Laboratory of Viruses Contaminants of Water and Food

UNIVERSITAT DE BARCELONA

Microbiology, Virology and Biotechnology Section
Departament de Genetics, Microbiology and Statistics
University of Barcelona
Head of the laboratory: rgirones@ub.edu

http://www.ub.edu/microbiologia_virology/en

Summary Report

Evaluation of the efficiency of the air disinfection unit WADU-02, WELLIS (Wellis Co., Ltd.) against Human Respiratory Syncytial Virus under wet conditions

Report nº: 20191212_3

UNIVERSITAT DE BARCELONA
Facultat de Biologia
Departament de Genètica, Microbiologia i Estadística
Secció de Microbiologia, Virologia i Biotecnologia

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REPORT Núm. 2019121203

Applicant: RECO PLANT Co., Ltd
Address of Applicant: 3Ho, Ga Dong,174-10, Chilgeori-ro
Eumam-myeon, Seosan-si,
Chungcheongnam-do,
Republic of Korea

Product evaluation
Product Description: Air Disinfection unit
Model number: WADU-02
Brand: WELLIS
Manufacturer: Wellis Co., Ltd.
Issue date: 12/9/2019

Summary

The effectiveness of the WELLIS WADU-02 air disinfection unit for the disinfection of viruses was measured against Human Respiratory Syncytial Virus (RSV). The inactivation or decay of infectious RSV was quantified using cell culture ($TCID_{50}$ assay) and all tests were done in duplicate. Wet viral suspensions were exposed to the disinfection unit in order to test virus stability over time. Control viral suspensions, not exposed to the disinfection unit, were tested in parallel. The disinfection treatment was able to reduce 99% the initial concentration of RSV after 2 hour of treatment.

Experimental procedure

RSV is an enveloped RNA virus with surface proteins that mediate RSV infection of human airway epithelial cells. RSV is the leading viral cause of acute lower respiratory tract infections, including bronchiolitis and pneumonia, among infants and young children globally. RSV can survive for many hours on hard surfaces such as tables and crib rails. It typically lives on soft surfaces such as tissues and hands for shorter amounts of time. It is usually transmitted through droplets from the cough or sneeze that contact with eyes, nose, or mouth, or by direct contact with a contaminated surface. For this test RSV strain A2 (ATCC® VR-1540TM) was produced in Hep2 cells (ATCC® CCL-23TM).

This experiment was performed for RSV under wet conditions. The air disinfection unit was stored in a metacrilate box (0,064 m3). All experiments were conducted at room temperature. One-hundred microliter droplets were disposed over small pieces of glass and placed inside or outside the box (control) as it is shown in picture 1.

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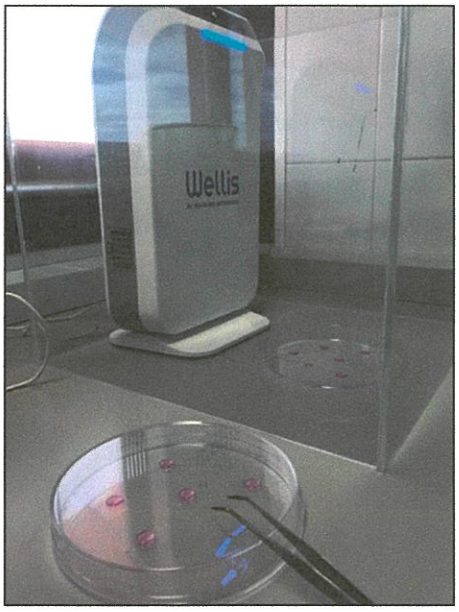

Picture 1: Droplets disposed over small glass pieces.

At each testing time viruses were recovered, from the glass surfaces, in culture medium (MEM) and the number of infectious viral particles were quantified by $TCID_{50}$ in Hep2 cells.

The inactivation effectiveness of the air disinfection unit over RSV wet suspensions are summarized in table 1 and figure 1. Viral quantities are expressed in logarithms

	Time	No treatment	Air disinfection unit (ozone + *d*-limomene)	log_{10} decay	% of decay
WET	0 minut	3,58E+05	3,58E+05		
	30 minut	2,60E+05	8,08E+04	0,48	67%
	1 hour	2,82E+05	5,00E+04	1,26	91%
	2 hour	1,77E+05	6,55E+03	2,19	99%

Table 1: RSV concentration decay over time under wet conditions.

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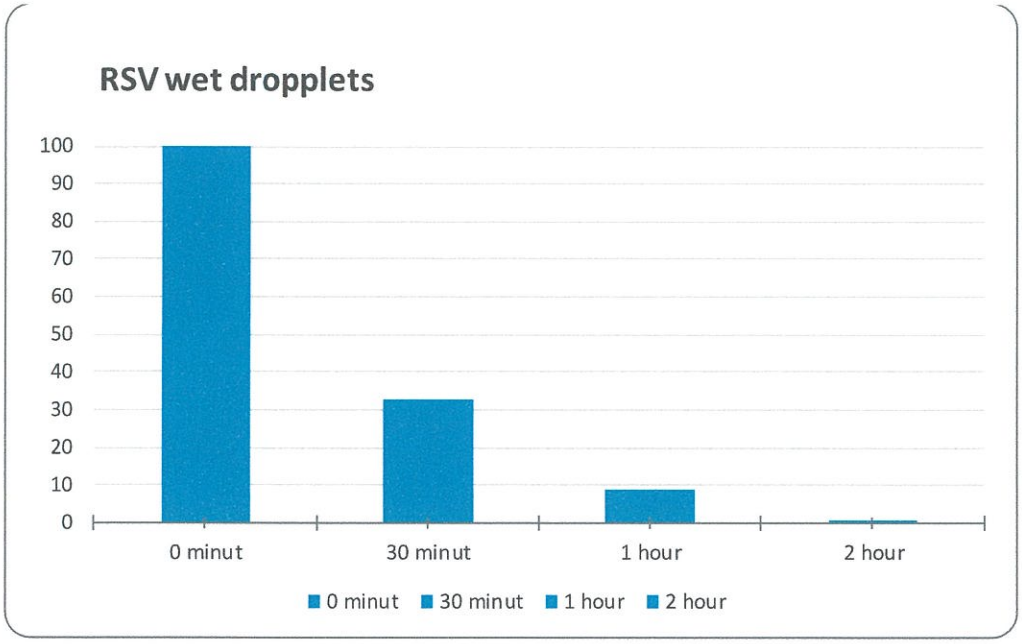

Figure 1: Percentages in RSV concentration over time under wet conditions.

Conclusion

The equipment, significantly reduce the concentration of RSV in wet dropplets. This virus presented in 2 hours a total decay of 2,19$\log_{10}$. The efficiency of WELLIS WADU-02 on aerosols receiving equivalent doses could be expected to be at least equivalent.

Date: 12-12-2019

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Summary Report

Evaluation of the efficiency of the air disinfection unit WADU-02, WELLIS (Wellis Co., Ltd.) against Human Respiratory Syncytial Virus under dry conditions

Report nº: 20191212_4

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REPORT Núm. 2019121204

Applicant: RECO PLANT Co., Ltd
Address of Applicant: 3Ho, Ga Dong,174-10, Chilgeori-ro
Eumam-myeon, Seosan-si,
Chungcheongnam-do,
Republic of Korea

Product evaluation
Product Description: Air Disinfection unit
Model number: WADU-02
Brand: WELLIS
Manufacturer: Wellis Co., Ltd.
Issue date: 12/9/2019

Summary

The effectiveness of the WELLIS WADU-02 air disinfection unit for the disinfection of viruses was measured against Human Respiratory Syncytial Virus (RSV). The inactivation or decay of infectious RSV was quantified using cell culture ($TCID_{50}$ assay) and all tests were done in duplicate. Dry viral suspensions were exposed to the disinfection unit in order to test virus stability over time. Control viral suspensions, not exposed to the disinfection unit, were tested in parallel. The disinfection treatment was able to reduce 92% of the initial concentration of RSV after 2 hour of treatment.

Experimental procedure

RSV is an enveloped RNA virus with surface proteins that mediate RSV infection of human airway epithelial cells. RSV is the leading viral cause of acute lower respiratory tract infections, including bronchiolitis and pneumonia, among infants and young children globally. RSV can survive for many hours on hard surfaces such as tables and crib rails. It typically lives on soft surfaces such as tissues and hands for shorter amounts of time. It is usually transmitted through droplets from the cough or sneeze that contact with eyes, nose, or mouth, or by direct contact with a contaminated surface. For this test RSV strain A2 (ATCC® VR-1540TM) was produced in Hep2 cells (ATCC® CCL-23TM).

This experiment was performed for RSV under dry conditions. The air disinfection unit was stored in a metacrilate box (0,064 m3). All experiments were conducted at room temperature. One-hundred microliter droplets were disposed over small pieces of glass, dried at room temperature and placed inside or outside the box (control) as it is shown in picture 1.

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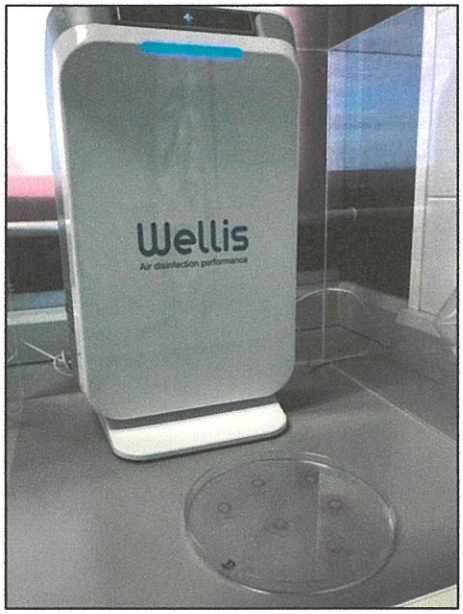

Picture 1: Dry droplets disposed over small glass pieces.

At each testing time viruses were recovered, from the glass surfaces, in culture medium (MEM) and the number of infectious viral particles were quantified by $TCID_{50}$ in Hep2 cells.

The inactivation effectiveness of the air disinfection unit over RSV dry suspensions are summarized in table 1 and figure 1. Viral quantities are expressed in logarithms

	Time	No treatment	Air disinfection unit (ozone + *d*-limomene)	log_{10} decay	% of decay
DRY	0 minut	5,30E+04	5,30E+04		
	30 minut	5,00E+04	1,29E+04	0,56	74%
	1 hour	4,30E+04	1,23E+04	0,78	87%
	2 hour	4,71E+04	9,05E+03	1,71	92%

Table 1: RSV concentration decay over time under dry conditions.

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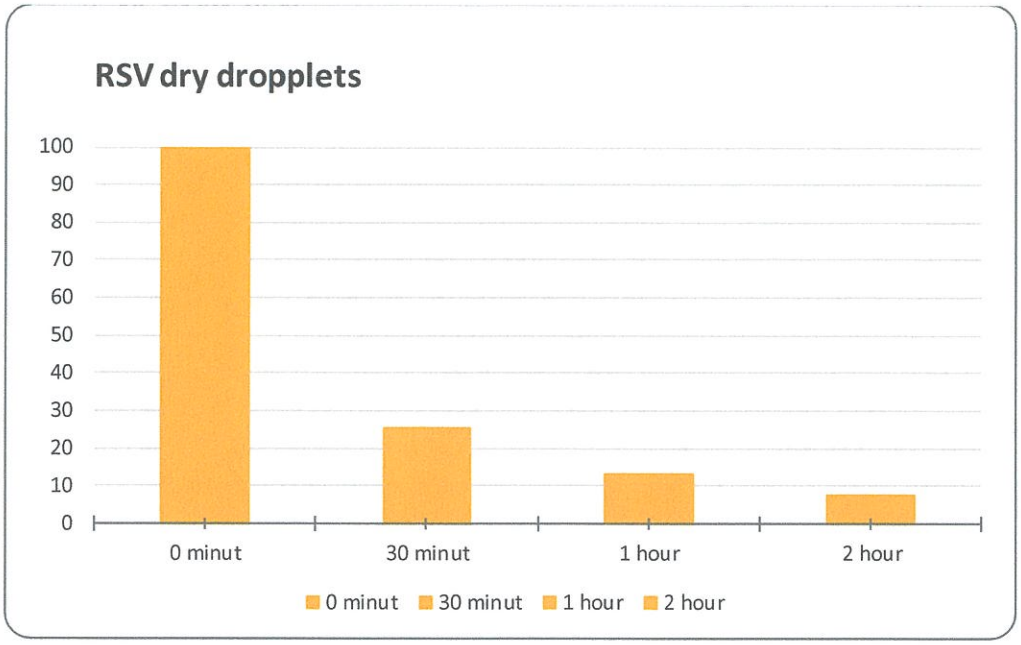


Figure 1: Percentages in RSV concentration over time under dry conditions.

Conclusion

The equipment, significantly reduce the concentration of RSV under dry conditions. This virus presented in 2 hours a total decay of 1,7log$_{10}$. The efficiency of WELLIS WADU-02 on aerosols receiving equivalent doses could be expected to be at least equivalent.

Date: 12-12-2019

6993-3909-1852-5439

TEST REPORT

1. No : CT16-027130

Reissuance (R1)
Date : 2016.03.24

2. Client
   - ○ Name : Wellis Co.,Ltd
   - ○ Address : W801, SK V1 Center Bldg, 11, DangSan-ro 41-gil, Yeungdeungpo-gu, Seoul, Korea

3. Date of Test : 2016.02.29 ~ 2016.03.24
4. Use of Report : Quality Control
5. Test Sample : Air Disinfection Purifier (WADU-02)
6. Test Method
   (1) Client's requirement method

Affirmation	Tested By Name : Kye Seung Chang JKS	Technical Manager Name : Sang Bok Bae Sangbok

Our report apply only to the standards or procedures identified and to the sample(s) tested unless otherwise specified. The test results are not indicative of representative of the qualities of the qualities of the lot from which the sample was taken or of apparently identical or similar products.

2016.03.24

Korea Conformity Laboratories President Kyung Sik Ki Kyungsik Ki

Address : #805, I' VALLEY Gunpo,149,Gongdan-ro,Gunpo-si,Gyeonggi-do,435-010,Korea 82-31-389-9100
Result Inquiry : The Center of Green Complex Technologies 82-31-389-9184

TEST REPORT

No : CT16-027130

7. Test Results

Test Items		Test Results			Test method	Testing Environment
		Before operating Conc.(CFU/㎥)	After operating Conc.(CFU/㎥)	Reduction rate of bacteria(%)		
Reduction test for Airborne microbes	Air Disinfection Purifier (WADU-02)	1.2×10^4	< 10	9 9 . 9	Client's requirement method	(23.0 ± 0.2) ℃ (50.1 ± 1.0) %R.H.

※ CFU : Colony Forming Unit

※ Test strain : *Klebsiella pneumoniae* ATCC 4352

※ Chamber size : 8 ㎥

※ Measurement equipment : MAS-100 NT (MERCK, Flow rate : 100 L/min)

※ Sample : Air Disinfection Purifier (WADU-02)

※ Operating time : 4 hours

※ Result concentration : Feller Conversion Table application

※ Client's requirement method : After injecting a constant concentration of target bacteria inside the test chamber and operating the sample for 4 hours, measure the reduction rate of bacteria.

TEST REPORT

No : CT16-027130

<Picture 1. *Klebsiella pneumoniae* - BLANK (0 h)>

<Picture 2. *Klebsiella pneumoniae* - Air Disinfection Purifier (WADU-02) (4 h)>

TEST REPORT

No : CT16-027130

<Picture 3. Sample[Air Disinfection Purifier (WADU-02)]>

----- End of Report -----

2601-8618-5628-5827

TEST REPORT

1. **No :** CT16-027128

Reissuance (R1)
Date : 2016.03.24

2. **Client**
   - ○ **Name :** Wellis Co.,Ltd
   - ○ **Address :** W801, SK V1 Center Bldg, 11, DangSan-ro 41-gil, Yeungdeungpo-gu, Seoul, Korea

3. **Date of Test :** 2016.02.29 ~ 2016.03.24
4. **Use of Report :** Quality Control
5. **Test Sample :** Air Disinfection Purifier (WADU-02)
6. **Test Method**
   (1) Client's requirement method

Affirmation	Tested By Name : Kye Seung Chang JKS	Technical Manager Name : Sang Bok Bae Saybok

Our report apply only to the standards or procedures identified and to the sample(s) tested unless otherwise specified. The test results are not indicative of representative of the qualities of the qualities of the lot from which the sample was taken or of apparently identical or similar products.

2016.03.24

Korea Conformity Laboratories President Kyung Sik Ki Kyungsik Ki

Address : #805, I' VALLEY Gunpo,149,Gongdan-ro,Gunpo-si,Gyeonggi-do,435-010,Korea 82-31-389-9100

Result Inquiry : The Center of Green Complex Technologies 82-31-389-9184

TEST REPORT

No : CT16-027128

7. Test Results

Test Items		Test Results			Test method	Testing Environment
		Early Conc. (CFU/mL)	After 4 h Conc. (CFU/mL)	Reduction rate of bacteria(%)		
Antibacterial test for *Escherichia coli*	BLANK	1.7×10^4	1.7×10^4	-	Client's requirement method	(37.0 ± 0.1) ℃ (33.1 ± 0.2) % R.H.
	Air Disinfection Purifier (WADU-02)	1.7×10^4	< 10	99.9		
Antibacterial test for *Pseudomonas aeruginosa*	BLANK	1.9×10^4	1.9×10^4	-		
	Air Disinfection Purifier (WADU-02)	1.9×10^4	< 10	99.9		
Antibacterial test for *Staphylococcus aureus*	BLANK	1.4×10^4	1.4×10^4	-		
	Air Disinfection Purifier (WADU-02)	1.4×10^4	< 10	99.9		

※ CFU : Colony Forming Unit

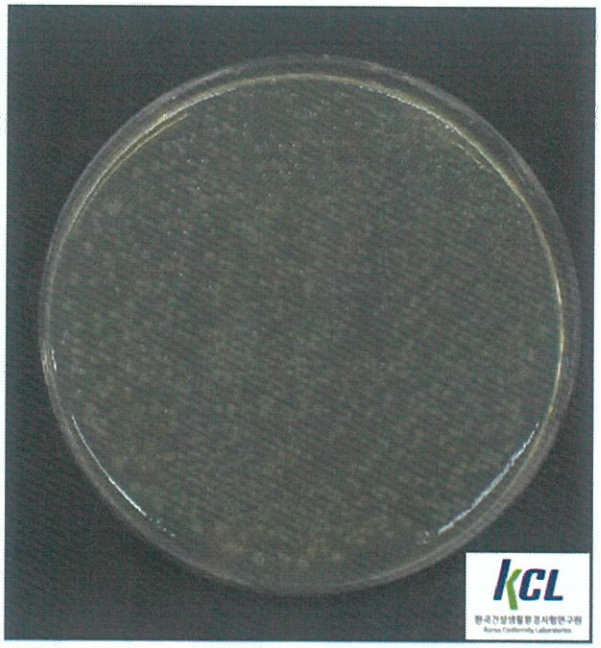
※ Test strain : *Escherichia coli* ATCC 25922
Pseudomonas aeruginosa ATCC 15442
Staphylococcus aureus ATCC 6538

※ Sample : Air Disinfection Purifier (WADU-02)

※ Client's requirement method
- Test time : 4 hours
- Distance between of the medium inoculated with the strain and the sample : 5 ㎝

TEST REPORT

No : CT16-027128



<Picture 1. *Escherichia coli* - BLANK (0 h)>

<Picture 2. *Escherichia coli* - Air Disinfection Purifier (WADU-02) (4 h)>

TEST REPORT

No : CT16-027128

<Picture 3. *Pseudomonas aeruginosa* - BLANK (0 h)>

<Picture 4. *Pseudomonas aeruginosa* - Air Disinfection Purifier (WADU-02) (4 h)>

TEST REPORT

No : CT16-027128

<Picture 5. *Staphylococcus aureus* - BLANK (0 h)>

<Picture 6. *Staphylococcus aureus* - Air Disinfection Purifier (WADU-02) (4 h)>

----- End of Report -----

5436-2724-6556-1924

TEST REPORT

Reissuance (R1)
Date : 2016.03.24

1. No : CT16-027129
2. Client
   - ○ Name : Wellis Co.,Ltd
   - ○ Address : W801, SK V1 Center Bldg, 11, DangSan-ro 41-gil, Yeungdeungpo-gu, Seoul, Korea
3. Date of Test : 2016.02.29 ~ 2016.03.24
4. Use of Report : Quality Control
5. Test Sample : Air Disinfection Purifier (WADU-02)
6. Test Method
   (1) Client's requirement method

Affirmation	Tested By Name : Kye Seung Chang JKS	Technical Manager Name : Sang Bok Bae Saybok

Our report apply only to the standards or procedures identified and to the sample(s) tested unless otherwise specified. The test results are not indicative of representative of the qualities of the qualities of the lot from which the sample was taken or of apparently identical or similar products.

2016.03.24

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Result Inquiry : The Center of Green Complex Technologies 82-31-389-9184

TEST REPORT

No : CT16-027129

7. Test Results

Test Items		Test Results			Test method	Testing Environment
		Early Conc. (CFU/mL)	After 4 h Conc. (CFU/mL)	Reduction rate of bacteria(%)		
Antibacterial test for *Salmonella typhimurium*	BLANK	1.6×10^4	1.6×10^4	-	Client's requirement method	(37.0 ± 0.1) ℃ (33.1 ± 0.2) % R.H.
	Air Disinfection Purifier (WADU-02)	1.6×10^4	< 10	99.9		
Antibacterial test for *Klebsiella pneumoniae*	BLANK	2.0×10^4	2.0×10^4	-		
	Air Disinfection Purifier (WADU-02)	2.0×10^4	< 10	99.9		
Antibacterial test for MRSA	BLANK	1.2×10^4	1.2×10^4	-		
	Air Disinfection Purifier (WADU-02)	1.2×10^4	< 10	99.9		

※ CFU : Colony Forming Unit

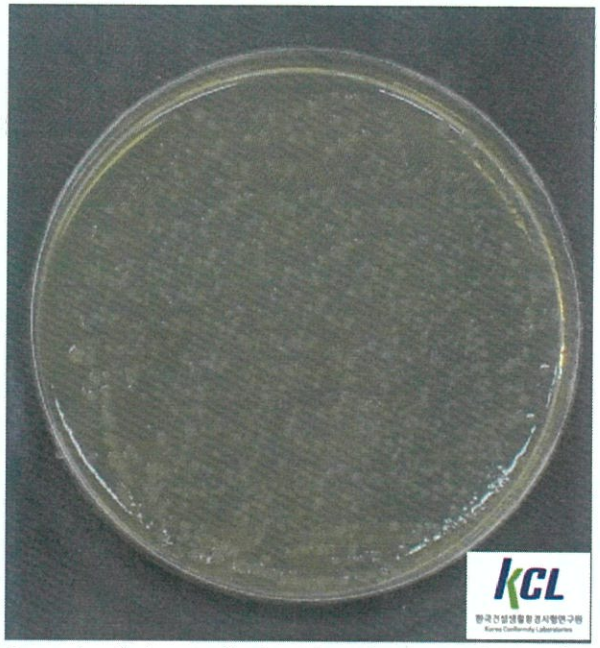
※ Test strain : *Salmonella typhimurium* IFO 14193
Klebsiella pneumoniae ATCC 4352
MRSA(*Staphylococcus aureus subsp. aureus* ATCC 33591)

※ Sample : Air Disinfection Purifier (WADU-02)

※ Client's requirement method
- Test time : 4 hours
- Distance between of the medium inoculated with the strain and the sample : 5 ㎝

TEST REPORT

No : CT16-027129



<Picture 1. *Salmonella typhimurium* - BLANK (0 h)>

<Picture 2. *Salmonella typhimurium* - Air Disinfection Purifier (WADU-02) (4 h)>

TEST REPORT

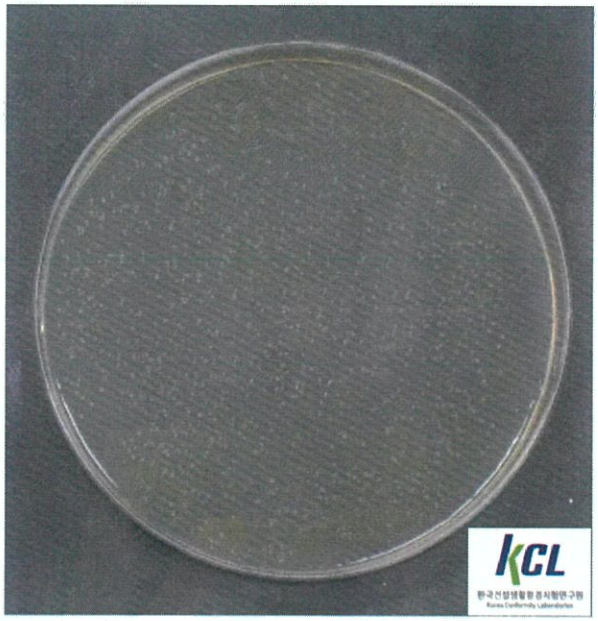
No : CT16-027129

<Picture 3. *Klebsiella pneumoniae* - BLANK (0 h)>

<Picture 4. *Klebsiella pneumoniae* - Air Disinfection Purifier (WADU-02) (0 h)>

TEST REPORT

No : CT16-027129



<Picture 5. MRSA - BLANK (0 h)>

<Picture 6. MRSA - Air Disinfection Purifier (WADU-02) (4 h)>

----- End of Report -----