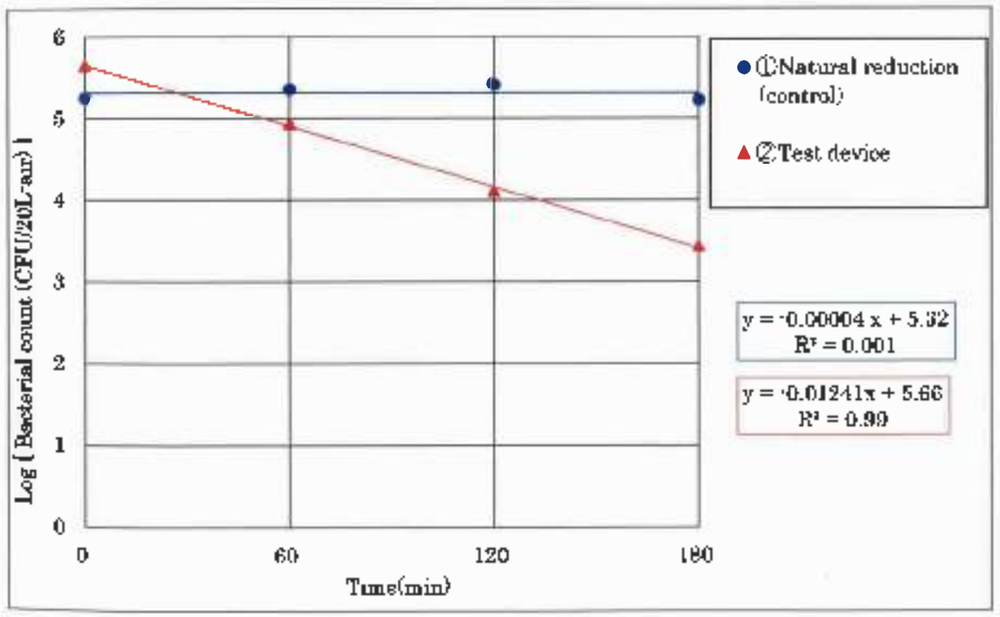


Figure1. Removal performance on airborne bacteria

Table 2. LRV and Net LRV (reduction rate) at each time

Test condition	Inclination	Net Inclination	Time(min)			
			0	60	120	180
①Natural reduction (Control)	-0.00004					
②Test device	-0.01241	-0.01237	0.00	0.74	1.48	2.22
			(0%)	(81%)	(96.6%)	(99.39%)

Net inclination = Inclination of "Test device" − Inclination of control

Net LRV = −{ Net inclination × Test time (min) }

$$\text{Reduction rate}(\%) = \left(1 - \frac{1}{10^{(\text{Net LRV})}}\right) \times 100\ (\%)$$

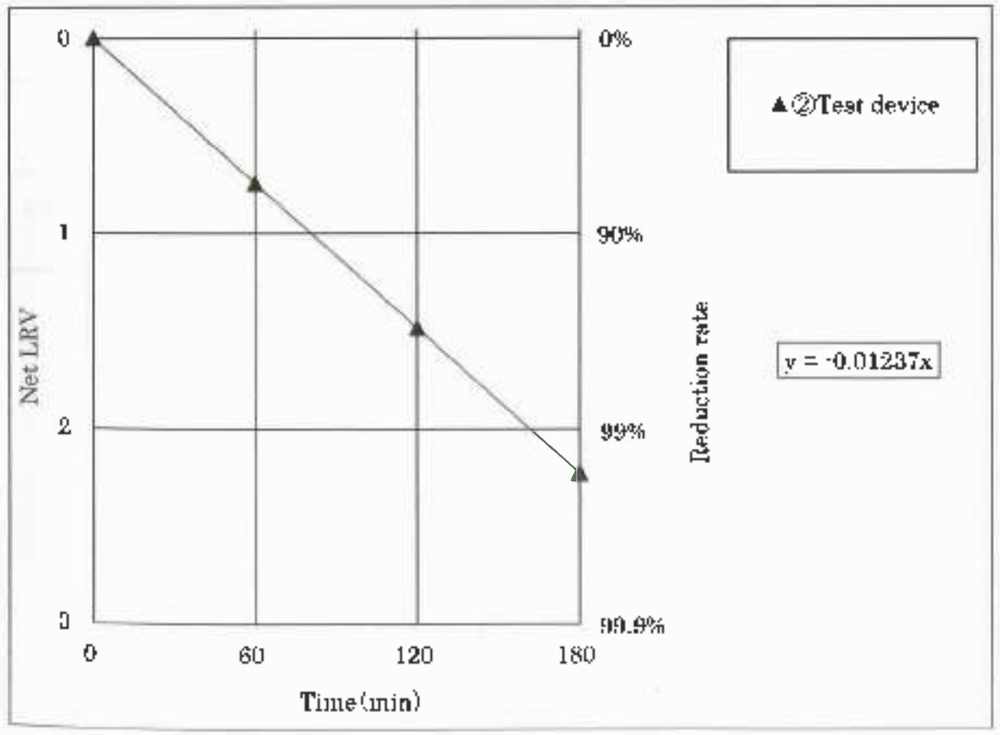


Figure 2. Net LRV and reduction rate at each time

Attached sheet

Table A. Test process (for test condition①)

Test operation	Equipment	Time(min) 0	60	120	180
To make homogeneous air in chamber	Circulation fan	→			
Spray bacteria	Nebulizer	10min (2min stir)			
Collect airborne bacteria	Impinger	2min	2min	2min	2min

Table B. Test process (for test condition②)

Test operation	Equipment	Time(min) 0	60	120	180
To make homogeneous air in chamber	Circulation fan	→			
Spray bacteria	Nebulizer	10min (2min stir)			
Test device	"Air conditioner with disinfecting function"		→		
Collect airborne bacteria	Impinger	2min	2min	2min	2min

Attached sheet

Photo B. Inside of the 25 m^3 test chamber

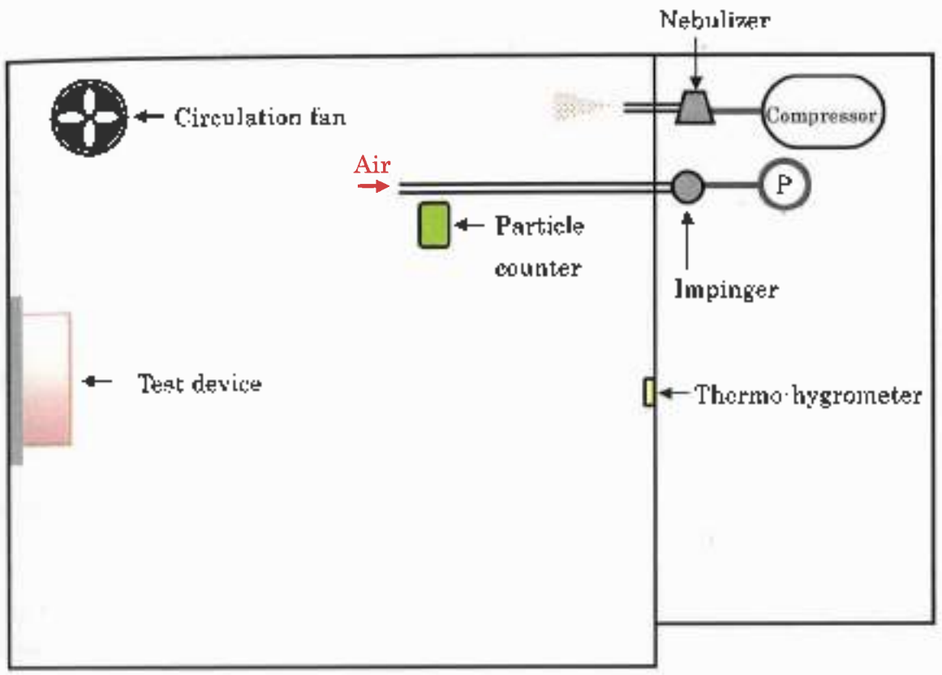


Figure A. 25 m³ Test chamber (top view)

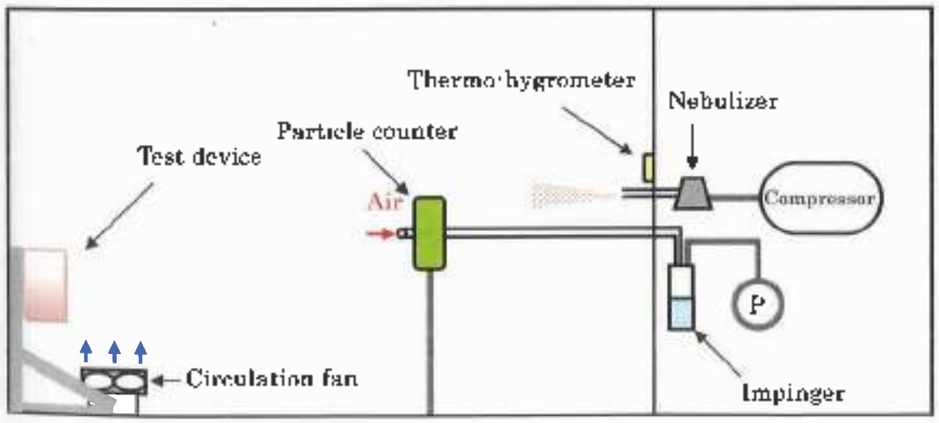
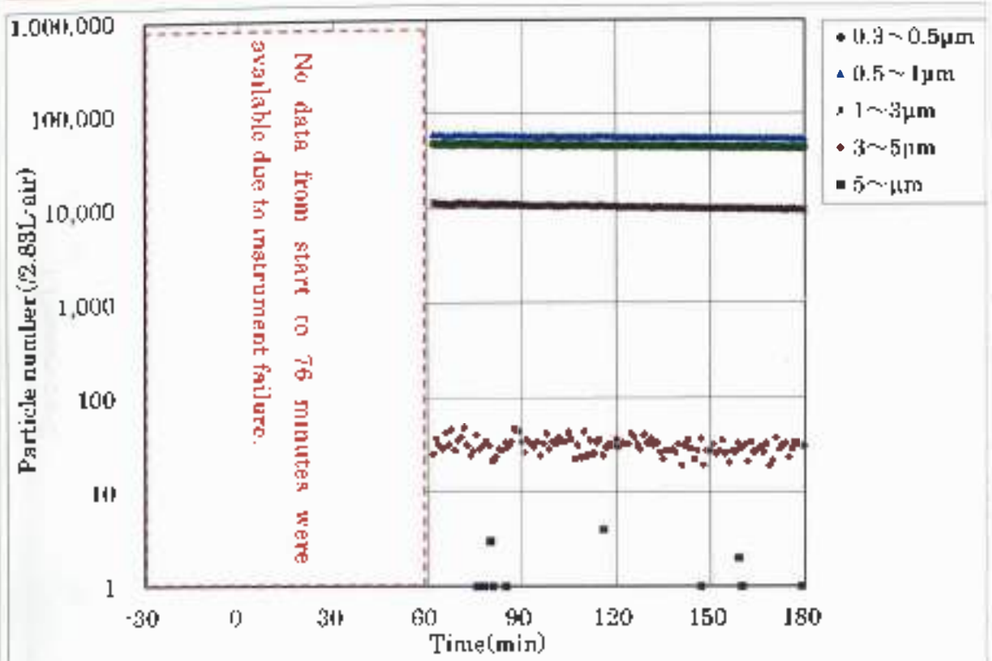
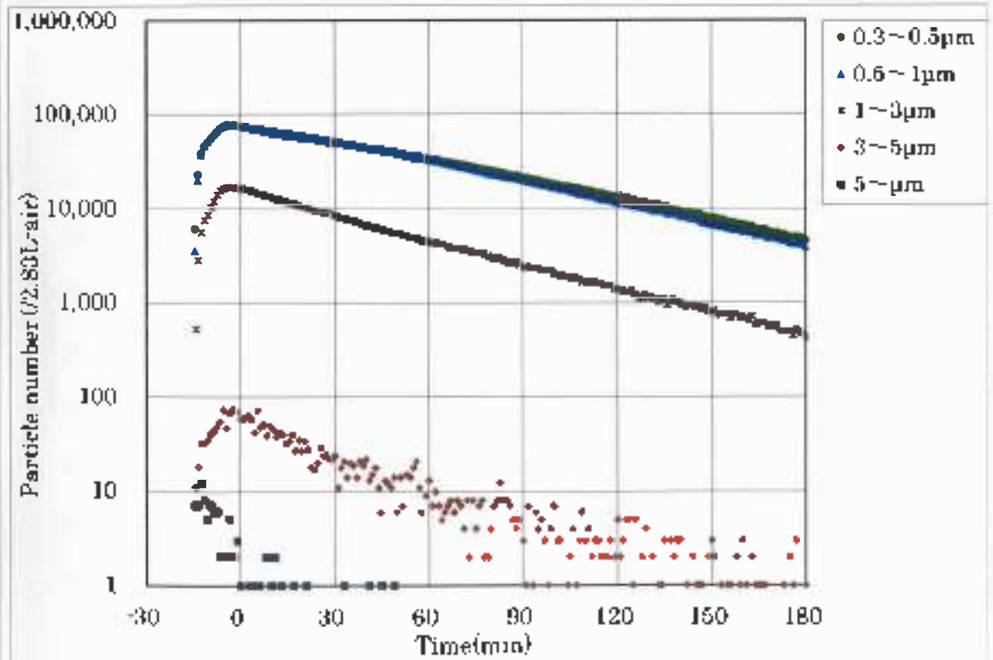


Figure B. 25 m³ Test chamber (side view)

reference data



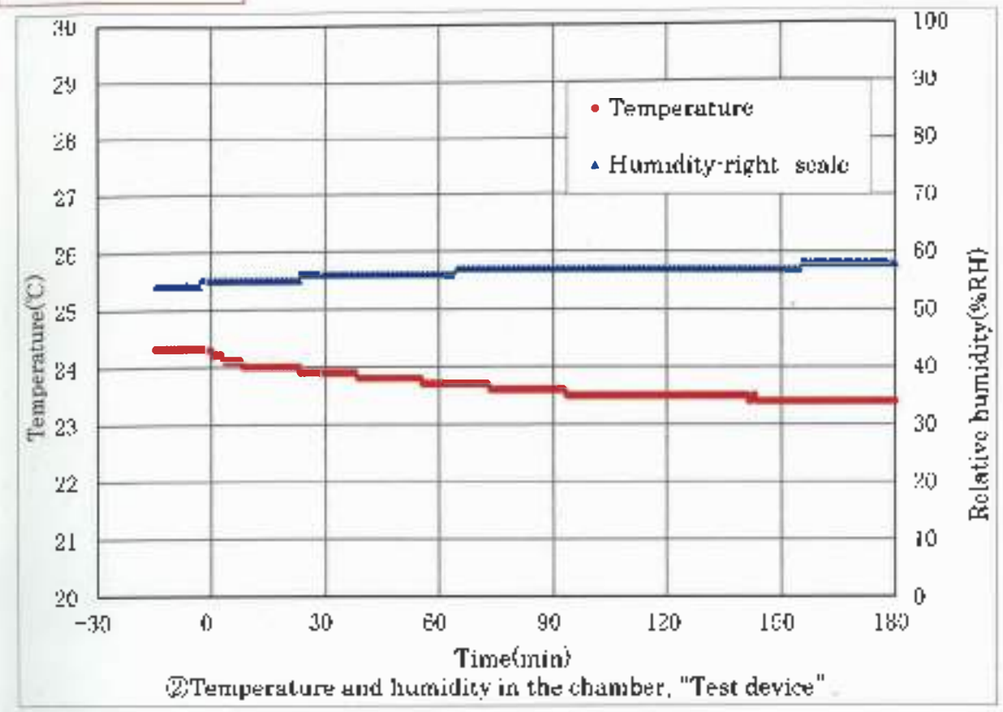
①The particle number in the chamber, Natural reduction



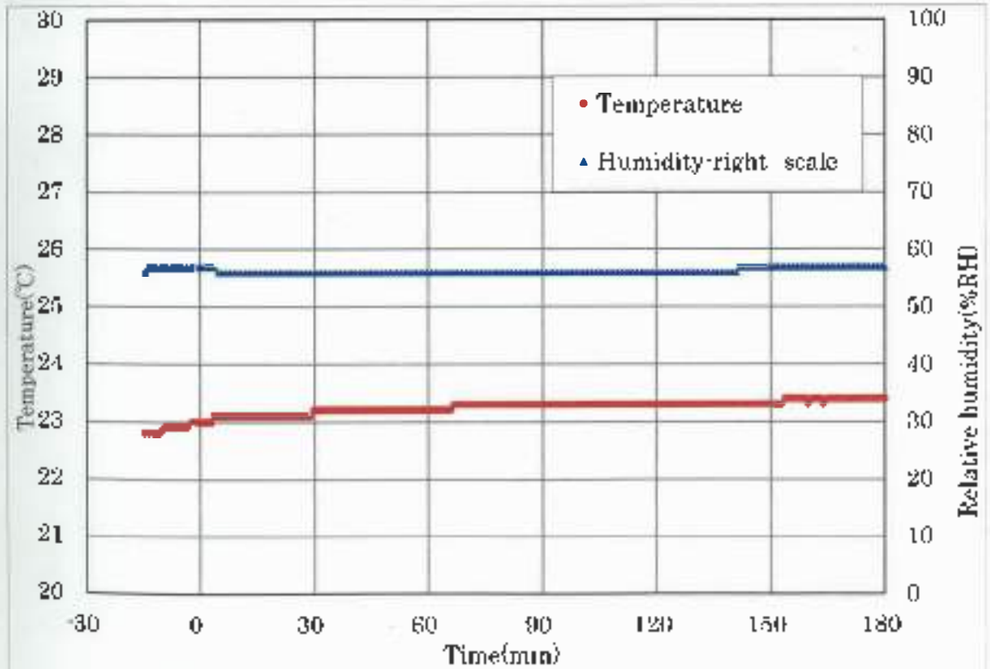
②The particle number in the chamber, "Test device"

＊Measured with a laser particle counter (Kanomax Japan, MODEL3886)

reference data



②Temperature and humidity in the chamber, "Test device"



③Temperature and humidity in the chamber. Natural reduction.

Measured by a thermo-hygrometer (TR-72U1.T&D)

No.T1606028

July 28, 2016

Report No.: T1606028

Customer: Mitsubishi Electric Corporation

Test Report

Institute of Tokyo Environmental Allergy, ITEA Inc.

1-2-5 Yushima Bunkyo-ku Tokyo 113-0034 Japan

Tel +81 3 3526 2031 Fax +81 3 3526 2032

VCN16A512

1-1. Test name　　Investigation of cat allergen in the air decreasing effect of air cleaning device

1-2. Sample

Sample name　　Air cleaning Device for MSZ-JL, LN (Below is written device)

Control　　Device turned power off (Below is written device off)

Wind speed when passing through device
1 m/s

1-3. Method　　The device was attached to a chamber (1 m^3) and the equipment of one pass air flow was set up (fig. 1-1). Test material containing a target allergen was scattered with a nebulizer into the chamber in which 4 fans were put. With stirring the material in air by the fans, the air was vacuumed to pass through the device and the material in the air was caught on a glass fiber filter. Cat allergen Fel d 1 on the filter was extracted and measured by ELISA. The number of particles in the air at the front and back points of the device was also counted by two particle counters. The same procedure was followed in the case of control.

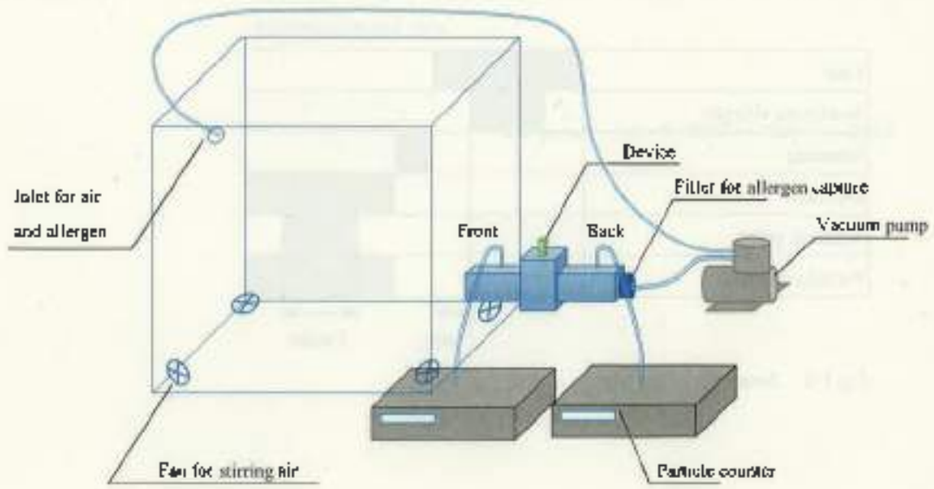


Fig 1-1.　Equipment for the test

1-4. Test condition

Target allergen	Cat allergen Fel d 1
Test material	Cat Hair and Epithelia Extract (Product No. 10104, ITEA)
Dose of material	10 μg as Fel d 1
Caught air volume	Approximately 60 L
Allergen measurement	Sandwich ELISA
Filter for allergen	Glass Fiber Filter (GA-55, ADVANTEC)
Particle counter	KC-52, RION (belongings of Mitsubishi Electric Corporation) Flow rate 0.28 L/minute Particle size ≧0.3、≧0.5、≧1、≧2、≧5 μm
Temperature	25℃
Humidity	Without artificial control (It is wrote on Appendix)
Sequence of the test	See fig. 1-2

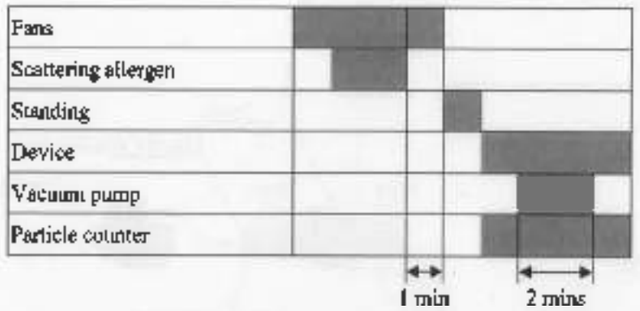


Fig 1-2. Sequence of the test

1-5. Result

Table 1-1. The number of particles in the air at the front and back points of the device

Test division	Measurement point	≧0.3 μm	≧0.5 μm	≧1.0 μm	≧2.0 μm	≧5.0 μm
Device on	Front	203,214	173,917	103,441	41,523	28
	Back	23,036	3,594	301	50	0
	Decreasing rate (%)	88.7	97.9	99.7	99.9	100.0
Device off	Front	204,297	175,326	105,003	42,713	24
	Back	197,395	159,286	88,566	32,626	18
	Decreasing rate (%)	3.4	9.1	15.7	23.6	27.1

Decreasing rate (%) = (X-Y) / Y × 100

X: Particle numbers in the front of device

Y: Particle numbers in the back of device

Table 1-2. The Amount of cat allergen, Fel d 1 in the air at the back point of the device (pg/L)

Test division	Initiatial amount	Back point
Device on	501.0	10.7
Device off	483.2	452.3

1-6. Addition The results of this test were not able to be compared with that of other experiments and tests.

Test period: July 5, 2016 – July 11, 2016

2-1. Test name　Investigation of ragweed pollen allergen in the air decreasing effect of air cleaning device

2-2. Sample

Sample name	Air cleaning Device for MSZ-JL, LN (Below is written device)
Control	Device turned power off (Below is written device off)

Wind speed when passing through device
1 m/s

2-3. Method　The device was attached to a chamber (1 m³) and the equipment of one pass air flow was set up (fig. 2-1). Test material containing a target allergen was scattered with a nebulizer into the chamber in which 4 fans were put. With stirring the material in air by the fans, the air was vacuumed to pass through the device and the material in the air was caught on a gluss fiber filter. Ragweed allergen Amb a 1 on the filter was extracted and measured by ELISA. The number of particles in the air at the front and back points of the device was also counted by two particle counters. The same procedure was followed in the case of control.

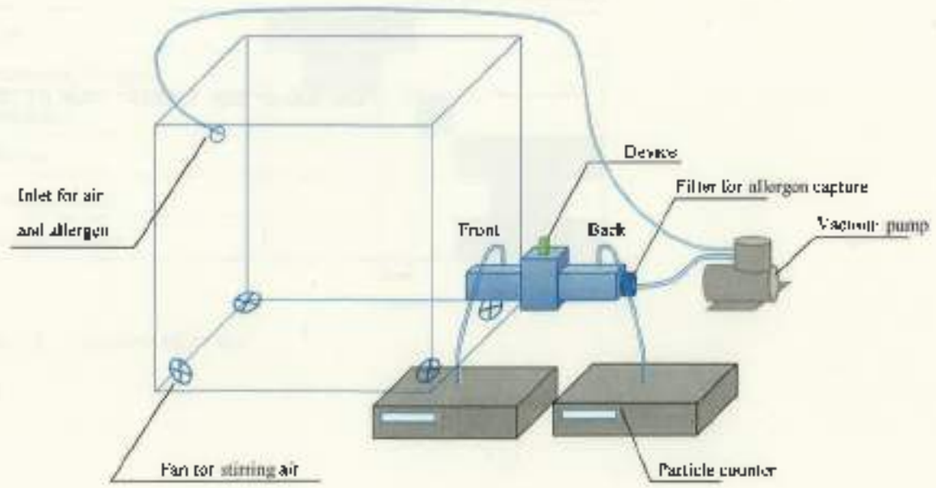


Fig 2-1　Equipment for the test

2-4. Test condition

Target allergen	Ragweed pollen allergen Amb a 1
Test material	Ragweed Pollen Extract (Product No. 10115, ITEA)
Dose of material	10 μg as Amb a 1
Caught air volume	Approximately 60 L
Allergen measurement	Sandwich ELISA
Filter for allergen	Glass Fiber Filter (GA-55, ADVANTEC)
Particle counter	KC-52, RION (belongings of Mitsubishi Electric Corporation) Flow rate　0.28 L/minute Particle size　≧0.3, ≧0.5, ≧1, ≧2, ≧5 μm
Temperature	25℃
Humidity	Without artificial control (It is wrote on Appendix)
Sequence of the test	See fig. 2-2

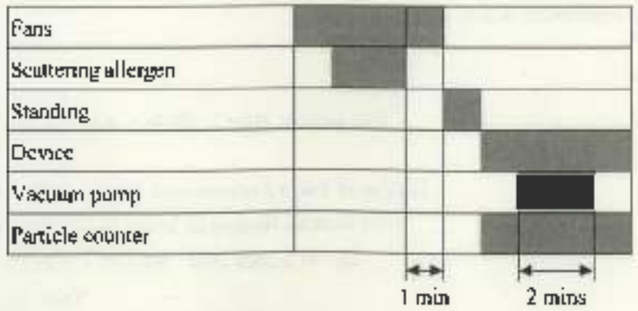


Fig 2-2.　Sequence of the test

2-5. Result

Table 2-1. The number of particles in the air at the front and back points of the device

Test division	Measurement point	≧0.3 μm	≧0.5 μm	≧1.0 μm	≧2.0 μm	≧5.0 μm
Device on	Front	200,721	163,712	88,092	29,132	16
	Back	14,129	2,087	191	26	0
	Decreasing rate (%)	93.0	98.7	99.8	99.9	100.0
Device off	Front	206,533	179,024	108,406	44,430	28
	Back	199,508	162,805	92,109	34,524	24
	Decreasing rate (%)	3.4	9.1	15.0	22.3	12.7

Decreasing rate (%) = (X-Y) / X × 100

X: Particle numbers in the front of device

Y: Particle numbers in the back of device

Table 2-2. The Amount of Ragweed pollen allergen. Amb a 1 in the air at the back point of the device (pg/L)

Test division	Initiatial amount	Back point
Device on	480.2	<7.4*
Device off	604.8	463.3

* Below the limit of detection

2-6. Addition

The results of this test were not able to be compared with that of other experiments and tests.

Test period: July 5, 2016 – July 11, 2016

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Appendix

Table S1. The temperature and humidity in the chamber when testing

Allergen	Test division	Beginning		End	
		Temperature (℃)	Humidity (%RH)	Temperature (℃)	Humidity (%RH)
Cat	Device on	29.2	40.0	28.9	42.8
	Device off	27.7	41.4	27.8	43.6
Ragweed pollen	Device on	27.8	42.5	27.8	44.3
	Device off	27.8	43.1	27.7	45.6

Table S2. The difference between particle counter (PC) 1 and PC2
(The average data for ten measurements)

Counter No.	≧0.3 μm	≧0.5 μm	≧1.0 μm	≧2.0 μm	≧5.0 μm
PC1	16,839	1,185	115	32	2
PC2	17,224	1,185	115	32	2
Ratio	0.98	1.00	1.00	1.01	1.87

* Ratio = PC1 / PC2

PC1: Measured at the front of the device

PC2: Measured at the back of the device

JFRL

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Date issued: August 08, 2016

REPORT

Client: Mitsubishi Electric Corporation
3-18-1 Oshika, Suruga-ku, Shizuoka-shi, Shizuoka 422-8528, Japan

Sample(s): Air Conditioners KIRIGAMINE MSZ-LN Series

Title: Airborne Mold Spores Removal Performance Test

Received date of sample(s): July 18, 2016

This report has been translated into English from Japanese report No. 16069353001-0101 (Date issued: August 08, 2016).

Signed for and on behalf of JFRL

JAPAN FOOD RESEARCH LABORATORIES

T. Arai
Takeko Arai
Section of Analysis Documentation

Aug. 30, 2016
Date

VCN16A513

一般財団法人
日本食品分析センター

Airborne Mold Spores Removal Performance Test

1. Client
   Mitsubishi Electric Corporation

2. Sample
   Air Conditioners KIRIGAMINE MSZ-LN Series

3. Outline of the method
   This test was performed using the method described in "Airborne Virus Removal Performance Test," Appendix-D (Regulations), Japan Electrical Manufacturers' Association Standard JEM 1467 Air Cleaners (revised on March 25, 2015) as a reference. The test organism was *Penicillium citrinum* NBRC 6352, and the incubation conditions were changed from the reference method.

1) Test date
   July 19 and 20, 2016

2) Test facility
   Osaka Branch, Japan Food Research Laboratories
   3-1 Toyotsu-cho, Suita-shi, Osaka 564-0051, Japan

4. Results
   Table 1 and Figure 1 show the test results.
   As reference data, Figures 2 and 3, and Table 2 show the measurement results of the airborne particles and the measurement results of temperature and humidity during the test, respectively.
   Table 3 shows the test conditions.

Table 1 Viable cell counts on gelatin fillers

Test organism	Condition	Viable cell count (per filter)			
		Initial	After 60 min.	After 120 min.	After 180 min.
Penicillium citrinum	Natural decline*	1.5×10^6	1.2×10^6	8.9×10^5	6.3×10^5
	Sample operation	1.2×10^6	6.1×10^4	6.8×10^3	9.3×10^2

* The sample was not operated.

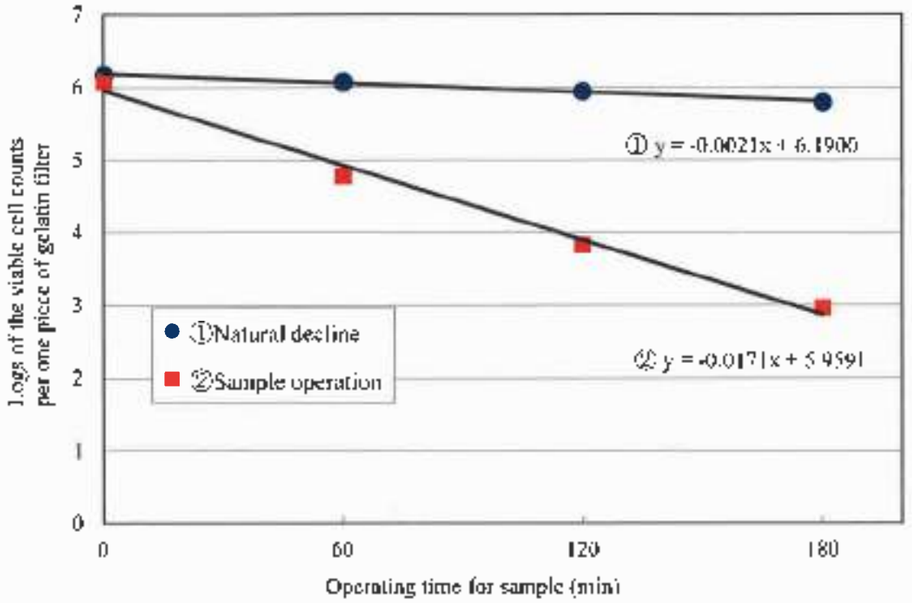
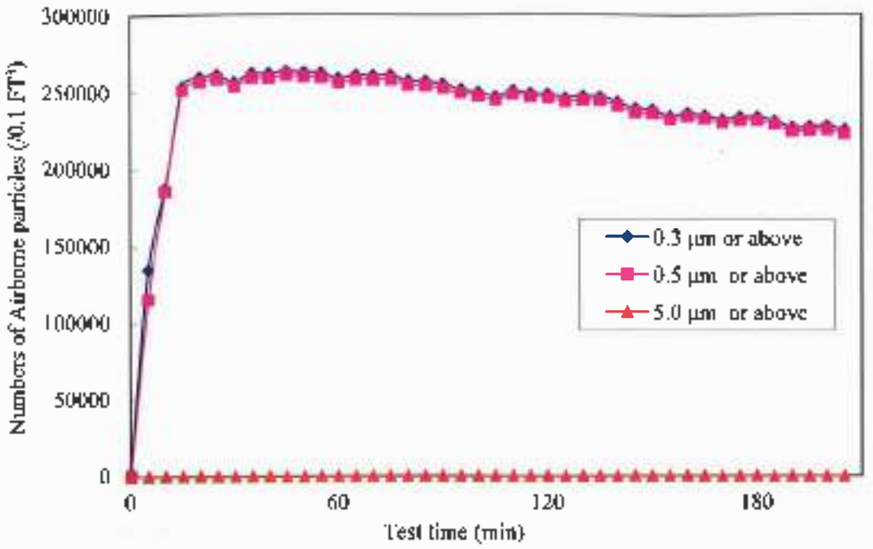
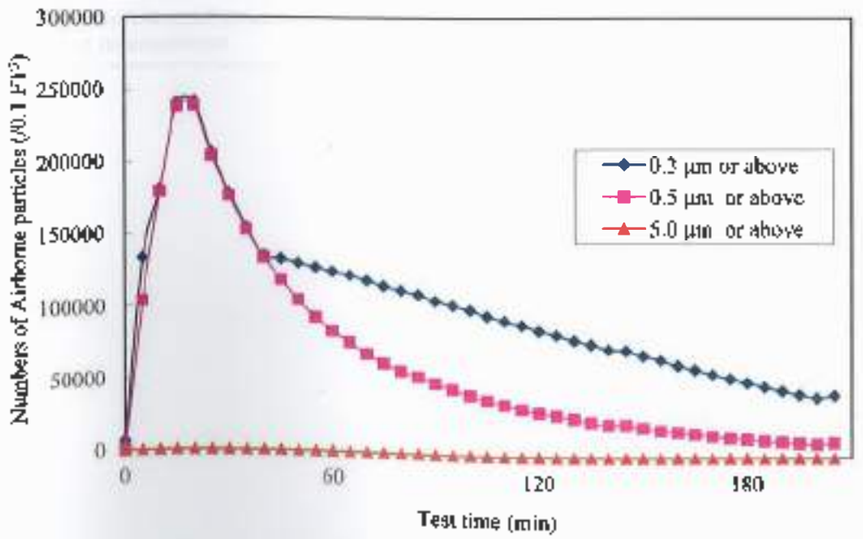


Figure 1. Graph obtained from the approximate expression



Measuring instrument: Handheld Laser Particle Counter (Kanomax Japan Incorporated)
Figure 2. Airborne particles measurement results: Natural decline



Measuring instrument: Handheld Laser Particle Counter (Kanomax Japan Incorporated)
Figure 3. Airborne particles measurement results: Sample operation

Table 2. Temperature and humidity at the start and the end of the test

Condition	Temperature (°C)		Humidity (%RH)	
	Start	End	Start	End
Natural decline*	27	28	50	50
Sample operation	28	29	50	40

Measuring instrument: Ondotori TR-72Ui (T & D Corporation)

* The sample was not operated.

Table 3. Test conditions

Capacity of the test chamber	About 25 m^3 [3266 mm (D) × 3290 mm (W) × 2328 mm (H)]
Test organism	*Penicillium citrinum* NBRC 6352
Viable cell counts of the spore suspension	Natural decline: 3.5×10^5/mL Sample operation: 2.4×10^5/mL
Spray volume of the spore suspension	6 mL (0.4 mL/min × 15 minutes)
Operating time period of the sample	60 minutes, 120 minutes, 180 minutes
Air collection volume by the gelatin filter	80 L (2.4 m^3/h × 2 minutes)
Solution for washing the gelatin filter	0.005 % dioctyl sodium sulfosuccinate solution, 10 mL
Method for viable cell count measurement	Pour plate method
Medium and incubation conditions for viable cell count measurement	Potato dextrose agar (Eiken Chemical Co., Ltd.) 25 °C ± 1 °C, 7 days

End of Report