

Antimicrobial Technology

Asahi Lifecare Technology



About Asahi Group

- Established since 28 March 1977.
- Manufacturers of conductive materials.
- Has built up a portfolio of patents and products since 1994.
- Factories spread across Asia with distributorship network spread across ASIA, EUROPE and USA.
- R&D center established in 1997.
- Affiliated with several institution such as IDTech, LUX consortium (Photovoltaics), G2G universities for the development of application of future technology in AI, IoT, EV, Alternative energy, etc.
- Website : <http://asahisolder.com/about-us/about-us-video/>



A large, dark blue ink splatter or blotch is centered on a white background. The splatter has irregular, feathered edges with some smaller droplets and speckles trailing off into the white space. The text is centered within the main body of the blue ink.

Asahi Corporate Organization Chart



Singapore Asahi Chemical & Solder Ind. Pte Ltd. (HQ)

47, Pandan Road, Singapore 609288

Sales and Manufacturing

100% Singapore Equity (HQ)

China

- Asahi (Tianjin) solder Technology Co., Ltd
Est Oct 2017
Sales and Manufacturing
- Asahi solder Technology (Beijing) Co., Ltd
Est 1993
Sales and Marketing
- Asahi Solder Technology (Wuxi) Co., Ltd
Est 1995
Sales and Manufacturing
- Asahi Metals(Shenzhen) Ltd
Est 1993
Sales and Manufacturing
- Asahi Metals (HK) Ltd
Est 1983
Sales and Manufacturing

Singapore

- Quantum Chemicals Technologies (S) Pte Ltd
Est March 1997
Research and Development
- Global Advanced Metals Technology (S) Pte Ltd
Est March 1999
Powder Manufacturing
- AMAT (S) Pte Ltd
Est Dec 2018
Copper Inks Development and Sales
- Emerging Polytech(S)Pte Ltd
Est September 2019
Trading in polymer resins
- Asahi Lifecare Technology
Est September 2020

South East Asia

- Sinasahi (M) Sdn Bhd
Est August 1991
Sales and Manufacturing
- PT Sinasahi Solder Indonesia
Est Nov 1997
Sales and Manufacturing
- Asahi Solder Technology (Thailand) Co., Ltd
Est January 2007
Sales and Marketing

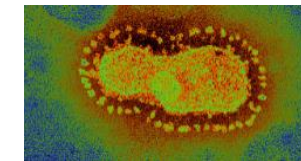
About Asahi Lifecare

- A division of Singapore Asahi
- Established to carry out business for Anti-microbial line of products
- R&D center housed in Singapore factory
- Affiliated with several government institutions such as A*star & SimTech for the development of anti-microbial line of products and new technologies

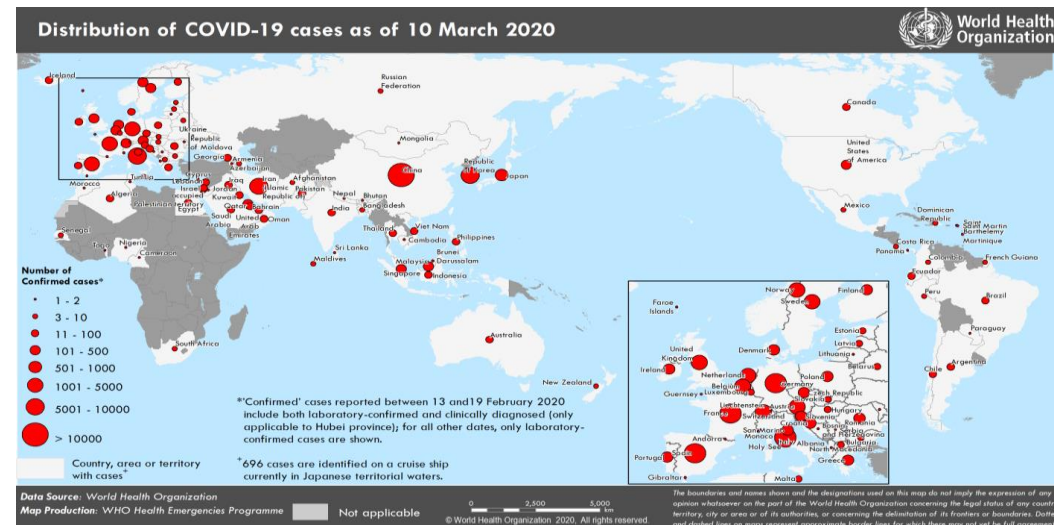


Mankind has faced, and will continue to face infectious diseases of different scales

DISEASE	R-NAUGHT VALUE	TRANSMISSION RATE	LETHALITY	TOTAL CASES	DEATH TOLL
SARS	2-5	77%	<1.0%	8,000	774
2018 INFLUENZA	<1.5	45%	<1.0%	50-million	250,000 to 500,000
CORONAVIRUS	4.7-6.6	83%	16%	???	???
1918 FLU	2-3	65%	>10%	500-million	>50-million
EBOLA 2014	2.0	90%	43%	28,000	12,000



VIRUS	YEAR IDENTIFIED	CASES	DEATHS	FATALITY RATE	NUMBER OF COUNTRIES
Marberg	1967	466	373	80%	11
Ebola*	1976	33,577	13,562	40.40%	9
Hendra	1994	7	4	57%	1
H5N1 Bird Flu	1997	861	455	52.80%	18
Nipah	1998	513	398	77.60%	2
SARS	2002	8,096	774	9.60%	29
H1N1**	2009	1,632,258	284,500	17.40%	214
MERS***	2012	2,494	858	34.40%	28
H7N9 Bird Flu	2013	1,568	616	39.30%	3



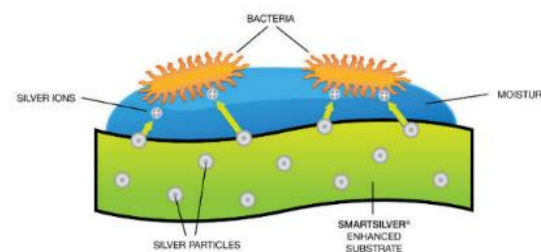
Coronavirus disease 2019 (COVID-19) Situation Report – 50, WHO

One of The Most Common Transmission of Infectious Diseases is via contact with contaminated surfaces



Wash our hand often is recommended but difficult to be practiced

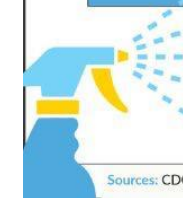
Anti-microbial coating on common areas will kill bacteria and virus and reduce the transmission rate of infectious diseases



WebMD

HOW LONG DO CORONAVIRUSES* LIVE ON SURFACES?

SURFACE	EXAMPLES	DAYS OR HOURS
Metal	Doorknobs, Jewelry, Silverware	5 Days
Glass	Drinking glasses, Mirrors, Windows	UP TO 5 Days
Ceramics	Dishes, Pottery, Mugs	5 Days
Paper	Newspaper, Magazines	UP TO 5 Days
Wood	Furniture, Decking	4 Days
Plastics	Milk bottles, Bus seats, Elevator buttons	2-3 Days
Stainless Steel	Refrigerators, Pots/pans, Sinks, Water bottles	2-3 Days
Cardboard	Shipping boxes	1 Day
Aluminum	Soda cans, Tinfoil, Water bottles	2-8 Hours
Copper	Pennies, Teakettles, Cookware	4 Hours
Food/Water	Doesn't seem to spread through food, and has not been found in water.	



WHAT YOU CAN DO: Disinfect all surfaces and objects in your home daily with a household cleaning spray or wipe. Wash hands for at least 20 seconds with soap and warm water, especially after visiting the supermarket or bringing in packages.

*Coronaviruses are a family of viruses that includes the SARS-CoV-2, the virus that causes COVID-19. This information is for your reference only and is changing constantly.

Sources: CDC, FDA. Medical Review: Brunilda Nazario, MD, 03/24/2020.

Introducing Asahi Lifecare Anti-microbial Coating: AHC7

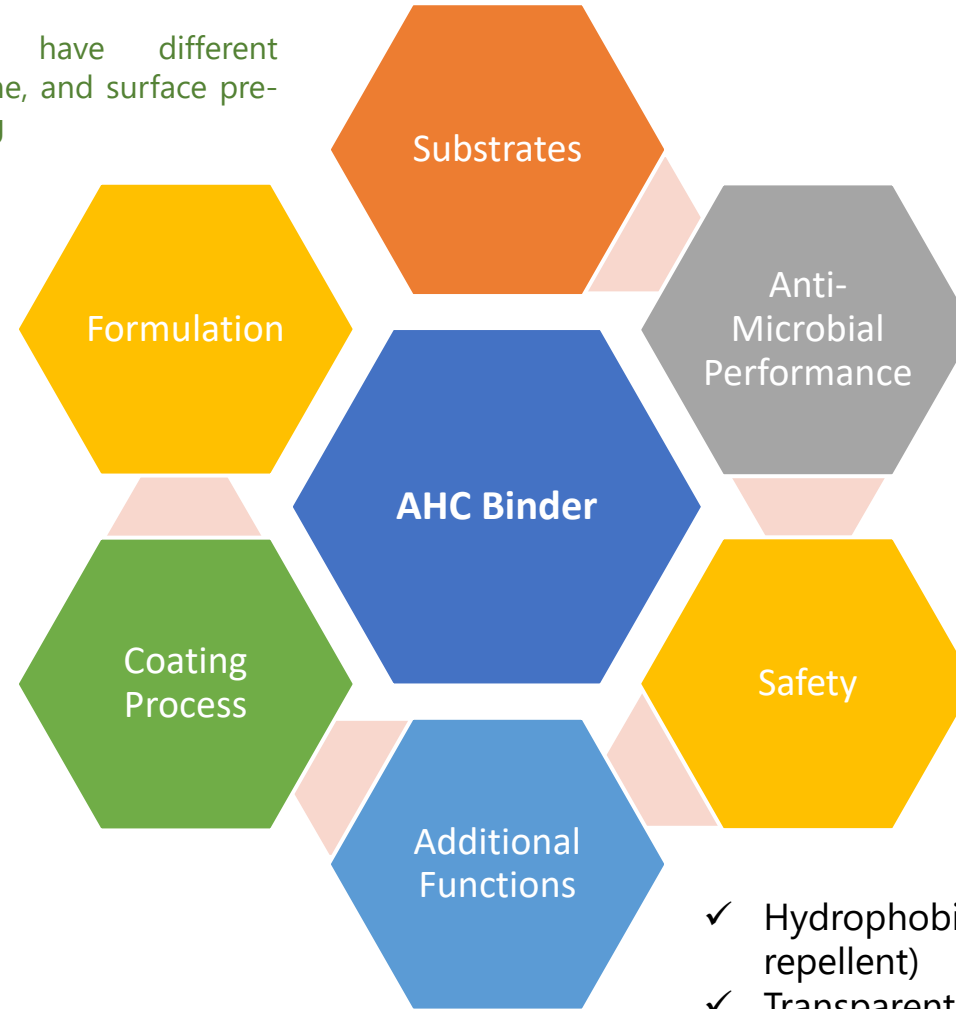


Technology Overview

➤ Suitable* for Glass, Textile, Polymer, Metals

*Different substrates have different adhesion and curing time, and surface pre-treatment before coating

- Matrix + Additives + Diluent
 - Specially formulated matrix for tunable concentration and functions
 - Silver based additives: antimicrobial function
-
- Suitable for spraying, dipping, brushing
 - Thermal and Ambient cure suitable



- ✓ 99.9% anti-bacterial efficacy against *E.coli* (ATCC 8739), *S.aureus* (ATCC 6538P), MRSA and others.
- ✓ >99.9% against EV-A71 virus, H1N1

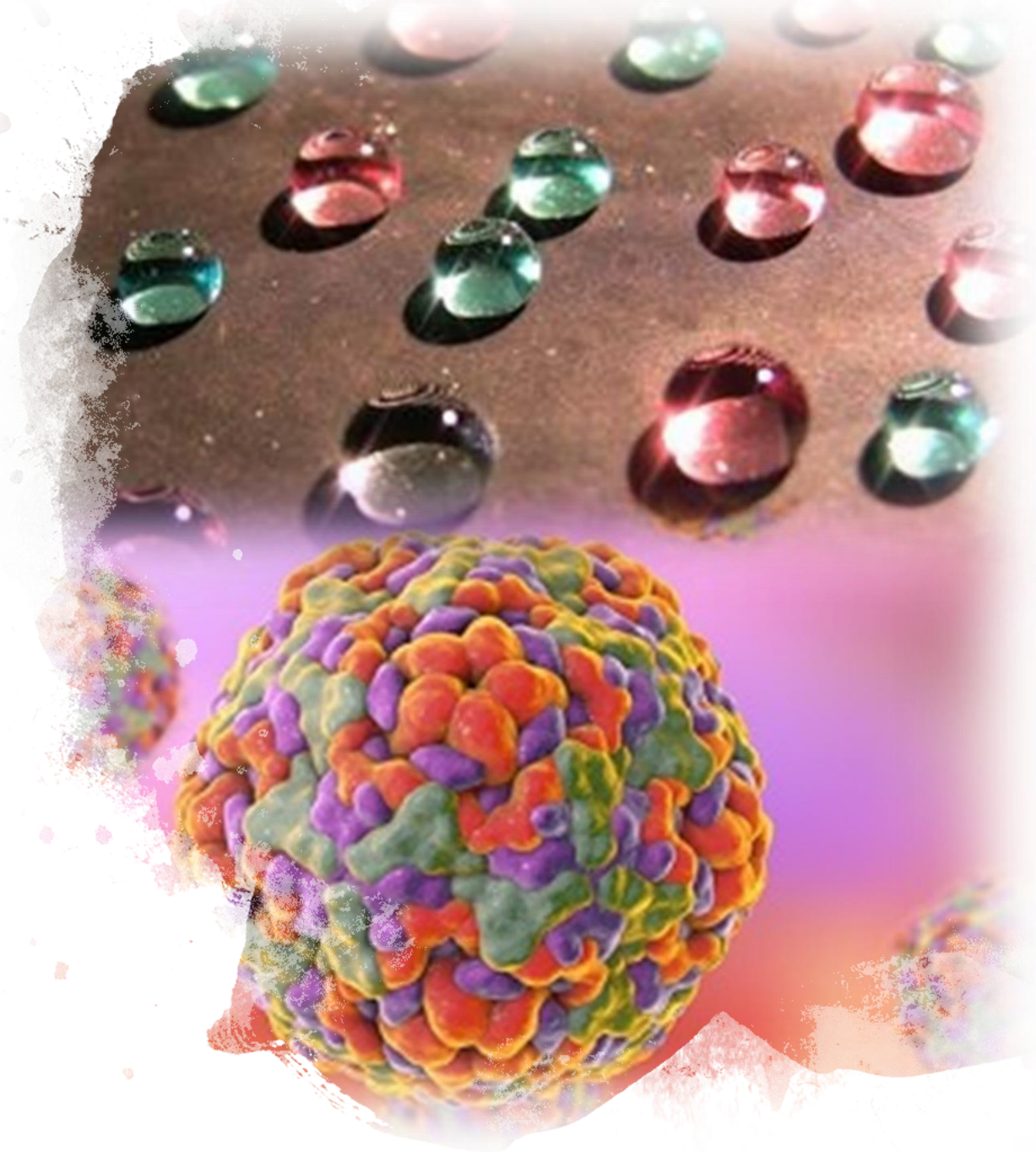
- ✓ Non-cytotoxic (*in-vitro*)
- ✓ Non-skin irritation/ sensitization (according to ISO10993-10)

- ✓ Hydrophobic (Easy-clean/ stain-repellent)
- ✓ Transparent
- ✓ Colored
- ✓ Gloss/ Matt finish tunable

Key Features

- Hydrophobic, making it easy-clean and stain repellent
- Up to 99.9% anti-bacterial efficacy against common bacteria (E. Coli, S. Aureus, K. pneumonia, MRSA)
- Up to 99.9% anti-viral efficacy against EV-A71(HFMD), H1N1 & Murine coronavirus strains
- Meets list of biocompatibility requirements as per ISO 10993-1:2018 Biological evaluation of medical devices
- Resistant to washing, up to 10,000 cycles (dependent on substrates)
- Suitable for application on different surfaces such as polymer, textile, glass and metal
- Can be formulated to desired material properties such as thickness, color or matt appearance

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Anti-bacterial Test Report

Coated PET film with >3.0

Antimicrobial activity value, tested as per JIS Z 2801: Antibacterial Products -- Test For Antibacterial Activity And Efficacy

TEST REPORT: 7191241946-CHM20-01-RC
12 AUG 2020



RESULTS

Test microorganism (Bacterial cells inoculated per test piece)	Average of the number of viable cells of test microorganism per test piece		Value of Antibacterial Activity (Criteria : Not less than 2.0)
	0 hour	24 hours	
<i>Staphylococcus aureus</i> (ATCC 6538P)			
Uncoated Sample	120 000	140 000	-
Product Name : AHC7b	-	Less than 10	More than 4.13

Test microorganism (Bacterial cells inoculated per test piece)	Average of the number of viable cells of test microorganism per test piece		Value of Antibacterial Activity (Criteria : Not less than 2.0)
	0 hour	24 hours	
<i>Escherichia coli</i> (ATCC 8739)			
Uncoated Sample	200 000	5 800 000	-
Product Name : AHC7b	-	Less than 10	More than 5.76

Test microorganism (Bacterial cells inoculated per test piece)	Average of the number of viable cells of test microorganism per test piece		Value of Antibacterial Activity (Criteria : Not less than 2.0)
	0 hour	24 hours	
Methicillin-resistant <i>Staphylococcus aureus</i> (NCTC 12493)			
Uncoated Sample	130 000	120 000	-
Product Name : AHC7b	-	Less than 10	More than 4.08

TEST REPORT: 7191241946-CHM20-01-RC
12 AUG 2020



RESULTS (cont'd)

Test microorganism (Bacterial cells inoculated per test piece)	Average of the number of viable cells of test microorganism per test piece		Value of Antibacterial Activity (Criteria : Not less than 2.0)
	0 hour	24 hours	
<i>Streptococcus pyogenes</i> (ATCC 19615)			
Uncoated Sample	160 000	110 000	-
Product Name : AHC7b	-	Less than 10	More than 4.05

Test microorganism (Bacterial cells inoculated per test piece)	Average of the number of viable cells of test microorganism per test piece		Value of Antibacterial Activity (Criteria : Not less than 2.0)
	0 hour	24 hours	
<i>Klebsiella pneumoniae</i> (ATCC 4352)			
Uncoated Sample	140 000	160 000	-
Product Name : AHC7b	-	Less than 10	More than 4.21

Test microorganism (Bacterial cells inoculated per test piece)	Average of the number of viable cells of test microorganism per test piece		Value of Antibacterial Activity (Criteria : Not less than 2.0)
	0 hour	24 hours	
<i>Pseudomonas aeruginosa</i> (ATCC 15442)			
Uncoated Sample	120 000	610 000	-
Product Name : AHC7b	-	Less than 10	More than 4.78

Coated fabric with >99.9% reduction rate, tested as per ASTM E2180 - 07: Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agent(s) In Polymeric or Hydrophobic Materials

RESULTS

Test microorganism (Bacterial cells inoculated per test piece)	Average of the number of viable cells of test microorganism per test piece		Percent Reduction*
	0 hour	24 hours	
<i>Staphylococcus aureus</i> (ATCC 6538)			
Blank (Control)	4 900 000	380 000	-
Hydrophobic Fabric, (Unwashed)	-	Less than 100	99,97

Test microorganism (Bacterial cells inoculated per test piece)	Average of the number of viable cells of test microorganism per test piece		Percent Reduction*
	0 hour	24 hours	
<i>Klebsiella pneumoniae</i> (ATCC 4352)			
Blank (Control)	4 700 000	300 000	-
Hydrophobic Fabric, (Unwashed)	-	Less than 100	99,97

Remarks :

*: Percent reduction is calculated using the control samples after 24 hours incubation and treated samples after 24 hours incubation.

The above test results related to the samples as received.



MS AW HWEE YING
HIGHER TECHNICAL EXECUTIVE



MR RANDY CHIN KOK FEI
PRODUCT MANAGER
MICROBIOLOGY
CHEMICAL & MATERIALS

RESULTS

Test microorganism (Bacterial cells inoculated per test piece)	Average of the number of viable cells of test microorganism per test piece		Percent Reduction*
	0 hour	24 hours	
<i>Staphylococcus aureus</i> (ATCC 6538)			
Blank (Control)	4 900 000	590 000	-
Hydrophobic Fabric, (Washed 10x)	-	Less than 100	99,98

Test microorganism (Bacterial cells inoculated per test piece)	Average of the number of viable cells of test microorganism per test piece		Percent Reduction*
	0 hour	24 hours	
<i>Klebsiella pneumoniae</i> (ATCC 4352)			
Blank (Control)	4 700 000	330 000	-
Hydrophobic Fabric, (Washed 10x)	-	Less than 100	99,97

Remarks :

*: Percent reduction is calculated using the control samples after 24 hours incubation and treated samples after 24 hours incubation.

The above test results related to the samples as received.



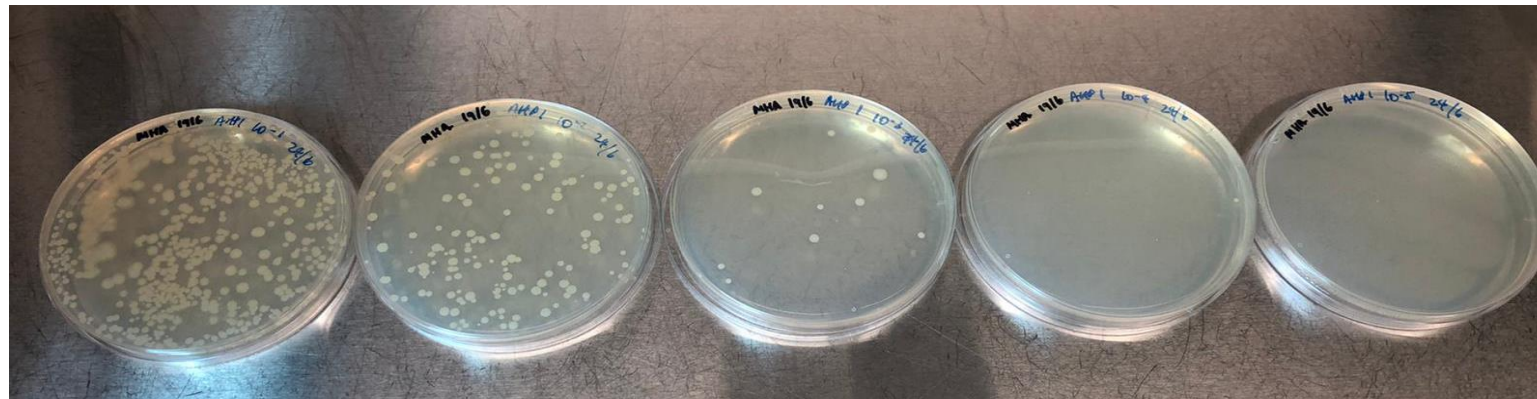
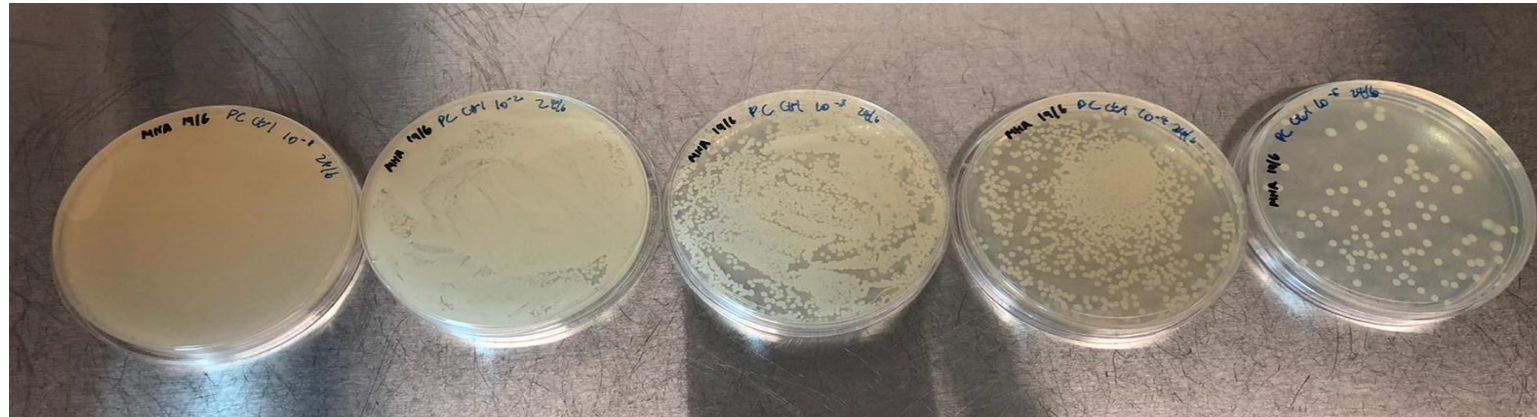
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CHEMICAL & MATERIALS

In-house Bacteria Test as per ASTM E2180

E. Coli: >99.9% reduction after 24hours



Anti-Virus Test Report

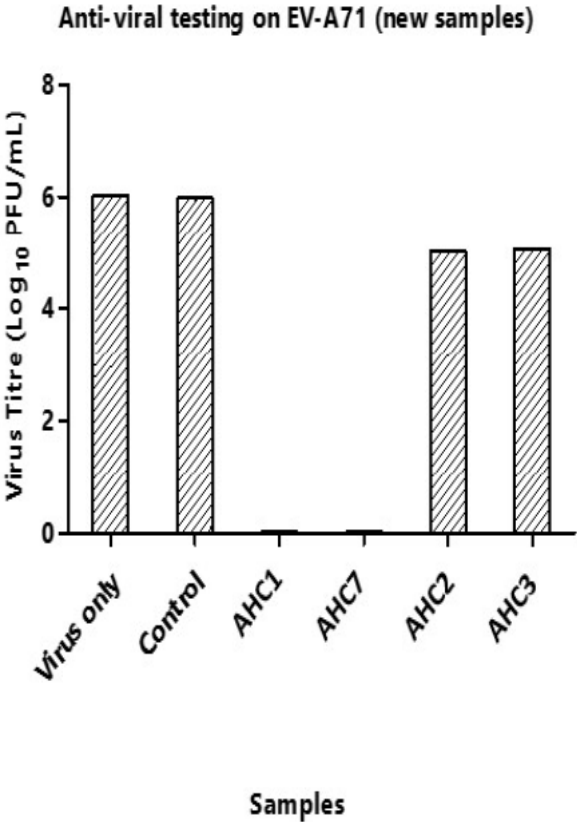
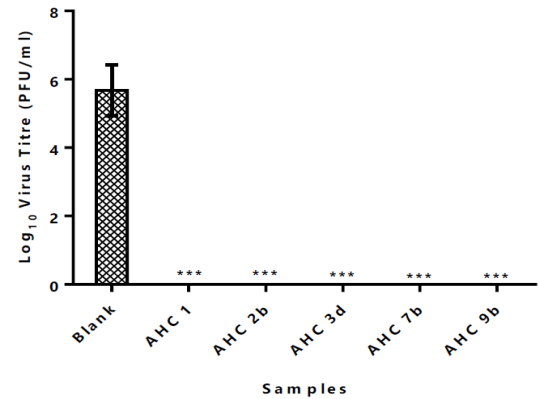
Coated glass slides with >99.99% reduction rate, Method to Determine the potential of test agent to disinfect hard, non porous surfaces contaminated with Influenza A virus and EV A71 virus

RESULTS:

Table 1: Average total virus titre of blank, and anti-microbial treated glass-slides.

Blank Sample 1	Blank Sample 2	Blank Sample 3	Average
4.82×10^5 PFU/ml	5.97×10^5 PFU/ml	6.24×10^5 PFU/ml	5.68×10^5 PFU/ml
AHC 1 Sample 1	AHC 1 Sample 2	AHC 1 Sample 3	Average
0	0	0	0
AHC 2b Sample 1	AHC 2b Sample 2	AHC 2b Sample 3	Average
0	0	0	0
AHC 3d Sample 1	AHC 3d Sample 2	AHC 3d Sample 3	Average
0	0	0	0
AHC 7b Sample 1	AHC 7b Sample 2	AHC 7b Sample 3	Average
0	0	0	0
AHC 9b Sample 1	AHC 9b Sample 2	AHC 9b Sample 3	Average
0	0	0	0

Figure 1: According to the results shown below,, all the samples treated with anti-microbial agents (AHC 1, AHC 2b, AHC 3d, AHC 7b, AHC 9b) showed complete inhibition influenza A virus.



Washability Test

Methodology

Adopted from ASTM D4828 - Standard Test Methods for Practical Washability of Organic Coatings

- Check WCA & other properties of sample before test
- Soak the 3M sponge sufficiently with tap water
- Place the wet sponge and holder at one end of the panel so that its long axis is parallel to the length of the sample
- Turn on pump to add water while the equipment run
- Allow the sponge to travel specific number of cycles
- Check WCA & other properties of sample after specific number of cycles



Speed: 37 ± 1 cycle/min

Load: Dry sponge + holder = 1kg

AMB results after washability test

Sample condition:

- Sprayed 1pass at 5cm distance – about 1 micron thickness
- Contact period: 24hours
- Incubation period: 24 hours

	Initial	After 5k wash	After 10k wash
AHC7b on PC	>99% reduction	> 99% reduction	> 99% reduction
AHC7b on glass	> 99% reduction	On-going	On-going

Cytotoxicity Test Report

- Degree of cytotoxicity <2, as per ISO 10993-5:2009 Biological evaluation of medical devices Part 5: Tests for in vitro cytotoxicity

RESULTS

Test Commencement Date : 18 Jun 2018
Test Completion date : 22 Jun 2018
Sample Description : Air cure [REDACTED]

Extracts of Sample and Controls	Description	Degree	Reactivity
<u>Triplicates</u>			
Sample extract # 1	Not more than 20% of the cells are round, loosely attached, and without intracytoplasmic granules or show changes in morphology; occasional lysed cells are present; only slight growth inhibition observable	1	Slight
Sample extract # 2	Not more than 20% of the cells are round, loosely attached, and without intracytoplasmic granules or show changes in morphology; occasional lysed cells are present; only slight growth inhibition observable	1	Slight
Sample extract # 3	Not more than 20% of the cells are round, loosely attached, and without intracytoplasmic granules or show changes in morphology; occasional lysed cells are present; only slight growth inhibition observable	1	Slight
Negative Control extract (HDPE Material) #1	Discrete intracytoplasmic granules; no cell lysis.	0	None
Negative Control extract (HDPE Material) #2	Discrete intracytoplasmic granules; no cell lysis.	0	None
Negative Control extract (HDPE Material) #3	Discrete intracytoplasmic granules; no cell lysis.	0	None
Positive Control (Zinc Sulphate Solution, 800 mg/L) #1	Complete destruction of the cell layers.	4	Severe
Positive Control (Zinc Sulphate Solution, 800 mg/L) #2	Complete destruction of the cell layers.	4	Severe
Positive Control (Zinc Sulphate Solution, 800 mg/L) #3	Complete destruction of the cell layers.	4	Severe
Reagent blank control #1	Discrete intracytoplasmic granules; no cell lysis.	0	None
Reagent blank control #2	Discrete intracytoplasmic granules; no cell lysis.	0	None
Reagent blank control #3	Discrete intracytoplasmic granules; no cell lysis.	0	None

Remarks :

The results of analysis showed that the sample "Air cure [REDACTED]" tested was considered to have no cytotoxic effect.

8.2 PRIMARY IRRITATION SCORE (PIS) AND PRIMARY IRRITATION INDEX (PII)

Animal ID	PIS _{test} (Sum of all scores of 2 test sites / 6)	PIS _{negative control} (Sum of all scores of 2 negative control sites / 6)	PIS (PIS _{test} - PIS _{negative control})	PII (Sum of PISs of individual animals / 3)
7191206474-01-00-1	0	0	0	0
7191206474-01-00-2	0	0	0	
7191206474-01-00-3	0	0	0	

8.3 OBSERVATION OF OTHER ADVERSE EFFECTS

No other adverse effect was observed in all the test animals during the observation period.

9. HISTORICAL DATA FOR POSITIVE CONTROL

The periodical positive control (20% (w/v) sodium dodecyl sulfate in water) was conducted in GLP study 7191197747-02-00. These historical data were adopted from GLP study 7191197747-02-00 conducted on 31 Dec 2018 to 11 Jan 2019 as follows:

Animal ID	PIS _{positive control} (Sum of all scores of positive control site / 3)	PIS _{negative control} (Sum of all scores of negative control site / 3)	PIS (PIS _{positive control} - PIS _{negative control})	PII (Sum of PISs of individual animals / 3)
7191197747-02-00-01	3.33	0	3.33	3.22
7191197747-02-00-02	3.33	0	3.33	
7191197747-02-00-03	3.00	0	3.00	

The skin irritation response category of the positive control is moderate (2 to 4.9).

8. TEST RESULTS

8.1 ERYTHEMA / ESCHAR (E) AND OEDEMA (O) FORMATION OF EACH ANIMAL AT EACH OBSERVATION TIMEPOINT

Animal ID	Application site	1 hr after exposure E/O	24 hrs after exposure E/O	48 hrs after exposure E/O	72 hrs after exposure E/O	Sum of all scores at 24, 48 and 72hrs E+O
7191206474-01-00-1	Site 2 (Test)	0/0	0/0	0/0	0/0	0
	Site 6 (Test)	0/0	0/0	0/0	0/0	
	Site 3 (Negative control)	0/0	0/0	0/0	0/0	0
	Site 5 (Negative control)	0/0	0/0	0/0	0/0	
7191206474-01-00-2	Site 2 (Test)	0/0	0/0	0/0	0/0	0
	Site 6 (Test)	0/0	0/0	0/0	0/0	
	Site 3 (Negative control)	0/0	0/0	0/0	0/0	0
	Site 5 (Negative control)	0/0	0/0	0/0	0/0	
7191206474-01-00-3	Site 2 (Test)	0/0	0/0	0/0	0/0	0
	Site 6 (Test)	0/0	0/0	0/0	0/0	
	Site 3 (Negative control)	0/0	0/0	0/0	0/0	0
	Site 5 (Negative control)	0/0	0/0	0/0	0/0	

11. CONCLUSION

Based on the above results, using direct contact method, the skin irritation response category of the test item – AHP-1 k ppm Ag Ac, Lot No: 01 is negligible (PII = 0, less than 0.4).

Skin Irritation Test Report

- Primary irritation is negligible (index <0.4), as per ISO 10993-10:2013 Biological evaluation of medical devices Part 10: Tests for irritation and skin sensitization



Skin Sensitization Test Report

No skin sensitization, as per ISO 10993-10:2013
Biological evaluation of medical devices Part 10: Tests for irritation and skin sensitization

11. CONCLUSION

Based on the above results, using direct contact of the test item - AHP 1K, Lot No: NA moistened with 0.9% NaCl saline, no skin sensitization was produced in guinea pigs when closed-patch method was conducted.

8. TEST RESULTS

8.1 SKIN REACTIONS AT THE CHALLENGE AREA OF EACH ANIMAL

8.1.1 The grades of each animal in test group and negative control group

Group	Animal ID	Grade at 24 hrs after removal of the challenge patch at the challenge area of test item	Grade at 48 hrs after removal of the challenge patch at the challenge area of test item
Test	7191209960-03-00-T-1	0	0
	7191209960-03-00-T-2	0	0
	7191209960-03-00-T-3	0	0
	7191209960-03-00-T-4	0	0
	7191209960-03-00-T-5	0	0
	7191209960-03-00-T-6	0	0
	7191209960-03-00-T-7	0	0
	7191209960-03-00-T-8	0	0
	7191209960-03-00-T-9	0	0
	7191209960-03-00-T-10	0	0
Negative control	7191209960-03-00-NC-1	0	0
	7191209960-03-00-NC-2	0	0
	7191209960-03-00-NC-3	0	0
	7191209960-03-00-NC-4	0	0
	7191209960-03-00-NC-5	0	0

Note: 0 = No visible change

8.2 OBSERVATION OF OTHER ADVERSE EFFECTS

No other adverse effect was observed on all animals during the observation period.

What Asahi could offer.....



WORK CLOSELY WITH COMPANIES TO
ENHANCE THEIR PRODUCT SAFETY
WITH OUR ANTIMICROBIAL COATING
TECHNOLOGY.



CONTINUE TO FORMULATE AND TEST
ON MORE VIRUS OR BACTERIAL THAT
ARE OF CONCERN BASED ON
DIFFERENT PRODUCT TYPE.

Industries looking for antimicrobial coating



Apparel & Uniform



Aerospace – Cabin
Interior



Childcare centers



Buildings (Glass &
other surfaces)



Furniture

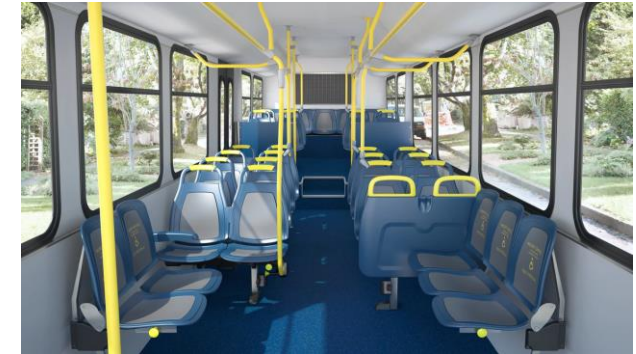


General purpose –
Bottling for
Cleaning services



Packaging

Areas of Application





For more information please
contact....

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KaiHwa Chew @ khchew@sinasahi.com.sg

Asahi Lifecare Technology

