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airDefender 365-day antibacterial and antiviral coating solutions

Certificates & Reports:

(i) Assessment of antibacterial effectiveness

- **1.1** Testing the virucidal activity of anti-microbial coating against SARS-CoV-2 using ISO21702 by Virology Research 新型冠狀病毒
- **1.2** Transmissible gastroenteritis coronavirus (COVID-19 virus family) by Eurovir Hygiene-Labor Labaoratory in Germany 冠狀病毒
- **1.3** Eurovir Examination of the virucidal activity of a disinfectant product – using the suspension test method following EN 14476 (Transmissible Gastroenteritis Virus of Swine - TGEV; Strain: Toyama 36) 冠狀病毒
- **1.4** Eurovir Examination of the virucidal activity of a disinfectant product – using the suspension test method following EN 14476 (Vacciniavirus) 牛痘病毒
- **1.5** H1N1 by Nissenken Quality Evaluation Center TOKYO Laboratory \ #DTK20-00415-1 甲型流感病毒
- **1.6** SGS report: #ASH19-000911-02 CMCC(B) 猩紅熱
- **1.7** SGS report: #SHFDO120810413FD Legionella pneumophila 退伍軍人菌
- **1.8** SGS report: #ASH14-025972-01 Listeria Monocytogenes 李斯特菌
- **1.9** SGS report: #SHFDO100912172FD1 MRSA Super Bug 金黃色葡萄球菌
- **1.10** SGS report: #ASH17-024697-02 Asperguillus niger 黑麴黴
- **1.11** SGS report: #ASH18-048042-01 Klebsiella 克雷伯氏肺炎菌
- **1.12** SGS report: #ASH15-026060-01 Salmonella typhimurium 沙門氏菌
- **1.13** SGS report: #ASH19-000911-02 Alpha hemolytic streptococcus 溶血性鏈球菌
- **1.14** SGS report: #SHFDO100912172FDS1 Escherichia. Coli 大腸桿菌

(ii) Safety tests

- **2.1** SGS report: #ASH18-033119-02 Non Toxic Oral Test 無毒測試 – 口服測試
- **2.2** SGS report: #ASH18-033119-01 Skin Irritation Test 無毒測試 – 皮膚刺激性
- **2.3** SGS report: #ASH21-001085-02 Eye Irritation 眼睛刺激性測試
- **2.4** SGS report: #ASH21-010934-01 Test for In Vitro Cytotoxicity 細胞毒性測試
- **2.5** SGS report: #ASH21-010951-01 Inhalation Toxicity Test 吸入毒性測試

(iii) Measurement of antibacterial activity and other tests

- **3.1** SGS report: #ASH20-072073-01 Rubbing 2000 Times 磨擦測試
- **3.2** SGS report: #ASH20-080039-02 Anti Alcohol 抗酒精測試
- **3.3** SGS report: #ASH20-077749-02 ASTM-1980 duration of 1 year 一年有效

(iv) ARCTICA washable mask test reports

4.1 ARCTICA washable mask SGS report: #T32020320103SN-01
Assessment of antibacterial finishes on ARCTICA washable mask textile material (AATCC 100-2012) (Test specimen: after 100 washes) 口罩抗菌測試 (洗 100 次)

4.2 ARCTICA washable mask SGS report: #T32020300217SN-01
Water repellency (AATCC 22-2017) after 60 washes/ after 100 washes /
Free and hydrolized formaldehyde content (ISO 14184-1: 2011)
口罩抗水性及甲醛測試 (洗 60 次/100 次)

4.3 ARCTICA washable mask SGS **r**eport: #T32020280887SN-01
ISO 14184-1:2011 – Free and hydrolized formaldehyde content/ Flammability test of clothing textiles/ Assessment of antibacterial finishes on textile material (AATCC 100-2012) (Test specimen: after 60 washes/100 washes)
口罩裡布甲醛/易燃及抗菌測試 (洗 60 次/100 次)

VRS Project #LF02

On behalf of AirDefender International Company Limited., Virology Research Services Limited (Company Number, 11718460) has tested the virucidal activity of Anti-microbial Coating against SARS-CoV-2.

The research was conducted strictly following the protocol for ISO21702:2019. This work was performed in the VRS London labs in May 2021.

Under the conditions tested, the Anti-microbial Coating has a virucidal activity against SARS-CoV-2 at a contact time of 24 h. The experimental protocol and its findings are described in detail in the attached report.

At 24 h, the average recovered titre for the Anti-microbial Coating was 2.15E+01 TCID50/cm^2 compared to 1.04E+04 TCID50/cm^2 for the reference control.
R (antiviral activity) = 2.69 at 24 h.

The above data indicate that the Anti-microbial Coating inactivates > 99% of virus after 24 h of contact relative to a non-treated control.

Authorized VRS signatory

Testing the virucidal activity of Anti-Microbial Coating against SARS-CoV-2 using ISO21702

A report prepared by Virology Research Services Ltd for

AirDefender International Company Limited

Project No. LF02

Document No. LF02_ISO21702

Experiment start date: 28th May 2021

Date of report: 1st June 2021

virology research services

ISO/IEC 17025:2017 Accredited

Accreditation #111376

Virology Research Services Ltd

Contents

Summary

Aim

This study tests the antiviral activity of Anti-Microbial Coating against SARS-CoV-2 at a contact time of 24 hours relative to a non-treated reference control.

Methods

ISO21702 is a standard protocol to quantify the antiviral properties of non-porous surfaces. In this protocol, a pre-determined concentration of virus was dispensed onto test and reference surfaces and incubated at room temperature for 24 hours in a humidified chamber.

Next, the samples were recovered by washing with media (neutraliser), and the amount of infectious virus in each suspension was quantified using a TCID50 assay. For the assay to be valid, the material tested must have no cytotoxic activity on the cells used to quantify the virus, nor interfere with cell sensitivity to infection.

Results

Virucidal activity against SARS-CoV-2 was observed for the treated material relative to the reference control. The R value (antiviral activity) was 2.69.

The test material had no cytotoxic activity towards the cells used to quantify the virus. No cytotoxic activity was detected for the reference control sample. No cytotoxic activity was detected for the media only sample.

Conclusion

Under the conditions tested, Anti-Microbial Coating displays virucidal activity against SARS-CoV-2.

Aim

To test the virucidal activity of Anti-Microbial Coating against SARS-CoV-2 at a contact time of 24 hours relative to a reference control, following ISO21702:2019.

Methods

Assay validity control tests

For the assay to be valid, the material tested must have no cytotoxic activity on the cells used to quantify the virus, nor interfere with cell sensitivity to infection. The two tests of these criteria are described below.

Cytotoxicity control: Is the tested material cytotoxic to the assay's host cells?

Assay media is added to treated material and reference control for 5 min, before being collected and added onto monolayers of cells seeded into the wells of a 96-well plate. Cells are then cultured, and after 3 days a viability assay (crystal violet staining) is used to determine cell viability. The test is carried out in triplicate for both the treated material and non-treated reference control.

Media that has been in contact with neither the treated material nor reference control is included as a reference. For the test to be valid, no cytotoxic effect should be observed compared to the media.

Sensitivity control: Do the tested materials affect the assay cells' sensitivity to the virus?

Assay media is added to treated material and reference control for 5 min, before being collected in tubes. Next, to test whether exposing the media to the materials affects the cells' sensitivity to infection, 0.5 x 10^6 infectious units (IU) of virus are added into each tube. After a 30-min incubation at room temperature, the amount of infectious virus in each sample is quantified (TCID50 assay). The 50% tissue culture infectious dose (TCID50) is the end-point virus dilution where 50% of the infected test cells die.

The tests are carried out in triplicate on treated and non-treated material. Media that has not been in contact with either material is also incubated with the virus.

When there is no cytotoxicity and the materials do not interfer with the host cell's sensitivity to infection, the assay is considered to meet the requirements for ISO 21702 and can be used to establish the antiviral activity of the test material.

Antiviral test procedure

Treated and non-treated materials were placed in individual discs in triplicate. A liquid volume (200 µl) of an appropriate concentration of virus (1 x 10^7 IU/ml stock of SARS-CoV-2) was added onto each surface and covered with an inert film.

A lid was placed over each disc, which was then incubated for 24 hours at room temperature in a humidified chamber. At the end of the incubation, the film was lifted, and the sample washed with media to recover the virus. The amount of infectious virus recovered from each sample was then quantified by TCID50.

As a further control, virus was added to three pieces of the reference control material and immediately recovered by washing (referred to as the 'virus recovery control' or 'back-titration'). This recovered virus is used to quantify the starting amount of virus.

TCID50 determination

A eight-point, ten-fold serial dilution from the virus-containing wash media was tested in quadruplicate for each sample on African Green Monkey Kidney Epithelial (Vero) cells. After 3 days, a viability crystal violet assay was carried out to determine cell viability across the dilution series. The dilution at which 50% of cells are infected/killed (TCID50) was calculated using a regression analysis.

Quantification of antiviral activity

When the test is deemed valid, the antiviral activity (R) is calculated as follows:

$R = Ut-At$

where Ut is the average of the common logarithm of the number of infectious units recovered from the untreated test specimens at the end of the incubation time;

and At is the average of the common logarithm of the number of infectious units recovered from the treated test specimens at the end of the incubation time.

An R value of ≥ 1 indicates antiviral activity.

Key test information

This page provides key additional information required when reporting the findings of an ISO 21702:2019 testing protocol:

Specimens

Test sample: Anti-Microbial Coating
Reference control: Standard Inert Sample
Size, shape, and thickness: 50 × 50 mm squares, < 10 mm thick

Film

Type of polymer: polyethylene
Shape and thickness: 40 × 40 mm, approx. 12.7 µm thick

Virus/cells

Virus strain: SARS-CoV-2
Host cells: African Green Monkey Kidney Epithelial (Vero)

Test inoculum

Volume: 200 µl
Virus titre: 1 × 10^7

Contact time

24 hours

Deviations from the standard protocol

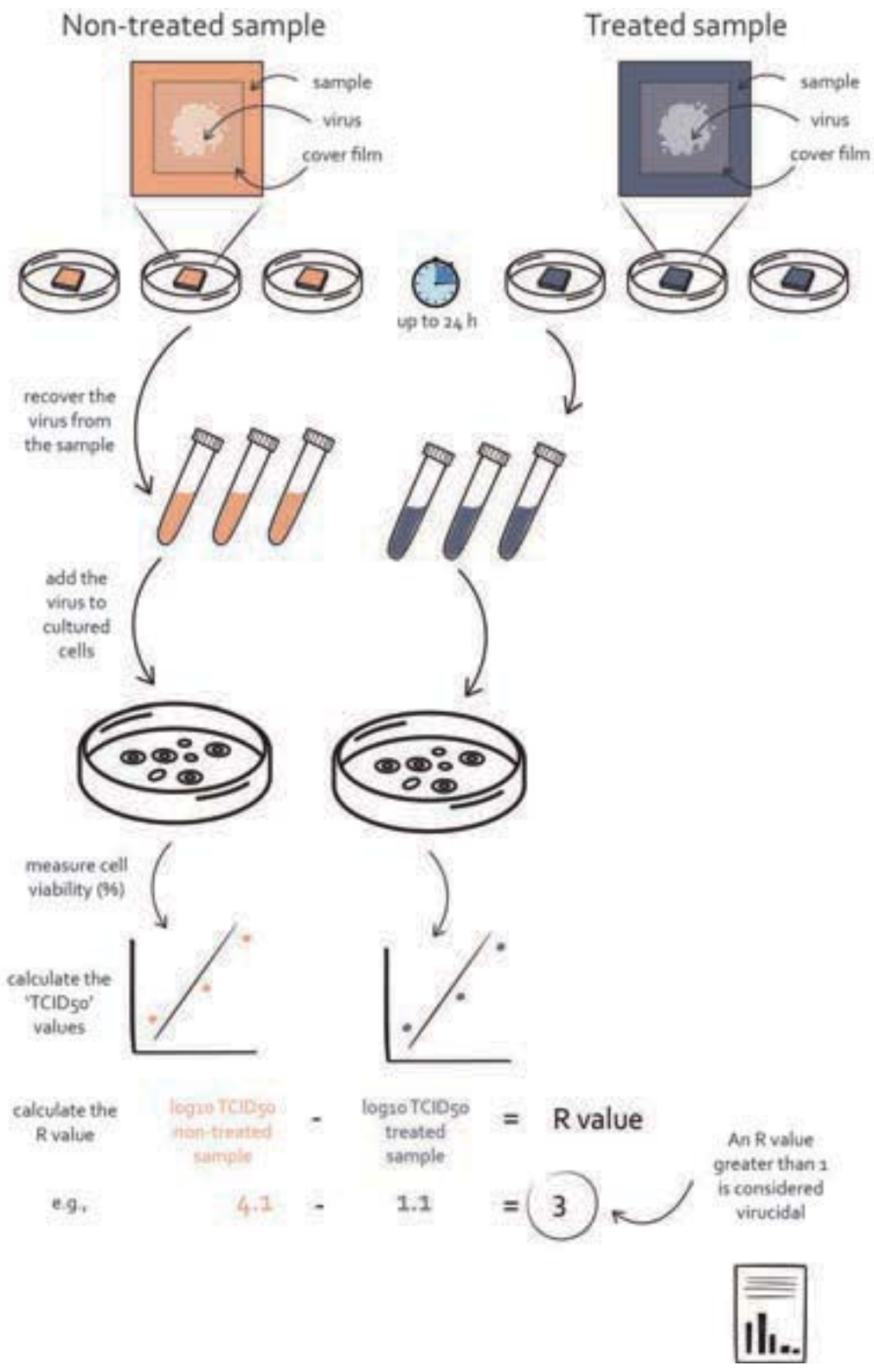
None

Test laboratory

Virology Research Services Ltd, London

virology research services

1st June 2021



Scheme 1. An outline of the method used to calculate the virucidal activity (R value) of treated samples relative to a non-treated control sample. Note that this scheme is not comprehensive and does not include all the various controls included in the ISO21702 protocol.

Results

Control tests

The control experiments are summarized in the Appendix.
The test material does not display cytotoxicity towards the cells used to host the virus in this experiment. The test material does not interfere with the cells used to host the virus in this experiment.

Antiviral tests

The results of the antiviral test for Anti-Microbial Coating are summarized in Table 1 and Figure 1. The treated material displays virucidal activity against SARS-CoV-2 when using a contact time of 24 hours.

Anti-Microbial Coating displays antiviral activity against SARS-CoV-2. The average recovered titre for the treated material was 2.15E+01 TCID50/cm² compared to the average recovered titre of 1.04E+04 TCID50/cm² for the non-treated reference control.

R (antiviral activity) = 2.69

Table 1. The average infectious units per cm² recovered from the test and reference control materials at a contact time of 24 hours with the virus.

Test Condition	Virus recovery control (TCID50/cm^2)			Antiviral test (TCID50/cm^2)		
Test	NA			2.15E+01	±	8.13E+00
Reference	6.29E+05	±	5.21E+05	1.04E+04	±	3.34E+03

Table 2. The average infectious units per cm² recovered from the test and reference control materials at a contact time of 24 hours with the virus.

Test Condition	TCID50 (log10)	R Value	% reduction
Test	1.33	2.69	99%
Reference	4.02		

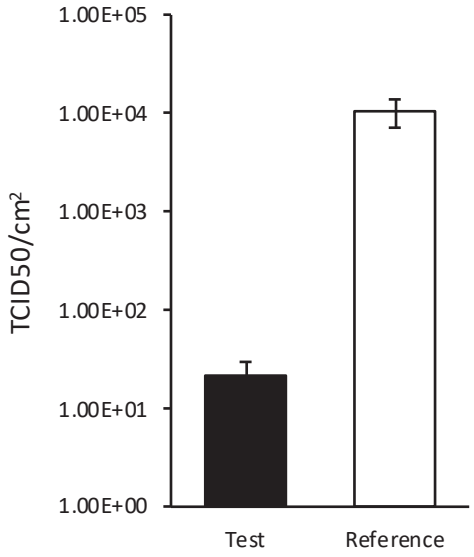


Figure 1. The mean TDIC50/cm² values for SARS-CoV-2 following a contact time of 24 hours with test and referencecontrol materials. Error bars are standard error of the mean.

Conclusion

Based on the findings reported here and following ISO 21702, the treated material displays virucidal activity against SARS-CoV-2 after a contact time of 24 hours.

The results of control assays confirm that the tested material is not cytotoxic for the test cells.

Also, the test material does not interfere with the cells' sensitivity to the virus. Thus, the experiment meets the requirements for a valid ISO 21702 test.

Appendix

Control tests

Cytotoxicity

Test Condition	Cytotoxicity
Test	Not cytotoxic
Reference	Not cytotoxic
Media	Not cytotoxic

Cell viability (%) upon incubation with media recovered from reference and treated materials, relative to the fresh media control.

Sensitivity control

Test Condition	Sensitivity control (TCID50/cm²)			Sensitivity control (Log10)	Media - material (Log10)
Test	2.75E+05	±	1.13E+05	5.44	0.17
Reference	1.33E+05	±	6.79E+04	5.12	0.48
Media	4.05E+05	±	6.93E+04	5.61	NA

Infectious TCID50/cm^2 recovered after 30 min incubation with 5 ml of media that has been in contact with the treated or untreated material. The difference between the natural logarithm of the infectivity titre of virus recovered from the media only control and each specimen should be less than or equal to 0.5.

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Eurovir® Hygiene-Labor
Antivirale Validierung & Rabies

Testing the virucidal activity of test specimens equipped with the product *airDefender Sol*

Examination of test surfaces equipped with a virucidal active coating using a praxis-near carrier test system following the RKI-Richtlinie (1995) as well as ISO 21702:2019 against the *Transmissible Gastroenteritis Virus (TGEV-Coronavirus)* - Test run S2 dated 30./31.03.2020

Short report: screening test S2

by
PD Dr. Olaf Thraenhart and Dr. Christian Jursch

Test period: March - April 2020

Dr. Christian Jursch
Eurovir Hygiene-Labor GmbH
Im Biotechnologiepark TGZ I
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Products:

- Test surfaces: glass carrier (according to ISO 21702; with the dimensions of 4 cm x 4 cm) coated with the product(s); applied by the principal
- 1. test item: test surfaces coated on one side with the product *airDefender Sol*
- 2. test item: test surfaces uncoated (control samples)

Test parameter:

- Test conditions: T = 25 °C and 90 % r.LF
- Protein load: no additional protein load; the virus material (cell culture supernatant) was spread onto the surface(s) w/o any further manipulation/alteration
- Volume to square ratio: 25 µL/cm²
- Virus suspension was not covered with foil
- Incubation: 1h, 8h and 24h in a climate chamber KBF 115 (Fa Binder)

Test system:

- Transmissible Gastroenteritis Virus of Swine (TGEV-Coronavirus); strain: Toyama 36 [used in test as the model virus for SARS-CoV]
  (Origin: Virusbank of the Friedrich Löffler-Institute, Insel Riems, Germany)
- ST75/2 cells (foetal testis cells of swine)
  (Origin: Robert Koch-Institute, Berlin, Germany)

Test procedure:

- The test was performed following ISO 21702:2019
- Test principle: quantitative virucidal carrier test at T = 25 °C and 90 % r.LF (climate chamber)
- the test was performed w/o (additional) protein load

Tab. 1: Product samples tested

No.	Product (s)	Storage conditions [1]
#1	Test item / uncoated or coated w/o the active component(s) (control sample)	at RT
#2	Test item / coated with the active component(s) *airDefender Sol* (test sample)	at RT

[1] = *access limited to the personnel of Eurovir*

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Test results:

Observations:

- The test surfaces were largely wettable by the aqueous virus suspension; thus, a more or less uniform liquid film could be produced by using glass spatulas.
- The virus film applied on the test items was stable over the entire observation period. This means that the virus film remained in the liquid state even at the end of the longest exposure time (24 h) and was not dried.

Tab. 2.1: Virus control *(Virus titration by limiting dilution)*

Sample	VK-1a	VK-1b	VK-2a	VK-2b	VK-3a	VK-3b
	Virus control / 1 h		Virus control / 8 h		Virus control / 24 h	
Titer/Test vol. ($lg\ ID_{50}$)	5,4	5,25	3,9	3,75	1,65	1,05
av. virus titer ± K (95%) [1]	**6,33 ± 0,29 / 1 mL**		**4,83 ± 0,26 / 1 mL**		**2,35 ± 0,27 / 1 mL**	

[1] = Calculation of the virus titer and its 95% confidence interval according to EN14476

Tab. 2.2: Virus inactivation *(Virus titration by limiting dilution)*

Sample	In-1a	In-1b	In-2a	In-2b	In-3a	In-3b
	Inactivation / 1 h		Inactivation / 8 h		Inactivation / 24 h	
Titer/Test vol. ($lg\ ID_{50}$)	4,8	4,95	3,15	3	≤ 0,30	≤ 0,30
av. virus titer ± K (95%) [1]	5,88 ± 0,27 / mL		4,08 ± 0,27 / mL		≤ 1,30 / mL	
Reduction [2] ($lg\ ID_{50}$ ± K [95%])	**0,45 ± 0,40**		**0,75 ± 0,38**		**≥ 1,05 ± 0,27**	

[1] = Calculation of the virus titer and its 95% confidence interval according to EN14476
[2] = Virus reduction: lg ID_{50} of virus input (virus control) minus lg ID_{50} of sample (at the given time point)

Virus inactivation: *(cf. Tab. 2)*

- The test surfaces were largely wettable by the aqueous virus suspension resulting in a more or less uniform liquid film when the virus material was distributed onto the test items. Without covering the virus material with a LDPE foil the amount of infectious virus was reduced by approximately 1,5 Log after 8 h and by approx. 4 Log after 24 h.
- In order to assess the virus inactivating capacity of the coating under test as a single factor an individual virus input control was analysed at each time point tested. With the amount of input virus at a given time point (cf. tab. 2.1) and with the correspondent amount of remaining test virus (cf. tab. 2.2) the virus reduction factor can be determined.
- After the incubation time was due and under the test conditions specified above the virus reduction factor associated with the antimicrobial coating amounted to RF = 0,45 ± 0,40 after 1 h, to RF = 0,75 ± 0,38 after 8 h and to RF ≥ 1,05 ± 0,27 after 24 h (cf. Tab. 2.2). It should be noted that after 24 h no residual test virus was detectable.

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Conclusions:

- When the virus material was distributed onto the test items a more or less uniform liquid film could be established. This behavior has made it unneccessarily to use a LDPE-foil as it is recommended by ISO 21702 in the case that the test surface is associated with a certain hydrophobicity. By the non-coverage of the test items the conditions of reality has been better respected with the present testing.
- The virus film applied on the test items was stable over the entire observation period. This means that the virus film remained in the liquid state even at the end of the longest exposure time (24 h) and was not dried. Thus, a continuous contact between the virus material and the surface of the test carrier was ensured all over the observation period and a distribution of the virus material in the liquid phase driven by diffusion was given.
- With the present testing only a low level virus inactivating activity of the product under test was demonstrated with the TGEV-Coronavirus (as the model virus for the SARS-CoV). After 8 h of contact the corresponding virus reduction factor was determined to below 1 Log.
- After 24 h the virus reduction amounted to RF $\geq$ 1,05. A precise virus reduction factor could not be determined for this time point because no residual test virus was detectable and, therefore, no concrete virus titer could be specified.

Luckenwalde, 8th of April 2020

Dr. Ch. Jursch
(GF und Laborleiter Eurovir)

- Cover sheet / Short test report -

This summary report is based on the test:

- Examination of the virucidal activity of the disinfectant products *airDefender* against the *Transmissible Gastroenteritis Virus of Swine (TGEV; strain: Toyama 36)* using the suspension test method following EN 14476:2019 - Screening test S4 at a temperature of T = 20 °C from 24.06.2020

The present summary report consists of the following parts:

1. Cover sheet [1 page]..... ☒
2. Summary of the test protocol(s) [2 pages]..... ☒

Co-applicable documents:

1. DIN EN 14476:2019
2. Finalised test protocol of the screening test S4 dated 14.07.2020

This summary report has been finalised and released:

Date/Signature: 08.08.2020 _____

Dr. Ch. Jursch, Laboratory Manager

Information about the testing

Product(s): airDefender
Test system: TGEV *(Toyama 36)* + ST75/2 cells
Test run: S4 / TGEV-Coronavirus
Test date: 24.06.2020
Analysis: 01.07.2020 *(7 p.i.)*

Test methodology and test parameters

Test method: Screening test using the methodology of the EN 14476 (quantitative virucidal suspensions test)
Test mixture: 1 VT protein load + 1 VT virus suspension + 8 VT neat product
Protein load: „clean conditions" *(low protein load)*
Test parameter: T = 20 °C / t = 60 min.

Tested product sample(s)

1st product: *airDefender* *[Product sample tested as received; Arrival: 29.04.2020; Storage at RT; the product under test was introduced into the experimental test with a preliminary product designation]*

Tab. 1: Weight of content

Set	Product (s)	Product conc.	Product conc. in test	Dosage	pH [1] of Working Sol.
#1	*airDefender*	undiluted *(neat product)*	80%	n.a.	*not reliably measurable*

[1] = pH was constantly drifting. The composition of the product under test was not communicated but this effect is typical for e.g. quarternary ammonium compounds which covers the pores of the electrode.

Test system:

- Transmissible Gastroenteritis Virus of Swine (TGEV); strain: Toyama 36
  (Origin: Virusbank der BFA f. Viruskrankheiten der Tiere; Friedrich Löffler-Institut, Insel Riems, Germany)
- ST75/2 cells (foetal testis cells of swine)
  (Origin: Robert Koch-Institute, Berlin, Germany)

Test results

1. Annotations:

- No changes were made to the test plan
- No abnormalities were observed.

2. Virus titration:

Tab. 2.1: Virus control *(Virus titration: by limiting dilution)*

Samples	VK-1a	VK-1b	Ø
	Virus control		
Titer/test vol. ($lg\ ID_{50}$) [1]	5,43 ± 0,35	5,43 ± 0,35	**5,43**
Average ± CI (95%) [1]	**6,43 ± 0,25 / mL**		

[1] = calculation of virus titer and its 95% confidential interval was performed according to EN 14476:2019

Tab. 2.2: Cytotoxicity control *(Virus titration: by limiting dilution)*

Samples	Tox Test	T-1
	data of cytotoxicity test *(T1; 18.06.2020)*	Cytotoxicity *(actual test run)*
Titer/test vol. ($lg\ ID_{50}$) [1]	3,45 / mL	2,75 / mL

[1] = calculation of virus titer and its 95% confidential interval was performed according to EN 14476:2019.

***Tab. 2.3*: Virus inactivation** (Virus titration: by limiting dilution)*

Samples	In-1a	In-1b	ø
Parameter	Inactivation		
Titer/Test vol. (lg ID_{50})	≤ 1,75	≤ 1,75	**≤ 1,75**
Average ± K (95%) [1]	≤ 2,75/mL		
Reduction [2] (lg ID_{50} ± CI [95%])	**≥ 3,68 ± 0,25**		

[1] = virus titer and its 95% confidential interval were calculated according to EN 14476:2019
[2] = virus reduction = titer of virus control (lg ID_{50}) minus titer of sample (lg ID_{50})

***Tab. 2.4*: Virus inactivation** (Virus titration: by Large Volume Plating [LVP])*

Samples	In-1
	Inactivation
Dilution factor (VF)	1.000
Sample vol. analysed	10 µL + 10 µL = 20 µL
Cell cultures inoculated	96
Virus positive cells	0
Virus input [mL]	6,43 ± 0,25
Titer/test vol. (lg ID_{50})	≤ 2,33 / mL
Reduction [2] (lg ID_{50} ± CI [95%])	**≥ 4,10 ± 0,25**

[1] = virus titer and its 95% confidential interval were calculated according to EN 14476:2019
[2] = virus reduction = titer of virus control (lg ID_{50}) minus titer of sample (lg ID_{50})

Conclusions:

- When the product ***airDefender*** (neat product) was introduced into test under „clean conditions" no residual test virus was detected above the cytotoxicity level (lg TD_{50} = 2,75/mL; cf. Tab. 2.3).
- Using the LVP-titration method also no residual virus was detected with the 1.000-fold diluted test sample. With the Poisson-formula applied the (virtual) virus titer amounted to lg ID_{50} ≤ 2,33/mL, corresponding to a virus reduction of RF ≥ 4,10 ± 0,25 (cf. Tab. 2.4).
- With the present screening test the TGEV-Coronavirus (cf. Test system) was used as the test virus. This virus is a member of the virus family *coronaviridae* to which SARS-CoV and SARS-CoV-2 also belong. Based on the data as obtained a basic virucidal activity against the coronaviruses was demonstrated.
- With respect to product validation a complete validation test according to EN 14476 vs. coronavirus (virus claim: specifically virucidal active against coronaviruses) can be striven.
- In my opinion, however, a complete validation test according to EN 14476 vs. Vacciniavirus is more advantageous. With a successful testing vs. Vacciniavirus a virucidal activity against all enveloped virus can be claimed. This virucidal claim includes (for example) HIV, HBV, HCV, the influenza viruses, the corona viruses [incl. SARS-CoV-2] and others.

- Cover sheet / Short test report -

This summary report is based on the test:

- Examination of the virucidal activity of the disinfectant product *airDefender* against *Vacciniavirus (Elstree)* using the suspension test method following EN 14476:2019 - Screening test S4 at a temperature of T = 20 °C from 24.06.2020

The present summary report consists of the following parts:

1. Cover sheet [1 page]. . . . . ☒
2. Summary of the test protocol(s) [2 pages]. . . . . ☒

Co-applicable documents:

1. DIN EN 14476:2019
2. Finalised test protocol of the screening test S4 dated 14.07.2020

This summary report has been finalised and released:

Date/Signature: 07.08.2020 _____

Dr. Ch. Jursch, Laboratory Manager

Information about the testing

		Test run:	S4 / Vacciniavirus
Product(s):	airDefender	*Test date:*	24.06.2020
Test system:	Vacciniavirus *(Elstree)* + Vero-76 cells	*Analysis:*	08.07.2020 *(14 p.i.)*

Test methodology and test parameters

Test method: Screening test using the methodology of the EN 14476 (quantitative virucidal suspensions test)
Test mixture: 1 VT protein load + 1 VT virus suspension + 8 VT neat product
Protein load: „clean conditions“ *(low protein load)*
Test parameter: T = 20 °C / t = 60 min.

Tested product sample(s)

1st product: *airDefender* *[Product sample tested as received; Arrival: 29.04.2020; Storage at RT; the product under test was introduced into the experimental test with a preliminary product designation]*

Tab. 1: Weight of content

Set	Product (s)	Product conc.	Product conc. in test	Dosage	pH [1] of Working Sol.
#1	*airDefender*	undiluted *(neat product)*	80%	n.a.	*not reliably measurable*

[1] = pH was constantly drifting. The composition of the product under test was not communicated but this effect is typical for e.g. quarternary ammonium compounds which covers the pores of the electrode.

Test system:

- Vacciniavirus (strain: Elstree)
  (Origin: Institute of virology and antiviral therapy of the University of Jena, Germany)
- Vero-76 cells
  (Origin: Institute of virology and antiviral therapy of the University of Jena, Germany)

Test results

1. Annotations:

- No changes were made to the test plan
- No abnormalities were observed.

2. Virus titration:

Tab. 2.1: Virus control *(Virus titration: by limiting dilution)*

Samples	VK-1a	VK-1b	Ø
	Virus control		
Titer/test vol. ($lg\ ID_{50}$) [1]	5,95 ± 0,49	5,95 ± 0,57	**5,95**
Average ± CI (95%) [1]	**6,95 ± 0,39 / mL**		

[1] = calculation of virus titer and its 95% confidential interval was performed according to EN 14476:2019

Tab. 2.2: Cytotoxicity control *(Virus titration: by limiting dilution)*

Samples	Tox Test	T-1
	data of cytotoxicity test *(T1; 18.06.2020)*	Cytotoxicity *(actual test run)*
Titer/test vol. ($lg\ ID_{50}$) [1]	3,45 / mL	3,45 / mL

[1] = calculation of virus titer and its 95% confidential interval was performed according to EN 14476:2019.

***Tab. 2.3*: Virus inactivation** (Virus titration: by limiting dilution)*

Samples	In-1a	In-1b	Ø
	Inactivation: neat / 60 min. / CC		
Titer/test vol. (lg ID_{50})	≤ 2,45	≤ 2,45	**≤ 2,45**
Average ± CI (95%) [1]	≤ 3,45 / mL		
Reduction [2] (lg ID_{50} ± CI [95%])	**≥ 3,50 ± 0,39**		

[1] = virus titer and its 95% confidental interval were calculated according to EN 14476:2019
[2] = virus reduction = titer of virus control (lg ID_{50}) minus titer of sample (lg ID_{50})

***Tab. 2.4*: Virus inactivation** (Virus titration: by Large Volume Plating [LVP])*

Samples	In-1
	Inactivation: neat / 60 min. / CC
Dilution factor (VF)	1.000
Sample vol. analysed	10 µL + 10 µL = 20 µL
Cell cultures inoculated	96
Virus positive cells	0
Virus input [mL]	6,95 ± 0,39
Titer/test vol. (lg ID_{50})	≤ 2,33 / mL
Reduction [2] (lg ID_{50} ± CI [95%])	**≥ 4,62 ± 0,39**

[1] = virus titer and its 95% confidential interval were calculated according to EN 14476:2019
[2] = virus reduction = titer of virus control (lg ID_{50}) minus titer of sample (lg ID_{50})

Conclusions:

- When the product ***airDefender*** (neat product) was introduced into test under „clean conditions“ no residual test virus was detected above the cytotoxicity level (lg TD_{50} = 3,45/mL; cf. Tab. 2.3).
- Using the LVP-titration method also no residual virus was detected with the 1.000-fold diluted test sample. With the Poisson-formula applied the (virtual) virus titer amounted to lg ID_{50} ≤ 2,33/mL, corresponding to a virus reduction of RF ≥ 4,62 ± 0,34 (cf. Tab. 2.4).
- Based on the present data as obtained in the corresponding screening test and to my opinion a complete validation test according to EN 14476 vs. Vacciniavirus (virucidal claim: "virucidal active against enveloped viruses") can be striven with the tested product. With this virucidal claim a virucidal activity against all enveloped virus is assumed (e.g. HIV, HBV, HCV, the influenza viruses, the corona viruses [incl. SARS-CoV-2] and others).
- From the data obtained it cannot be concluded whether or not a virucidal activity against the non-enveloped viruses is also given (virus claim: "limited virucidal PLUS" or "virucidal").

NQEC

Nissenken Quality Evaluation Center

2-16-11, KURAMAE,TAITO-KU, TOKYO, JAPAN
TELEPHONE : (03) 5809 - 1360

CERTIFICATE NUMBER : DTK20-00415-1 (1/2)
REQUEST DATE : April 30, 2020
ISSUE DATE : May 18, 2020

REQUESTER : airDefender

CERTIFICATE OF TESTING

Regarding the material submitted by the client described above, we hereby certify that our test results were as follows:

SAMPLES : (1) Metamaterial Coated Glass Sample

TESTING ITEM : Testing of antiviral activity
TESTING METHOD : ISO21702:2019 Measurement of antiviral activity on plastics and other non-porous surfaces
Measurement method : Plaque assay

TESTING VIRUS : 1 . *Influenza A virus* ; A/PR/8/34 (H1N1) ATCC VR-1469

Nissenken Quality Evaluation Center
TOKYO Laboratory

Test is according to submitted samples

SIGNATURE
CHIEF OF LABORATORY

SIGNATURE
PERSON IN CHARGE

TEST RESULT

CERTIFICATE NUMBER : DTK20-00415-1 (2/2)

REQUESTER : airDefender

ISSUE DATE : May 18, 2020

Measurment Result

【Virus suspension】

Virus	*Influenza A virus* ; A/PR/8/34 (H1N1) ATCC VR-1469
Infectivity titre (PFU/mL)	2.10×10^{7}

【Final test】

control specimen

Virus	Specimen		Common logarithm	
1	Control	immediately after inoculation	U_0	5.64
		after 1h contact	Ut	5.64
		after 24h contact	Ut	5.10

control specimen: Polyethylene film

test specimen

Virus	Specimen		Common logarithm		Antiviral activity value R = Ut - At
1	(1)	after 1h contact	At	5.06	0.6
		after 24h contact	At	0.80	4.3

* Transcribed from DTK19-07040 (Issued on April 21th, 2019)

Nissenken Quality Evaluation Center
TOKYO Laboratory

Test Report

Report No: ASH19-000911-01 **Issue Date: Jan 15 2019**

Client name:	TitanPE Technologies,Inc.
Client address:	
Sample name:	AG420
Sample Batch No.:	08S43S-ET
Product Date:	/
Manufacturer:	TitanPE Technologies,Inc.

Above information and sample(s) was/were submitted and certified by the client, SGS quoted the information with no responsibility as to the accuracy, adequacy and/or completeness.

SGS Sample No.:	ASH19-000911.001
Date of sample received:	Jan 07 2019
Testing period:	Jan 07 2019 ~ Jan 15 2019

TEST(S) REQUESTED:
Selected test(s) as requested by applicant:
Antibacterial Assessment for the submitted sample

TEST METHOD(S):
Please refer to the next page(s)
TEST RESULT(S):
Please refer to the next page(s)
CONCLUSION(S):

Name of test bacteria (Strain number)	Antibacterial value:A	Efficacy of antibacterial property	Comment
CMCC (B) (32213)	>6.2	Antibacterial value 2≤A<3, the efficacy of antibacterial property of the test fabric can be considered significant; Antibacterial activity A≥3, the efficacy of antibacterial property of the test fabric can be considered strong	Pass, the efficacy of antibacterial property of the test fabric can be considered strong

SGS Authorized Signature

SGS-CSTC Standards Technical Services (Shanghai) Co.,Ltd.

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SGS

Test Report

Report No: ASH19-000911-01 **Issue Date: Jan 15 2019**

TEST METHOD:
ISO 20743:2013 Textiles-Determination of antibacterial activity of textile products: 8.1 Absorption method

TEST ORGANISMS:
CMCC (B) 32213

TEST RESULT(S):

Name of test bacteria (Strain number)	*CMCC (B)* (32213)	
Concentration of inoculum (CFU/mL)	$1.2x10^5$	
Difference of extremes for the three control specimens(lg) (condition: less than 1)	0h	24h
	<0.1	<0.1
Difference of extremes for the three antibacterial testing specimens(lg) (condition: less than 2)	0h	24h
	<0.1	<0.1
The growth value on the control sample F ($F=lgC_t-lgC_0$)	+3.2 (lgC_t + 7.5 , lgC_0 +4.3)	
The growth value on the antimicrobial-treated sample G ($G=lgT_t-lgT_0$)*	< -3.0 (lgT_t <+ 1.3 , lgT_0 +4.3)	
Antibacterial activity value (A=F-G)	>6.2	
Measuring method	Plate count method	
Sterilization method	Autoclave	
Incubation time	24h	

REMARK: The control sample is 100% cotton fabric, provided by SGS lab.
* In case of $C_0 > T_0$, substitute C_0 for T_0.

SAMPLE DESCRIPTION:

*** End ***

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SGS

Test Report

Report No: ASH19-000911-02 Issue Date: Jan 16 2019

TEST METHOD:
ISO 20743:2013 Textiles-Determination of antibacterial activity of textile products: 8.1 Absorption method

TEST ORGANISMS:
CMCC (B) 32213

TEST RESULT(S):

Name of test bacteria (Strain number)	*Alpha Hemolytic Streptococcus (CMCC 32213)*	
Concentration of inoculum (CFU/mL)	1.2×10^5	
Difference of extremes for the three control specimens(lg) (condition: less than 1)	0h	24h
	<0.1	<0.1
Difference of extremes for the three antibacterial testing specimens(lg) (condition: less than 2)	0h	24h
	<0.1	<0.1
The growth value on the control sample F ($F=lgC_t-lgC_0$)	+3.2 (lgC_t + 7.5 , lgC_0 +4.3)	
The growth value on the antimicrobial-treated sample G ($G=lgT_t-lgT_0$)*	< -3.0 (lgT_t <+ 1.3 , lgT_0 +4.3)	
Antibacterial activity value (A=F-G)	>6.2	
Measuring method	Plate count method	
Sterilization method	Autoclave	
Incubation time	24h	

REMARK: The control sample is 100% cotton fabric, provided by SGS lab.
* In case of $C_0 > T_0$, substitute C_0 for T_0.

SAMPLE DESCRIPTION:

*** End ***

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Test Report **No: SHFDO120810413FD** **Date: Sep 18 2012**

Client name: Titanpe Technologies. Inc
Client address: .

The following sample(s) was/were submitted by/ on behalf of the client as (except SGS reference No. & SGS job No. & Date of receipt & Testing period):

Sample name: Sample
Batch No./Date: /
Manufacturer: /
SGS job No.: SHFDO120810413FD
Date of receipt: Aug 02 2012
Testing period: Aug 02 2012 ~ Sep 18 2012

TEST(S) REQUESTED:
Selected test(s) as requested by applicant:
Antibacterial Assessment for the submitted sample

TEST METHOD:
JIS L 1902:2008 The Method of antibacterial test and assessment of antibacterial effectiveness for textiles, Chapter 10: Quantitative test (Absorption method)

TEST RESULT(S):
Please refer to next page

CONCLUSION:
Pass: The Log value of bacteriostatic for * *Legionella pneumophila* is > 5.2, comply with JIS L 1902:2008 Specification for antibacterial finish (The bacteriostatic activity value shall be ≥ 2.0 for antibacterial finish).
*According to client's requirement, judge with reference to JIS L 1902:2008

Signed for and on behalf of SGS

SGS-CSTC CONSUMER TESTING SERVICES SGS FOOD SHANGHAI

Authorized Signature

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Member of the SGS Group (SGS SA)

Test Report **No: SHFDO120810413FD** **Date: Sep 18 2012**

TEST ORGANISMS:
Legionella pneumophila ATCC33152

TEST RESULT(S):

Name of test bacteria (Strain number)	*Legionella pneumophila* (ATCC33152)
Concentration of inoculum (CFU/mL)	2.3×10^5
The growth value on the control sample F ($F=M_b-M_a$)	+2.1 (M_b:+ 6.5 , M_a:+4.4)
The growth value on the antimicrobial-treated sample (M_c-M_d)	< -3.1 (M_c: < +1.3 , M_d:+4.4)
Bacteriostatic activity value $S= (M_b-M_a)- (M_c-M_d)$	> 5.2
Bactericidal activity value $L= M_a-M_c$	> 3.1
Incubation time（h）	18
Measuring method	Plate count method

REMARK:
M_a: The average of log value of bacteria obtained from the three control sample that inoculated the test germ after 0h.
M_b: The average of log value of bacteria obtained from the three control sample that inoculated the test germ after 18h.
M_c: The average of log value of bacteria obtained from the three antibacterial finishes that inoculated the test germ after 18h.
M_d: The average of log value of bacteria obtained from the three antibacterial finishes that inoculated the test germ after 0h
CFU: Colony forming unit

The control sample is standard cotton cloth specified by JISL 1902:2008, provided by SGS lab.

SAMPLE DESCRIPTION: White cloth

*** End of Report***

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Test Report **Report No: ASH14-025972-01** **Date: Sep 02 2014**

Client name:	TITANPE TECHNOLOGIES,INC.
Client address:	
Sample name:	AG425K Coated Sample
Sample Batch No.:	/
Product Date:	/
Manufacturer:	TITANPE TECHNOLOGIES,INC.

Above information and sample(s) was/were submitted and certified by the client, SGS quoted the information with no responsibility as to the accuracy, adequacy and/or completeness.

SGS Sample No.:	ASH14-025972.001
Date of sample received:	Aug 22 2014
Testing period:	Aug 22 2014 ~ Sep 02 2014

TEST(S) REQUESTED:
Selected test(s) as requested by applicant
Antibacterial Assessment for the submitted sample

TEST METHOD:
JIS L 1902:2008 The Method of antibacterial test and assessment of antibacterial effectiveness for textiles, Chapter 10: Quantitative test (Absorption method)

TEST RESULT(S):
Please refer to the next page(s)

CONCLUSION:
Pass: The Log value of bacteriostatic for *Listeria monocytogenes* is 3.8, complies with JIS L 1902:2008 Specification for antibacterial finish (The bacteriostatic activity value shall be ≥ 2.0 for antibacterial finish). (According to client's requirement, judge with reference to JIS L 1902:2008)

SGS-CSTC CONSUMER TESTING SERVICES SGS SHANGHAI

lily zhao

SGS Authorized Signature

SGS-CSTC Standards Technical Services (Shanghai) Co.,Ltd. Testing Center
Page 1 of 2 RAND: **3521216**

Test Report **Report No: ASH14-025972-01** **Date: Sep 02 2014**

TEST ORGANISMS:
Listeria monocytogenes 54001

TEST RESULT(S):

Name of test bacteria (Strain number)	*Listeria monocytogenes* (54001)
Concentration of inoculum (CFU/mL)	$2.7x10^5$
The growth value on the control sample F ($F=M_b-M_a$)	+2.2 (M_b:+ 6.7 , M_a:+4.5)
The growth value on the antimicrobial-treated sample (M_c- M_d)	-1.6 (M_c:+ 2.9 , M_d:+4.5)
Bacteriostatic activity value $S= (M_b-M_a)- (M_c-M_d)$	3.8
Bactericidal activity value $L= M_d-M_c$	1.6
Incubation time（h）	18
Measuring method	Plate count method

REMARK:
M_a: The average of log value of bacteria obtained from the three control samples that inoculated the test germ after 0h.
M_b: The average of log value of bacteria obtained from the three control samples that inoculated the test germ after 18h.
M_c: The average of log value of bacteria obtained from the three antibacterial finishes that inoculated the test germ after 18h.
M_d: The average of log value of bacteria obtained from the three antibacterial finishes that inoculated the test germ after 0h

The control sample is standard cotton cloth specified by JISL 1902:2008, provided by SGS lab.

SAMPLE DESCRIPTION: 1 bag, ca.50g/bag, sample in bag

*** End of Report***

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Member of the SGS Group (SGS SA)

Test Report **No: SHFDO100912172FD1** **Date: Sep 21 2010**

Client name: TitanPE Technologies, Inc.
Client address: .

The following sample(s) was/were submitted by/ on behalf of the client as:

Sample name: Photocatalytic Textile
Batch No.: A1663
Manufacturer: TitanPE Technologies, Inc.
SGS Reference No.: GZFDO100903654FD.2
SGS Job no.: SHFDO100912172FD
Date of receipt: Sep 01 2010
Testing period: Sep 10 2010 ~ Sep 21 2010

TEST(S) REQUESTED:
Selected test(s) as requested by applicant:
Antibacterial Assessment for the submitted sample

TEST METHOD:
JIS L 1902:2008 The Method of antibacterial test and assessment of antibacterial effectiveness for textiles , Chapter 10: Quantitative test (Absorption method)

TEST ORGANISMS:
Methicillin Resistant Staphylococcus aureus ATCC 33591

CONCLUSION:
Pass: The Log value of bacteriostatic for *Methicillin Resistant Staphylococcus aureus* is > 2.7, complies with JIS L 1902:2008 Specification for antibacterial finish (The bacteriostatic activity value shall be ⩾2.0 for antibacterial finish) .

Signed for and on behalf of SGS

Amy Gan
Authorized Signature

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Member of the SGS Group (SGS SA)

Test Report **No: SHFDO100912172FD1** **Date: Sep 21 2010**

TEST RESULT(S):

Name of test bacteria (Strain number)	*Methicillin Resistant Staphylococcus aureus* (ATCC 33591)
Concentration of inoculum (CFU/mL)	1.1×10^5
The growth value on the control sample F ($F=M_b-M_a$)	+ 2.1 (M_b:+ 6.4 , M_a:+ 4.3)
The growth value on the antimicrobial-treated sample (M_c- M_d)	- 0.6 (M_c:+ 3.4 , M_d:+ 4.0)
Bacteriostatic activity value $S= (M_b-M_a)- (M_c-M_d)$	2.7
Bactericidal activity value $L= M_a-M_c$	0.9
Incubation time（h）	18
Measuring method	Plate count method

REMARK:

M_a: The average of log value of bacteria obtained from the three control sample that inoculated the test germ after 0h.

M_b: The average of log value of bacteria obtained from the three control sample that inoculated the test germ after 18h.

M_c: The average of log value of bacteria obtained from the three antibacterial finishes that inoculated the test germ after 18h.

M_d: The average of log value of bacteria obtained from the three antibacterial finishes that inoculated the test germ after 0h

The control sample is standard cotton cloth specified by JISL 1902:2008, provided by SGS lab.

SAMPLE DESCRIPTION: White cloth

*** End of Report***

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Test Report

Report No: ASH17-024697-02 **Date: Jun 29 2017**

Client name:	TitanPE Technologies, Inc.
Client address:	
Sample name:	Coating Suisse AGSOL5000
Sample Batch No.:	R0613
Product Date:	/
Manufacturer:	TitanPE Technologies, Inc.

Above information and sample(s) was/were submitted and certified by the client, SGS quoted the information with no responsibility as to the accuracy, adequacy and/or completeness.

SGS Sample No.:	ASH17-024697.001
Date of sample received:	Jun 13 2017
Testing period:	Jun 13 2017 ~ Jun 29 2017

TEST(S) REQUESTED:
Selected test(s) as requested by applicant:
Antifungal activity test

TEST METHOD(S)/TEST RESULT(S):
Please refer to the next page(s)

CONCLUSION(S):

Test Fungal (Strain number)	Antifungal activity value A	Criterion of antifungal efficacy
Aspergillus niger ATCC 6275	>4.7	Fungistatic with full effect

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested, and for clients internal use only, not to the society has the proof function. This document cannot be used for publicity, without prior written approval of the SGS.

SGS Authorized Signature

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Test Report

Report No: ASH17-024697-02 **Date: Jun 29 2017**

TEST METHOD(S):
ISO 13629-2:2014 Textiles-Determination of antifungal activity of textile products-Part 2: Plate count method

TEST ORGANISM(S):
Aspergillus niger ATCC 6275

TEST RESULT(S):

Test Fungal (Strain number)	*Aspergillus niger ATCC 6275*
Concentration of spore suspension	$2.3x10^5$
The growth value on the control fabric ($F=lgC_t-lgC_0$)	+1.5 (lgC_t + 6.1 , lgC_0+4.6)
The growth value on the antifungal-treated samples ($G=lgT_t-lgT_0$)	< -3.2 (lgT_t <+ 1.3 , lgT_0 <+ 4.5)
The antifungal activity value (A=F-G)	>4.7
Inoculation method	Absorption method
Sterilization method	Autoclave(121℃, 20min)

Remark:
Control fabtic:100% cotton fabric without fluorescent brighteners or other finish ,provided by SGS lab.
C_t is the arithmetic average of the number of fungi obtained from three test samples of control fabric after (48±2)h incubation
C_0 is the arithmetic average of the number of fungi obtained from three test samples of control fabric immediately after inoculation.
T_t is the arithmetic average of the number of fungi obtained from three antifungal-treated test samples after (48±2)h incubation
T_0 is the arithmetic average number of the number of fungi obtained from three antifungal-treated test samples immediately after inoculation.
F: is the growth value on the control fabric
G: is the growth value on the antifungal-treated samples
A: is the antifungal activity value

Example of efficacy of antifungal property

Item	A value	Explanation
Criterion of antifungal efficacy by antifungal activity value A in Formula	A<1	No effect
	2>A>1	Fungistatic with small effect
	3>A>2	Fungistatic with medium effect
	A>3	Fungistatic with full effect
	Tt=0	Fungicidal effect

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Test Report Report No: ASH17-024697-02 Date: Jun 29 2017

SAMPLE DESCRIPTION: sample in bag

*** End ***

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SGS CNAS 中国认可 检测 TESTING CNAS L0599

Test Report

Report No: ASH18-048042-01 Issue Date: Oct 16 2018

Client name: TitanPE Technologies,Inc.
Client address:
Sample name: AG425K
Sample Batch No.: ET001
Product Date: /
Manufacturer: TitanPE Technologies,Inc.

Above information and sample(s) was/were submitted and certified by the client, SGS quoted the information with no responsibility as to the accuracy, adequacy and/or completeness.

SGS Sample No.: ASH18-048042.001
Date of sample received: Sep 25 2018
Testing period: Sep 25 2018 ~ Oct 16 2018

TEST(S) REQUESTED:
Selected test(s) as requested by applicant:
Antibacterial Assessment for the submitted sample

TEST METHOD(S)/ TEST RESULT(S):
Please refer to the next page(s)

CONCLUSION(S):

Name of test bacteria (Strain number)	Antibacterial value:A	Efficacy of antibacterial property	Comment
Klebsiella pneumoniae (ATCC 4352)	>6.3	Antibacterial value 2≤A<3, the efficacy of antibacterial property of the test fabric can be considered significant; Antibacterial activity A≥3, the efficacy of antibacterial property of the test fabric can be considered strong	Pass, the efficacy of antibacterial property of the test fabric can be considered strong

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SGS

Test Report

Report No: ASH18-048042-01 Issue Date: Oct 16 2018

TEST METHOD:
ISO 20743:2013 Textiles-Determination of antibacterial activity of textile products: 8.1 Absorption method

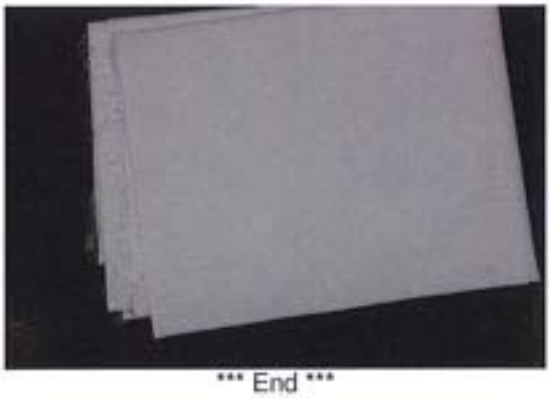
TEST ORGANISMS:
Klebsiella pneumoniae ATCC 4352

TEST RESULT(S):

Name of test bacteria (Strain number)	*Klebsiella pneumoniae* (ATCC 4352)	
Concentration of inoculum (CFU/mL)	2.9×10^5	
Difference of extremes for the three control specimens(lg) (condition: less than 1)	0h	24h
	<0.1	<0.1
Difference of extremes for the three antibacterial testing specimens(lg) (condition: less than 2)	0h	24h
	<0.1	<0.1
The growth value on the control sample F ($F=lgC_t-lgC_0$)	3.0 (lgC_t +7.7 , lgC_0 +4.7)	
The growth value on the antimicrobial-treated sample G ($G=lgT_t-lgT_0$)*	< -3.2 (lgT_t :<+ 1.3 , lgT_0 +4.5)	
Antibacterial activity value (A=F-G)	>6.3	
Measuring method	Plate count method	
Sterilization method	Autoclave	
Incubation time	24h	

REMARK: The control sample is 100% cotton fabric, provided by SGS lab.
* In case of $C_0 > T_0$, substitute C_0 for T_0.

SAMPLE DESCRIPTION:



*** End ***

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Test Report

Report No: ASH15-026060-01 Date: Jul 30 2015

Client name:	TitanPE Technologies,Inc.
Client address:	
Sample name:	AG-Series
Sample Batch No.:	/
Product Date:	/
Manufacturer:	TiPE

Above information and sample(s) was/were submitted and certified by the client, SGS quoted the information with no responsibility as to the accuracy, adequacy and/or completeness.

SGS Sample No.:	ASH15-026060.001
Date of sample received:	Jul 21 2015
Testing period:	Jul 21 2015 ~ Jul 30 2015

TEST(S) REQUESTED:
Selected test(s) as requested by applicant:
Antibacterial Assessment for the submitted sample

TEST METHOD(S):
Please refer to the next page(s)

TEST RESULT(S):
Please refer to the next page(s)

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested. This document cannot be used for publicity, without prior written approval of the SGS.

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Test Report

Report No: ASH15-026060-01 **Date: Jul 30 2015**

TEST METHOD:
ISO 20743:2013 Textiles-Determination of antibacterial activity of textile products: 8.1 Absorption method

TEST ORGANISMS:
Salmonella typhimurium AS 1.1194

TEST RESULT(S):

Name of test bacteria (Strain number)	*Salmonella typhimurium* (AS 1.1194)	
Concentration of inoculum (CFU/mL)	1.3×10^5	
Difference of extremes for the three control specimens(lg) (condition: less than 1)	0h	24h
	< 0.1	< 0.1
Difference of extremes for the three antibacterial testing specimens(lg) (condition: less than 2)	0h	24h
	< 0.1	< 0.1
The growth value on the control sample F ($F=lgC_t-lgC_0$)	+2.9 (lgC_t +7.1 , lgC_0 +4.2)	
The growth value on the antimicrobial-treated sample G ($G=lgT_t-lgT_0$)*	<-2.9 (lgT_t :<+1.3 , lgT_0 :<+2.3)	
Antibacterial activity value (A=F-G)	> 5.8	
Measuring method	Plate count method	
Sterilization method	Autoclave(121℃,15min)	
Incubation time	24h	

REMARK: The control sample is 100% cotton fabric, provided by SGS lab.
* In case of $C_0 > T_0$, substitute C_0 for T_0.

SAMPLE DESCRIPTION: Beige fabric

*** End ***

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Test Report

Report No: ASH19-000911-02 **Issue Date: Jan 16 2019**

Client name:	TitanPE Technologies,Inc.
Client address:	
Sample name:	AG420
Sample Batch No.:	08S43S-ET
Product Date:	/
Manufacturer:	TitanPE Technologies,Inc.

Above information and sample(s) was/were submitted and certified by the client, SGS quoted the information with no responsibility as to the accuracy, adequacy and/or completeness.

SGS Sample No.:	ASH19-000911.001
Date of sample received:	Jan 07 2019
Testing period:	Jan 07 2019 ~ Jan 15 2019

TEST(S) REQUESTED:
Selected test(s) as requested by applicant:
Antibacterial Assessment for the submitted sample

TEST METHOD(S):
Please refer to the next page(s)

TEST RESULT(S):
Please refer to the next page(s)

This Test Report supersedes the Test Report No. ASH19-000911-01 dated Jan 16 2019 issued by SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. Original test report will be invalid from today.

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SGS

Test Report

Report No: ASH19-000911-02 Issue Date: Jan 16 2019

CONCLUSION(S):

Name of test bacteria (Strain number)	Antibacterial value:A	Efficacy of antibacterial property	Comment
Alpha Hemolytic Streptococcus (CMCC 32213)	>6.2	Antibacterial value 2≤A<3, the efficacy of antibacterial property of the test fabric can be considered significant; Antibacterial activity A≥3, the efficacy of antibacterial property of the test fabric can be considered strong	Pass, the efficacy of antibacterial property of the test fabric can be considered strong

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Test Report **No: SHFDO100912172FDS1** **Date: Sep 14 2010**

Client name: TitanPE Technologies, Inc.
Client address:

The following sample(s) was/were submitted by/ on behalf of the client as:

Sample name: Photocatalytic Textile
Batch No.: A1663
Manufacturer: TitanPE Technologies, Inc.
SGS Reference No.: GZFDO100903654FD
SGS Job no.: SHFDO100912172FD
Date of receipt: Sep 01 2010
Testing period: Sep 01 2010 ~ Sep 09 2010

TEST(S) REQUESTED:
Selected test(s) as requested by applicant:
Antibacterial Assessment for the submitted sample

TEST METHOD:
JIS L 1902:2008 The Method of antibacterial test and assessment of antibacterial effectiveness for textiles , Chapter 10: Quantitative test (Absorption method)

TEST ORGANISMS:
Escherichia.coli ATCC 8739

CONCLUSION:
Pass: The Log value of bacteriostatic for *Escherichia.coli* is > 6.6, complies with JIS L 1902:2008 Specification for antibacterial finish (The bacteriostatic activity value shall be ⩾2.0 for antibacterial finish) .

Signed for and on behalf of SGS

Amy Gan

.....
Authorized Signature

SHFD
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Member of the SGS Group (SGS SA)

Test Report **No: SHFDO100912172FDS1** **Date: Sep 14 2010**

TEST RESULT(S):

Name of test bacteria (Strain number)	*Escherichia.coli* (ATCC 8739)
Concentration of inoculum (CFU/mL)	1.7×10^5
The growth value on the control sample F ($F=M_b-M_a$)	+ 3.8 (M_b:+ 8.1 , M_a:+ 4.3)
The growth value on the antimicrobial-treated sample (M_c- M_d)	< - 2.8 (M_c:< + 1.3 , M_d:+ 4.1)
Bacteriostatic activity value $S= (M_b-M_a)- (M_c-M_d)$	> 6.6
Bactericidal activity value $L= M_a-M_c$	> 3.0
Incubation time（h）	18
Measuring method	Plate count method

REMARK:

M_a: The average of log value of bacteria obtained from the three control sample that inoculated the test germ after 0h.

M_b: The average of log value of bacteria obtained from the three control sample that inoculated the test germ after 18h.

M_c: The average of log value of bacteria obtained from the three antibacterial finishes that inoculated the test germ after 18h.

M_d: The average of log value of bacteria obtained from the three antibacterial finishes that inoculated the test germ after 0h

The control sample is standard cotton cloth specified by JISL 1902:2008, provided by SGS lab.

SAMPLE DESCRIPTION: White cloth

*** End of Report***

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Test Report

Report No: ASH18-033119-02 **Issue Date: Aug 27 2018**

Sample name: AIR DEFENDER NANO TIO2 SOL
Sample Batch No.: /
Product Date: /
Manufacturer: /

Above information and sample(s) was/were submitted and certified by the client, SGS quoted the information with no responsibility as to the accuracy, adequacy and/or completeness.

SGS Sample No.: ASH18-033119.001
Date of sample received: Jul 11 2018
Testing period: Jul 11 2018 ~ Aug 21 2018

TEST(S) REQUESTED:
Selected test(s) as requested by applicant

TEST METHOD(S):
Please refer to the next page(s)

TEST RESULT(S):
Please refer to the next page(s)

CONCLUSION:
Oral LD_{50} of the sample on Rat is more than 5000mg/kg, which was non-toxic substance.

SAMPLE DESCRIPTION: Sample in bottle

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Test Report

Report No: ASH18-033119-02 Issue Date: Aug 27 2018

TEST METHOD(S):

* Acute oral toxicity test: 16 CFR 1500.3

Test environment: Barrier system animal room. Certificate No. SYXK（Zhe）2018-0003, room temperature 21.5℃~23.1℃, relative humidity 44.6%~57.8%.

Test animal: SD rat, obtained from Centre for Laboratory Animal of Zhejiang Province. Certificate No. SCXK（Zhe）2014-0001.

No. of animals/sex: 5 males, 5 females

Sample preparation: 25.0012g samples were dissolved and poured into a 50mL volumetric flask respectively. The pure water was added to the calibration line, all these samples were fully shake into the reagent bottle, labeled standby.

Test method: The sample was administered as supplied at a limit dosage as 5000.24mg/kg. The animals were fasted for overnight before dosing. And the animals were fasted for 3 hours after dosing. The animals were checked for mortality or signs of morbidity at least twice a day during the observation period. The body weight of each animal was recorded once a week. Gross autopsies were performed on all animals that died during the observation period and on all survivors after 14 days observation.

TEST RESULT(S):

All animals No abnormal clinical symptoms and poisoning deaths were occurred in all experimental animals during 14 days observation. Body weights of animals were no significantly changes during the study. Gross anatomy no remarkable pathological findings on all survivor animals after 14 days observation. LD_{50}>5000.24mg/kg.

Attach Table 2 Results of acute oral toxicity test

Sex	Number of animals	weight（$\overline{X}$ ±SD）（g）				Mortality	Rate of Death
		0day	7day	14day	weight gain		
Male	5	214.1±4.63	256.7±7.38	301.1±4.16	87.0±7.14	0	0
Female	5	204.5±5.14	239.1±4.26	275.3±13.85	70.8±11.95	0	0

REMARK：This report is the replace of the report 231800027255 issued in 2018.08.17, the original report was voided.

Remark: * Test was carried out by NB CIQ laboratory assessed as competent.

*** End ***

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SGS report: Skin Irritation Test

SGS

Test Report

Report No: ASH18-033119-01 **Issue Date: Aug 27 2018**

Sample name: AIR DEFENDER NANO TIO2 SOL
Sample Batch No.: /
Product Date: /
Manufacturer: /

Above information and sample(s) was/were submitted and certified by the client, SGS quoted the information with no responsibility as to the accuracy, adequacy and/or completeness.

SGS Sample No.: ASH18-033119.001
Date of sample received: Jul 11 2018
Testing period: Jul 11 2018 ~ Aug 21 2018

TEST(S) REQUESTED:
Selected test(s) as requested by applicant

TEST METHOD(S):
Please refer to the next page(s)

TEST RESULT(S):
Please refer to the next page(s)

CONCLUSION:
The primary irritation score is 0.

SAMPLE DESCRIPTION: Sample in bottle

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SGS

Test Report

Report No: ASH18-033119-01 Issue Date: Aug 27 2018

TEST METHOD(S):

* Method of testing primary irritant substances: 16 CFR 1500.41

Test environment: Rabbit room of conventional condition. Certificate No. SYXK（Zhe）2018-0003, Room temperature 20.9℃~23.8℃, Relative humidity 52.9%~69.3%.

Test animal: New Zealand White Albino Rabbit, supplied by Yinhai rabbit specialty cooperative organization of Tongxiang Zhejiang Province, Certificate No. SCXK（Zhe）2013-0056.

No. of animals/sex: 6/not specified

Test method: 0.5mL sample was applied to clipped test site (abraded and intact skin) and wrapped with rubberized cloth for 24 hours.

Observation period: After 24 hours of exposure, the patches were removed and the resulting reactions were evaluated. Readings were again made 48 hours after the first reading.

TEST RESULT(S):

The value of skin reaction (abraded and intact skin) at any observation point was 0.

Attach Table 1 Result of thetesting primary irritant substances

Animal No.	Animal sex	B.W. (kg)	Erythema and eschar formation					Edema formation					Total	Primary irritation score
			Intact skin		Abraded skin		Subtotal	Intact skin		Abraded skin		Subtotal		
			24h	72h	24h	72h		24h	72h	24h	72h			
1	♂	2.5	0	0	0	0		0	0	0	0			
2	♂	2.3	0	0	0	0		0	0	0	0			
3	♀	2.5	0	0	0	0		0	0	0	0			
4	♂	2.5	0	0	0	0	0	0	0	0	0	0	0	0
5	♀	2.6	0	0	0	0		0	0	0	0			
6	♀	2.3	0	0	0	0		0	0	0	0			
Value			0	0	0	0		0	0	0	0			

REMARK：This report is the replace of the report 231800027255 issued in 2018.08.17, the original report was voided.

Remark: * Test was carried out by NB CIQ laboratory assessed as competent.

*** End ***

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SGS report: Eye Irritation

SGS

Test Report

Report No: ASH21-001085-02 Date: Feb 23 2021

Sample name:	AirDefender® Antibacterial Solution
Sample Batch No.:	AD4220
Product Date:	/
Manufacturer:	/

Above information and sample(s) was/were submitted and certified by the client, SGS quoted the information with no responsibility as to the accuracy, adequacy and/or completeness.

Date of sample received:	2021-01-07
Testing period:	2021-01-07~2021-02-23
Test Requested:	Selected test(s) as requested by applicant
Test Method:	Please refer to the next page(s)
Test Result(s):	Please refer to the next page(s)

This Test Report supersedes the Test Report No. ASH21-001085-01 issued by SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. Original test report will be invalid from today. " Sample name " information was modified by the request of the client after the Test Report was issued.

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ASH21-001085-02

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Test Report

Report No: ASH21-001085-02 Date: Feb 23 2021

Sample Description:

Specimen No.	SGS Sample ID	Description
1	ASH21-001085.001	sample in bag

TEST RESULT(S):

Test standard	16 CFR Part 1500.42
Test type	*Acute Ocular Irritation Test
Test environment	Rabbit room of conventional condition. Certificate No. SYXK (Zhe) 2018-0003, Room temperature 20.5℃~22.7℃; Relative humidity 56.2%~67.4%.
Test animal	Healthy adult New Zealand Albino Rabbit, 2.27kg~2.88kg, supplied by Yinhai rabbit specialty cooperative organization of Tongxiang Zhejiang Province, Certificate No. SCXK (Zhe) 2018-0002. Animal Quality Certificate No.: 20210117Cezz0610038319.
Number of animals/sex	6, female animals are nulliparous and non-pregnant
Test method	In 24h before the test, 1drop of 2% fluorescein sodium solution was dropped directly on the cornea of the eyes of the animals. After 15s, the eyes were gently flushed with warm saline and examined under the hand slit-lamp, and only those animals without eye defects or irritation shall be used. The 0.1mL of the original sample was placed in one eye of each animal by gently pulling the lower lid away from the eyeball to form a cup into which the test sample was dropped. The lids were then gently held together for one second and the animal was released. The other eye, remaining untreated, was served as a control. The eyes were not washed after instillation of test sample.
Observation period	24h, 48h and 72h after dosage.
Results	No ocular reaction was observed at 24h, 48h and 72h after instillation of test sample.
Conclusions	The test was regarded as negative, and the test sample was considered as non-irritant under the non-flush test condition.

Attached Table Result of the acute ocular Irritation Test

Test condition: Non-flush

Animal No.	Sex	Body weight (kg)	Parts of eye	Observation Time Point

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Test Report Report No: ASH21-001085-02 Date: Feb 23 2021

				24h	48h	72h
1	♂	2.27	Cornea	0	0	0
			Iris	0	0	0
			Conjunctivae	0	0	0
2	♀	2.46	Cornea	0	0	0
			Iris	0	0	0
			Conjunctivae	0	0	0
3	♀	2.88	Cornea	0	0	0
			Iris	0	0	0
			Conjunctivae	0	0	0
4	♂	2.59	Cornea	0	0	0
			Iris	0	0	0
			Conjunctivae	0	0	0
5	♂	2.62	Cornea	0	0	0
			Iris	0	0	0
			Conjunctivae	0	0	0
6	♀	2.35	Cornea	0	0	0
			Iris	0	0	0
			Conjunctivae	0	0	0

Remark:
*Test items were carried out by Ningbo Customs District Technology Center assessed as competent.

*** End ***

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TESTING
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Test Report

Report No: ASH21-010934-01 **Date: Mar 26 2021**

Sample name:	AirDefender® Anti-bacterial Solution
Sample Batch No.:	/
Product Date:	/
Manufacturer:	/

Above information and sample(s) was/were submitted and certified by the client, SGS quoted the information with no responsibility as to the accuracy, adequacy and/or completeness.

Date of sample received:	Mar 01 2021
Testing period:	Mar 01 2021 ~ Mar 26 2021
Test Requested:	Selected test(s) as requested by applicant
Test Method:	Please refer to the next page(s)
Test Result(s):	Please refer to the next page(s)

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scan to see the report
ASH21-010934-01

Test Report

Report No: ASH21-010934-01 **Date: Mar 26 2021**

Sample Description:

Specimen No.	SGS Sample ID	Description
1	ASH21-010934.001	sample in bottle

TEST METHOD(S):
ISO 10993-5:2009 Biological evaluation of medical devices — Part 5: Tests for in vitro cytotoxicity
Test Article: The sample preparation was in accordance with ISO 10993-12:2012. Extration condition is 24h at 37℃ in culture medium. The volume of extract is determined by the standard surface area.
Cell lines: L-929 cells (mouse fibroblast)
Medium: MEM medium（Gibco） with 10% FBS
Negative control: Medical PE gloves
Positive control: Medical latex gloves
General Procedure: Test on extracts(microscopic observation)
The prepared cell suspension was seeded in 96-well culture plate, set blank control, negative control, the positive control and the test sample group, inoculated with 100μL of cell suspension per well. Set CO_2 incubator (5% CO_2, the same below) 37 ℃ cultured for 24 h , discard the original culture medium. Adding fresh cell culture medium in blank control group, added extracts of the negative control in negative control group, added positive control solution or positive control extracts in the positive control group, added the extracts of the experimental material in the test sample. The test volume is 100μL per well, set CO_2 incubator cultured for 24h. Observed cell morphology under the microscope.

TEST RESULT(S):
Tests for in vitro cytotoxicity (test on extracts)
The cytotoxicity of the sample was grade 1, cell growth state in blank control,negative control and positive control is normal

Grade	Reactivity	Conditions of all cultures
0	None	Discrete intracytoplasmatic granules, no cell lysis, no reduction of cell growth
1	Slight	Not more than 20 % of the cells are round,loosely attached and without intracytoplasmatic granules, or show changes in morphology; occasional lysed cells are present; only slight growth inhibition

		observable.
2	Mild	Not more than 50 % of the cells are round, devoid of intracytoplasmatic granules, no extensive cell lysis; not more than 50 % growth inhibition observable.
3	Moderate	Not more than 70 % of the cell layers contain rounded cells or are lysed; cell layers not completly destroyed, but more than 50 % growth inhibition observable.
4	Severe	Nearly complete or complete destruction of the cell layers.

CONCLUSION:
The cytotoxicity of the sample was grade 1, which is slight cytotoxic. The negative positive controls have the expected response in the test system.

*** End ***

Test Report

Report No: ASH21-010951-01 **Date: Apr 20 2021**

Sample name:	AirDefender® Anti-bacterial Solution
Sample Batch No.:	/
Product Date:	/
Manufacturer:	/

Above information and sample(s) was/were submitted and certified by the client, SGS quoted the information with no responsibility as to the accuracy, adequacy and/or completeness.

Date of sample received:	2021-03-01
Testing period:	2021-03-01 ~2021-04-20
Test Requested:	Selected test(s) as requested by applicant
Test Method:	Please refer to the next page(s)
Test Result(s):	Please refer to the next page(s)

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ASH21-010951-01

Sample Description:

Specimen No.	SGS Sample ID	Description
1	ASH21-010951.001	sample in bag

TEST RESULT(S):

Test Item: Acute inhalation toxicity test

Test Standard: OECD TG 403

Conclusions: Under the conditions of this test, Inhalation LC_{50} of the sample on ICR mice is more than 21.9mg/L.

Acute inhalation toxicity test

1. Materials and methods

1.1. Sample preparation

Original sample

1.2. Experimental animals and feeding environment

1.2.1. Experimental animals

Species: mice;

Strain: ICR;

Microbial status: SPF;

Quantity: 6;

Sex: 3 males, 3 females, females were nulliparous and non-pregnant;

Weeks of age: 4 ~ 5 weeks

Body weight: 18g ~ 22g, Body weight was in an interval within ± 20 % of the mean weight of animals day 0;

Animal source: Laboratory Animal Center for Hangzhou Medical College;

Experimental Animal Production License Number: SCXK（Zhe）2019-0002;

Animal Quality Certificate No.: 20210323Abba0100018337.

1.2.2. Feeding environment

Facilities: Barrier system;

Temperature: 23.2℃～24.8℃;

Relative humidity: 47.9%～61.2%;

Experimental Animal Use License Number：SYXK (Zhe) 2018-0003.

1.2.3. Feed

Name: Co 60-irradiated standard commercial pelleted rat feed;

Manufacturers: Jiangsu Xietong Pharmaceutical Bio-engineering Co., Ltd.

Production License Number: Susi license (2019) 01008;

Production Date：2021.01.05;

Quality guarantee period: 6 months;

Qualification certificate number: No.120210105024.

1.2.4. Drinking water

Grade I RO ultrafiltration water（The free chlorine in water was kept at 2-3ppm for sterilization by adding sodium hypochlorite) was provided for animals to drink *ad libitum* by the spout.

1.3. Test method

Before the experiment, the animals were acclimatized in the laboratory animal room environment for 7 days. The sample was administered as supplied at a limit dose. Using a single-concentration oral and nasal exposure system, the parameters were set before the exposure (concentration 20mg/L, average aerosol flow 9.072L/min, average dilution flow 0.305L/min, average pumping flow 1.986L/min). The results of the operation (concentration 21.9mg/L) were obtained directly after the end of the exposure, and the cumulative injection was 47.6g. Inhalation was conducted for 4 hours at a time. The animals were observed for signs of toxicity or behavioral changes frequently per day thereafter. Individual weights were recorded weekly. Gross autopsies were performed on all animals that died during the observation period and on all survival animals after 14 days.

2. Results

Neither abnormal clinical symptoms nor poisoning deaths occurred in all experimental animals during 14 days observation. Body weights of animals were no significantly changes during the study. Gross anatomy no

remarkable pathological findings on all survivor animals after 14 days observation. LC_{50}＞21.9mg/L. (See Table 1).

3. Conclusions

Under the conditions of this test, Inhalation LC_{50} of the sample on ICR mice is more than 21.9mg/L.

Table 1 Results of acute inhalation toxicity test

Sex	Number of animals	weight ($\overline{X}$ ±SD) (g)						Mortality	Rate of death
		0 day	1day	3 days	7 days	14 days	14 days weight gain		
Male	3	21.1±0.42	21.9±0.47	23.3±0.50	25.3±0.42	30.6±0.25	9.4±0.40	0	0
Female	3	18.8±0.47	19.3±0.49	20.3±0.42	22.3±0.25	25.2±0.70	6.3±0.32	0	0

Remark:
Test items were carried out by Ningbo Customs District Technology Center assessed as competent.

*** End ***

中国认可
检测
TESTING
CNAS L0599

Test Report

ASH20-072073-01

Date: 08 Dec 2020

Sample Name:	AirDefender® Coated Textile
Manufacturer:	/
Sample Batch No.:	/
Production Date:	/

Above information and sample(s) was/were submitted and certified by the client, SGS quoted the information with no responsibility as to the accuracy, adequacy and/or completeness.

Date of Sample Received :	19 Nov 2020
Testing Period :	19 Nov 2020 - 08 Dec 2020
Test Requested :	Selected test(s) as requested by client.
Test Method :	Please refer to next page(s).
Test Result(s) :	Please refer to next page(s).

Unless otherwise stated the results shown in this test report refer only to the items tested, and for clients internal use only, not to the society has the proof function. This document cannot be used for improper publicity, without prior written approval of the SGS.

scan to see the report

ASH20-072073-01

SGS Authorized Signature

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Test Report

ASH20-072073-01

Date: 08 Dec 2020

Sample Description :

Specimen No.	SGS Sample ID	Description
1	ASH20-072073.001	sample in bag

Test Result(s) :

Test Requested : Antibacterial Assessment for the submitted sample

Test Method : ***ISO 105 X12: 2016Rubbing 2000 times(1000 times to and 1000 times fro)
ISO 20743:2013 Textiles-Determination of antibacterial activity of textile products: 8.1 Absorption method

ASH20-072073.001

Test organism(s)	**Pseudomonas aeruginosa ATCC 15442
Test inoculum (CFU/mL)	1.6x10^5
F	2.8
lgCt	7.3
lgC0	4.5
G*	-3.2
lgTt	1.3
lgT0	4.4
A	6.0
Comment	Pass:Strong

Notes :

The control sample was 100% cotton fabric, provided by SGS lab.
F: Growth value of F on the control specimens (F=lgCt-lgC0);
G*: Growth value of G on the antibacterial testing specimens (G=lgTt-lgT0);
A: antibacterial activity value (A=F-G);
lgCt: common logarithm of arithmetic average of the numbers of bacteria, obtained from three control specimens after 24 h incubation;
lgC0: common logarithm of arithmetic average of the numbers of bacteria, obtained from three control specimens immediately after incubation;
lgTt: common logarithm of arithmetic average of the numbers of bacteria, obtained from three test specimens after 24 h incubation;
lgT0: common logarithm of arithmetic average of the numbers of bacteria, obtained from three test specimens immediately after incubation.

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The sterilization method was UV sterilization 30min.
The testing specimens incubation time was 24 h.
The testing measuring method was plate count method.
* In case of C0> T0, substitute C0 for T0.
**According to client's requirement, judge with reference to ISO20743:2013.
The efficacy of antibacterial property requirement of ISO20743:2013: Significant: 2.0≤A<3.0,Strong: A≥3.0
***Test item(s) was/were not included in the CNAS Accredited Schedule for our laboratory.The test address of the project is 2F, Building 9, No.69, 1159 East Kangqiao Rd, Pudong District, Shanghai, P.R.China.

Sample photo:

ASH20-072073.001

SGS authenticate the photo on original report only

*** End ***

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SGS report: Anti Alcohol

中国认可
检测
TESTING
CNAS L0599

Test Report

ASH20-080039-02 Date: 05 Jan 2021

Sample Name:	AirDefender® Antibacterial Solution Coated Glass
Manufacturer:	/
Sample Batch No.:	/
Production Date:	/

Above information and sample(s) was/were submitted and certified by the client, SGS quoted the information with no responsibility as to the accuracy, adequacy and/or completeness.

Date of Sample Received :	22 Dec 2020
Testing Period :	22 Dec 2020 - 31 Dec 2020
Test Requested :	Selected test(s) as requested by client.
Test Method :	Please refer to next page(s).
Test Result(s) :	Please refer to next page(s).

This Test Report supersedes the Test Report No. ASH20-080039-01 issued by SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. Original test report will be invalid from today.

Unless otherwise stated the results shown in this test report refer only to the items tested, and for clients internal use only, not to the society has the proof function. This document cannot be used for improper publicity, without prior written approval of the SGS.

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ASH20-080039-02

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Test Report

ASH20-080039-02

Date: 05 Jan 2021

Sample Description :

Specimen No.	SGS Sample ID	Description
1	ASH20-080039.001	sample in bag

Test Result(s) :

Test Requested : Test of antimicrobial activity

Test Method : ISO 22196:2011 Measurement of antibacterial activity on plastics and other non-porous surfaces

ASH20-080039.001

Test organism(s)	Staphylococcus aureus ATCC 6538P
Concentration of bacteria (cells/mL)	8.2x10^5
Volume of test inoculum (mL)	0.4
U_0	4.31
Ut	5.65
At	-0.20
B (cells/cm²)	4.5x10^5
C (cells/cm²)	<0.63
R	5.9
*The antibacterial activity rate (%)	>99.99

Notes :

1.The control sample is plastic film without antimicrobial activity, provided by SGS laboratory.

2.U_0: the average of the common logarithm of the number of viable bacteria(cells/cm²) recovered from the untreated test specimens immediately after inoculation.

3.Ut: the average of the common logarithm of the number of viable bacteria(cells/cm²) recovered from the untreated test specimens after 24 h.

4.At: the average of the common logarithm of the number of viable bacteria(cells/cm²) recovered from the treated test specimens after 24 h.

5.R: the value of antimicrobial activity,R=Ut-At.

6.* The calculation formula of the antibacterial activity rate is 【(B-C)/B】*100%;

B: arithmetic average of the numbers of bacteria obtained from control samples after 24 h incubation(cells/cm²);

C: arithmetic average of the numbers of bacteria obtained from samples after 24 h incubation(cells/cm²).

7.Pre-treatment: The surface of test specimen was wiped with 70% ethanol, rinsed with sterile water and let it air-dry.

8.Test the remarked surface without dots.

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Test Report ASH20-080039-02 Date: 05 Jan 2021

Sample photo:

ASH20-080039.001

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*** End ***

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中国认可
检测
TESTING
CNAS L0599

Test Report

ASH20-077749-02

Date: 21 Jan 2021

Sample Name:	AirDefender® Coated Glass
Manufacturer:	/
Sample Batch No.:	/
Production Date:	/

Above information and sample(s) was/were submitted and certified by the client, SGS quoted the information with no responsibility as to the accuracy, adequacy and/or completeness.

Date of Sample Received :	11 Dec 2020
Testing Period :	11 Dec 2020 - 21 Jan 2021
Test Requested :	Selected test(s) as requested by client.
Test Method :	Please refer to next page(s).
Test Result(s) :	Please refer to next page(s).

Unless otherwise stated the results shown in this test report refer only to the items tested, and for clients internal use only, not to the society has the proof function. This document cannot be used for improper publicity, without prior written approval of the SGS.

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ASH20-077749-02

SGS Authorized Signature

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Test Report

ASH20-077749-02

Date: 21 Jan 2021

Sample Description :

Specimen No.	SGS Sample ID	Description
1	ASH20-077749.001	sample in bag

Test Result(s) :

Test Requested : Test of antimicrobial activity

Test Method : ISO 22196:2011 Measurement of antibacterial activity on plastics and other non-porous surfaces

ASH20-077749.001

Test organism(s)	Staphylococcus aureus ATCC 6538P
Concentration of bacteria (cells/mL)	4.2x10^5
Volume of test inoculum (mL)	0.4
U_0	4.00
Ut	5.07
At	1.97
B (cells/cm²)	1.2x10^5
C (cells/cm²)	93
R	3.1
*The antibacterial activity rate (%)	99.9

Notes :

**After Accelerated Aging tested for antibacterial activity
Test Method: ASTM F 1980-16
Test Condition: Accelerated aging temperature: 60 ℃
Accelerated aging time: 3.74 weeks
Lab Environmental Condition: 23 ± 2 ℃, 50 ± 5 % RH
Note: The data as follow were provided by client.
1.Past life: 1 year
2.Q10 value: 2
3.Ambient temperature: 22℃
4.The simulated shelf life: 1 year.
**The sample is the same as ASH20-077748-01, Test address:2F, Building 9, No.69, 1159 East Kangqiao Rd, Pudong District, Shanghai
1.The control sample is plastic film without antimicrobial activity, provided by SGS laboratory.
2.U_0: the average of the common logarithm of the number of viable bacteria(cells/cm²) recovered from the untreated test specimens immediately after inoculation.
3.Ut: the average of the common logarithm of the number of viable bacteria(cells/cm²) recovered from the

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untreated test specimens after 24 h.

4.At: the average of the common logarithm of the number of viable bacteria(cells/cm²) recovered from the treated test specimens after 24 h.

5.R: the value of antimicrobial activity,R=Ut-At.

6.*The calculation formula of the antibacterial activity rate is 【(B-C)/B】*100%;

B: arithmetic average of the numbers of bacteria obtained from control samples after 24 h incubation(cells/cm²);

C: arithmetic average of the numbers of bacteria obtained from samples after 24 h incubation(cells/cm²).

7.Pre-treatment: Ultraviolet sterilization for 30min

8.Test the surface without circle

Sample photo:

ASH20-077749.001

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*** End ***

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ARCTICA washable mask SGS report: Assessment of Antibacterial Finishes on ARCTICA washable mask textile material (AATCC 100-2012)(Test specimen: after 100 washes)

SGS

Test Report No.T32020320103SN-01 Date: Dec 04, 2020 Page 1 of 3

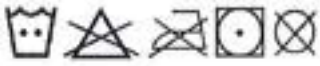
ARCTICA COMPANY LIMITED

UNIT H, 27/F, LEGEND TOWER, 7 SHING YIP STREET, KWUN TONG, KOWLOON, HONG KONG

This report supersedes all previous documents bearing the test report number T32020320103SN with amendment on product information for editorial change.

The following samples were submitted and identified by/on behalf of the client as:

WASHABLE FACE MASK

Case No.	:	CA320203108189
Lot No. / Batch Code	:	NOT PROVIDED
Sample Description	:	PINK MASK
Quantity Submitted	:	10 PCS
Style / Item No.	:	GW909
Country of Origin	:	HONG KONG
Applicant's Proposed Care Instruction	:	 MACHINE WASH WARM, DO NOT BLEACH, DO NOT IRON, TUMBLE DRY LOW, DO NOT DRYCLEAN.
Sample Receiving Date	:	NOV 05, 2020
Testing Period	:	NOV 05 TO NOV 30, 2020

Test Requested	Conclusion
Assessment of Antibacterial Finishes on Textile Material (AATCC 100-2012)	SEE RESULT

******** FOR FURTHER DETAILS, PLEASE REFER TO THE FOLLOWING PAGE(S) ********

Signed for and on behalf of
SGS Hong Kong Ltd.

Au Kam Chi, Gigi
Technical Manager

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Laboratory: 1/F, Units 16-29 3/F, 4/F & 5/F, On Wui Centre, 25 Lok Yip Road, Fanling, New Territories, Hong Kong. www.sgsgroup.com.hk

Member of the SGS Group (SGS SA)

Test Results:

Assessment of Antibacterial Finishes on Textile Material (AATCC 100-2012)

Test specimen: After 100 washes

Test bacteria: *Staphylococcus aureus* (ATCC 6538)

Tested Specimen	Bacterial count (colony forming unit, CFU per sample) over contact period		Result: % of reduction of bacteria
	0 hour	24 hours	
After 100 washes	1.60×10^5	300	99.84
Untreated control sample	1.83×10^5	1.29×10^7	/

Test bacteria: *Klebsiella pneumoniae* (ATCC 4352)

Tested Specimen	Bacterial count (colony forming unit, CFU per sample) over contact period		Result: % of reduction of bacteria
	0 hour	24 hours	
After 100 washes	1.42×10^5	200	99.86
Untreated control sample	1.40×10^5	3.65×10^8	/

Test bacteria: *Escherichia coli* (ATCC 25922)

Tested Specimen	Bacterial count (colony forming unit, CFU per sample) over contact period		Result: % of reduction of bacteria
	0 hour	24 hours	
After 100 washes	1.54×10^5	<100	>99.95
Untreated control sample	1.85×10^5	2.06×10^8	/

Note: The untreated control sample is a 100% cotton fabric without fluorescent brighteners or other finish.

Remarks:

1 Washing procedure: AATCC 135-2018t Test No.(1)IIIA(ii); Machine wash at 105 degree F with 1.8 kg total loading (Type 3 ballast + specimen) and 66±1 g of 1993 AATCC Standard Reference detergent, normal cycle, tumble dry delicate at 140±10 degree F

2 The number of circular swatches (4.8 +/- 0.1 cm in diameter) used per jar: Sample A: 10; Sample B: 7; Sample C: 12

3 Sterilization of samples: By autoclave.

4 Culture medium used for bacterial culture preparation: Nutrient broth

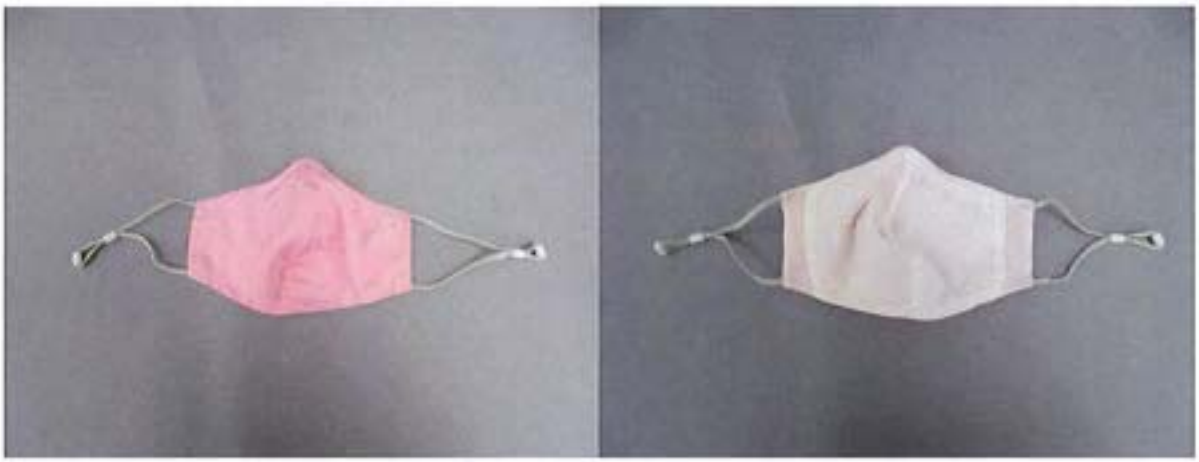
5 Diluent used for inoculum dilution: 1:20 Nutrient broth

6 Surfactant used in inoculums: 0.05% Tween 80

7 Neutralizing solution: 0.85% Saline + 0.1% Tween 80

Sample Photo:

Sample Picture (As received)



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ARCTICA washable mask SGS report: Water repellency (AATCC 22-2017) after 60 washes/ after 100 washes / Free and Hydrolized Formaldehyde Content (ISO 14184-1: 2011)

Test Report

No.T32020300217SN-01 Date: Oct 20, 2020

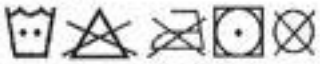
ARCTICA COMPANY LIMITED

UNIT H, 27/F, LEGEND TOWER, 7 SHING YIP STREET, KWUN TONG, KOWLOON, HONG KONG

This report supersedes all previous documents bearing the test report number T32020300217SN with amendment on client information for editorial change.

The following samples were submitted and identified by/on behalf of the client as:

100% POLYESTER, HI-COUNT, 75DX75D / 124X93T, C6 DWR, 80/L20, ANTI-BACTERIAL, AIRDEFENDER®, 82G/M2, 58"

Case No.	:	CA320202834429
Lot No. / Batch Code	:	NOT PROVIDED
Sample Description	:	BLACK FABRIC
Quantity Submitted	:	1 BAG
Style / Item No.	:	WPP608-3
Country of Origin	:	TAIWAN
Applicant's Proposed Care Instruction	:	 MACHINE WASH WARM, DO NOT BLEACH, DO NOT IRON, TUMBLE DRY LOW, DO NOT DYCLEAN.
Sample Receiving Date	:	AUG 28, 2020
Testing Period	:	AUG 28, 2020 – OCT 20, 2020

Test Requested	Conclusion
Water Repellency (AATCC 22-2017) - As received / After 60 washes / After 100 washes	PASS
Free and Hydrolized Formaldehyde Content (ISO 14184-1: 2011) - As received	See Result

******** FOR FURTHER DETAILS, PLEASE REFER TO THE FOLLOWING PAGE(S) ********

Signed for and on behalf of
SGS Hong Kong Ltd.

Au Kam Chi, Gigi
Technical Manager

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Test Results:

Water Repellency
(AATCC 22-2017; Spray Test – Tested under controlled condition, water temperature: 27±1°C)

		Specified Requirement
As received		
Rating		
Individual reading 1	100	Min. 90
Individual reading 2	100	
Individual reading 3	100	
After 60 wash*		
Rating		
Individual reading 1	100	Min. 70
Individual reading 2	100	
Individual reading 3	100	
After 100 wash*		
Rating		
Individual reading 1	95	Min. 70
Individual reading 2	95	
Individual reading 3	95	

Remarks : Nomenclature for rating:
100 – No sticking or wetting of the specimen face
90 – Slight random sticking or wetting of the specimen face
80 – Wetting of specimen face at spray points
70 – Partial wetting of the specimen face beyond the spray points
50 – Complete wetting of the entire specimen face beyond the spray points
0 – Complete wetting of the entire face of the specimen

*Washing procedure:
AATCC 135-2018t Test No.(1) III A (ii); Machine wash at 105±5 degree F with 1.8 kg total loading (Type 3 ballast + specimen) and 66 ± 1g of 1993 AATCC Standard Reference detergent, Normal cycle, Tumble dry delicate at 140±10 degree F, do not iron.

ISO 14184-1: 2011 - Free and Hydrolized Formaldehyde Content

Method: With reference to ISO 14184-1: 2011, Textiles- Determination of formaldehyde - Part 1: Free and Hydrolized formaldehyde (water extraction method)

Analysis was performed by Ultraviolet Visible Spectrometer (UV-Vis)

Specimen Description	Result(s) (mg/kg)
1. Black fabric (As received)	ND

Note:
- mg/kg = milligram per kilogram
- ND = Not Detected (lower than MDL)
- MDL = Method Detection Limit = 10 mg/kg

Sample Photo:

Sample Picture (As received)

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*** End of Report ***

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Member of the SGS Group (SGS SA)

ARCTICA washable mask SGS report: Free and hydrolized formaldehyde content/ Flammability test of clothing textiles/ Assessment of antibacterial finishes on textile material

Test Report

No.T32020280887SN-01 Date: Sep 30, 2020

ARCTICA COMPANY LIMITED

UNIT H, 27/F, LEGEND TOWER, 7 SHING YIP STREET, KWUN TONG, KOWLOON, HONG KONG

This report supersedes all previous documents bearing the test report number T32020280887SN with amendment for product information as requested by client.

The following samples were submitted and identified by/on behalf of the client as:

100% COTTON POPLIN, 80'S/1X80'S/1/94X88T, AIRDEFENDER®, 54G/M2, 57"

Case No.	:	CA320202834409
Lot No. / Batch Code	:	NOT PROVIDED
Sample Description	:	NATURAL FABRIC
Quantity Submitted	:	1 BAG
Style / Item No.	:	WCP44
Country of Origin	:	TAIWAN
Applicant's Proposed Care Instruction	:	 MACHINE WASH WARM, DO NOT BLEACH, DO NOT IRON, TUMBLE DRY LOW, DO NOT DYCLEAN.
Sample Receiving Date	:	AUG 28, 2020
Testing Period	:	AUG 28 TO Sep 30, 2020

Test Requested	Conclusion
ISO 14184-1: 2011 - Free and Hydrolized Formaldehyde Content	SEE RESULT
Flammability Test of Clothing Textiles (16 CFR Part 1610 - October 20, 2008 Edition)	PASS
Assessment of Antibacterial Finishes on Textile Material (AATCC 100-2012)	SEE RESULT

******** FOR FURTHER DETAILS, PLEASE REFER TO THE FOLLOWING PAGE(S) ********

Signed for and on behalf of
SGS Hong Kong Ltd.

Au Kam Chi, Gigi
Technical Manager

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Test Results:

ISO 14184-1: 2011 - Free and Hydrolized Formaldehyde Content

Method: With reference to ISO 14184-1: 2011, Textiles- Determination of formaldehyde - Part 1: Free and Hydrolized formaldehyde (water extraction method)

Analysis was performed by Ultraviolet Visible Spectrometer (UV-Vis)

Specimen Description	Result(s) (mg/kg)
1. Natural fabric (Raw)	ND

Note:
- mg/kg = milligram per kilogram
- ND = Not Detected (lower than MDL)
- MDL = Method Detection Limit = 10 mg/kg
- Relative expanded method uncertainty: ±27%

Flammability Test of Clothing Textiles (16 CFR Part 1610 – October 20, 2008 Edition)

Fabric Surface : Smooth
Test Specimen Direction : Length

	As Received			After Dry-cleaning and Laundering *	
	Flame Spread (sec.)	Burn Code		Flame Spread (sec.)	Burn Code
(1)	5.5	--	(1)	6.0	--
(2)	6.3	--	(2)	5.8	--
(3)	5.7	--	(3)	5.8	--
(4)	5.6	--	(4)	6.4	--
(5)	6.2	--	(5)	6.1	--
Avg.	5.9		Avg.	6.0	

Flammability Classification: Class 1

Remarks : Class 1 Normal Flammability
Class 1 textiles exhibit normal flammability and are acceptable for use in clothing.

* Drycleaning / Laundering procedure is according to 16 CFR 1610:6(b).

Burn Code Description:
_.._ sec. = Actual burn time measured and recorded by the timing device.

Assessment of Antibacterial Finishes on Textile Material (AATCC 100-2012)

Test specimen: As received / After 60 wash / After 100 wash

Test bacteria: *Staphylococcus aureus* (ATCC 6538)

Tested Specimen	Bacterial count (colony forming unit, CFU per sample) over contact period		Result: % of reduction of bacteria
	0 hour	24 hours	
As received sample	1.95×10^5	<100	>99.95
After 60 wash sample	1.94×10^5	<100	>99.95
After 100 wash sample	1.84×10^5	<100	>99.95
Untreated control sample	1.21×10^5	3.50×10^7	/

Test bacteria: *Klebsiella pneumoniae* (ATCC 4352)

Tested Specimen	Bacterial count (colony forming unit, CFU per sample) over contact period		Result: % of reduction of bacteria
	0 hour	24 hours	
As received sample	1.05×10^5	<100	>99.92
After 60 wash sample	1.02×10^5	3.00×10^3	97.59
After 100 wash sample	1.10×10^5	200	99.84
Untreated control sample	1.25×10^5	2.42×10^8	/

Test bacteria: *Escherichia coli* (ATCC 25922)

Tested Specimen	Bacterial count (colony forming unit, CFU per sample) over contact period		Result: % of reduction of bacteria
	0 hour	24 hours	
As received sample	1.44×10^5	<100	>99.93
After 60 wash sample	1.36×10^5	<100	>99.93
After 100 wash sample	1.08×10^5	<100	>99.93
Untreated control sample	1.35×10^5	1.26×10^8	/

Test bacteria: *Pseudomonas aeruginosa* (ATCC 9027)

Tested Specimen	Bacterial count (colony forming unit, CFU per sample) over contact period		Result: % of reduction of bacteria
	0 hour	24 hours	
As received sample	1.23×10^5	<100	>99.93
After 60 wash sample	1.45×10^5	2.80×10^8	0
After 100 wash sample	1.43×10^5	3.20×10^8	0
Untreated control sample	1.52×10^5	2.81×10^8	/

Assessment of Antibacterial Finishes on Textile Material (Modified AATCC 100-2012)

Test specimen: As received / After 60 wash / After 100 wash

Test organism: *Candida albicans* (ATCC 10231)

Tested Specimen	Fungal count (colony forming unit, CFU per sample) over contact period		Result: % of reduction of fungi
	0 hour	24 hours	
As received sample	1.20×10^5	<100	>99.92
After 60 wash sample	1.00×10^5	2.33×10^6	0
After 100 wash sample	1.00×10^5	4.15×10^6	0
Untreated control sample	1.22×10^5	6.35×10^6	/

Note: The untreated control sample is a 100% cotton fabric without fluorescent brighteners or other finish.

Remarks:

1 Washing procedure: AATCC 135-2018t Test No.(1)IIIA(ii); Machine wash at 105 degree F with 1.8 kg total loading (Type 3 ballast + specimen) and 66±1 g of 1993 AATCC Standard Reference detergent, normal cycle, tumble dry delicate at 140±10 degree F
2 The number of circular swatches (4.8 +/- 0.1 cm in diameter) used per jar: 12
3 Sterilization of samples: By autoclave.
4 Culture medium used for bacterial culture preparation: Nutrient broth
5 Diluent used for inoculum dilution: 1:20 Nutrient broth
6 Surfactant used in inoculums: 0.05% Tween 80
7 Neutralizing solution: 0.85% Saline + 0.1% Tween 80

Sample Photo:

SGS authenticate the photo on original report only

*** End of Report ***