



Department of Environmental Science

College of Natural Sciences

Chuncheon, Kangwon Do 200-701, KOREA

Phone: +82-33-250-8570, Fax: +82-33-251-3991

<http://www.kangwon.ac.kr/~envsci>

**Kangwon
National
University**

KANGWON NATIONAL UNIVERSITY
Environmental microbiology laboratory

REPORT FOR ANALYSIS

Tested by Da woon Jung

ISSUED BY Tae-Seok Ahn

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REPORT FOR ANALYSIS

TEST No. : EM20150002

Period tested : March 1 ~ April 30, 2015

Applicant	Wellis. Co., Ltd. (located in Seoul, Korea)
Name of sample	Wellis air disinfection unit : WADU-01
Status of sample	Device + Cartridge including liquid type container
Standard and Method	- Surface disinfection test : Reference - Leeds University Tests Report, November 2007 - Airborne disinfection test : Reference - HPA Report, August 2006
Items of Analysis	-Surface and Airborne Disinfection Examination <i>Bacillus subtilis</i> <i>Escherichia coli</i> <i>Staphylococcus aureus</i>
Remarks	Test Chamber : 8M ³ (2M x 2M x 2M)





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REPORT FOR ANALYSIS

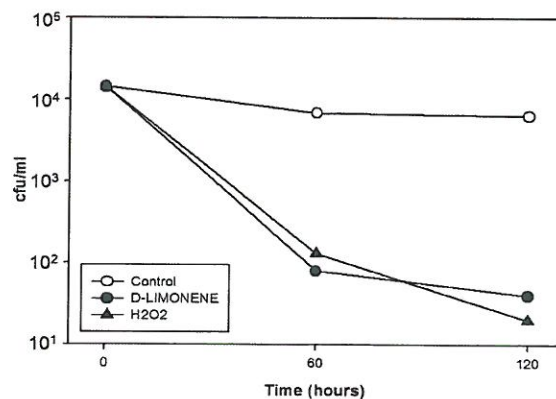
Surface disinfection test (Reference : Leeds University Tests Report, November 2007)

	Control		Test			
	Bacterial colony (CFU)	Removal rate (%)	D-LIMONENE		H ₂ O ₂	
			Bacterial colony (CFU)	Removal rate (%)	Bacterial colony (CFU)	Removal rate (%)
<i>B. subtilis</i>	6850	52.4	80	99.4	130	99.1
<i>E-coli</i>	15552	38.3	10	99.9	20	99.9
<i>S. aureus</i>	13830	10.2	7717	52.3	7469	50.0

Note :

1. Test chamber: 8m³
2. Results at 1 hour operating
3. 2 solution (D-LIMONENE, H₂O₂) were used for device
4. 3 bacteria species (*Bacillus subtilis*, *Escherichia coli*, and *Staphylococcus aureus*) were used.
5. Cloths (cotton) surface

1) *Bacillus subtilis*



*Detection limit: <10¹ cfu/ml

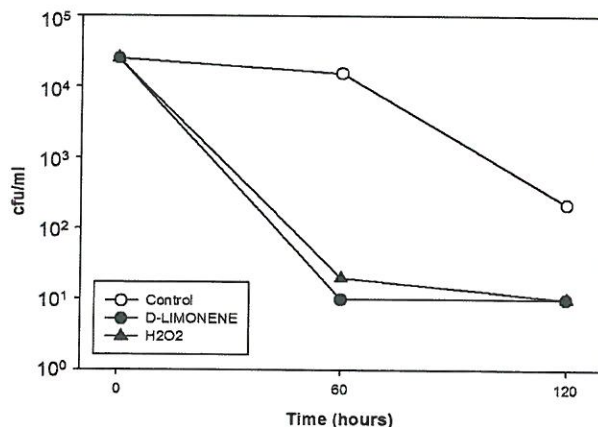
Removal rate at 60 min.

	Control	D-LIMONENE	H ₂ O ₂
Removal rate (%)	52.4	99.4	99.1
Test - control (%)	-	47.0	46.7





2) *Escherichia coli*

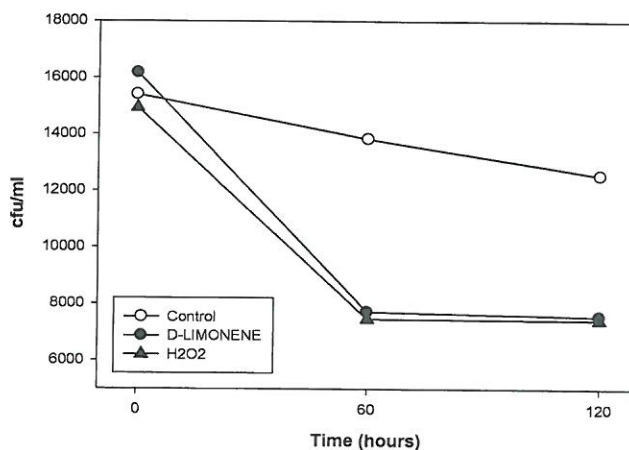


*Detection limit: <10¹ cfu/ml

Removal rate at 60 min.

	Control	D-LIMONENE	H ₂ O ₂
Removal rate (%)	38.3	99.9	99.9
Test - control(%)	-	61.7	61.6

3) *Staphylococcus aureus*



*Detection limit: <10¹ cfu/ml

Removal rate at 60 min.

	Control	D-LIMONENE	H ₂ O ₂
Removal rate (%)	10.2	52.3	50.0
Test - control(%)	-	42.1	40.0



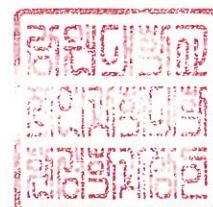


Airborne disinfection test (Reference: HPA Report, August 2006)

	Before		After			
	Bacterial colony (CFU)		D-LIMONENE		H ₂ O ₂	
	D-LIMONENE	H ₂ O ₂	Bacterial colony (CFU)	Removal rate (%)	Bacterial colony (CFU)	Removal rate (%)
<i>Bacillus subtilis</i>	10400	10000	40	99.6	8	99.9
<i>Escherichia coli</i>	65000	38000	38	99.9	4	99.9
<i>Staphylococcus aureus</i>	270000	228000	159	99.9	118	99.9

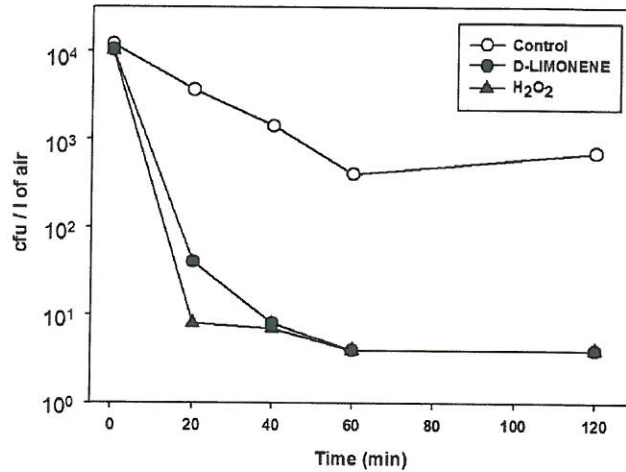
Note :

1. Test chamber: 8m³
2. Results at 20, 60 mins operating
3. 2 solution (D-LIMONENE, H₂O₂) were used for device
4. 3 bacteria species (*Bacillus subtilis*, *Escherichia coli*, and *Staphylococcus aureus*) were used.





1) *Bacillus subtilis*



* Detection limit: < 2 cfu/L

The number of bacterial colonies in air (l) under device switched ON (D-LIMONENE, H₂O₂) and OFF (control) condition.

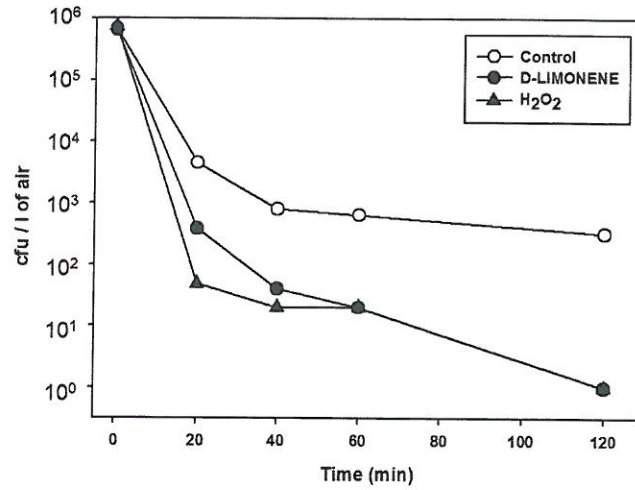
	0 min	20 min	40 min	60 min	120 min
Control	12000	3600	1400	400	700
D-LIMONENE	10400	40	8	4	4
H ₂ O ₂	10000	8	7	4	4

Unit: cfu/ l





2) *Escherichia coli*



* Detection limit: < 2 cfu/L

The number of bacterial colonies in air (l) under device switched ON (D-LIMONENE, H₂O₂) and OFF (control) condition.

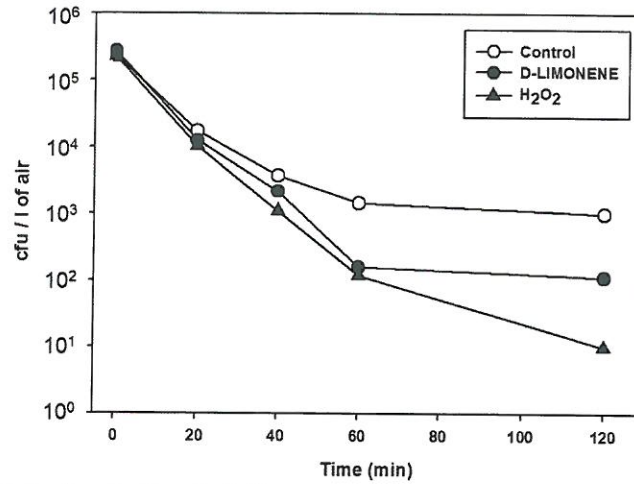
	0 min	20 min	40 min	60 min	120 min
Control	67000	448	80	64	32
D-LIMONENE	64000	4	6	2	<2
H ₂ O ₂	65000	38	4	2	<2

Unit: cfu/l





3) *Staphylococcus aureus*



* Detection limit: < 2 cfu/L

The number of bacterial colonies in air (l) under device switched ON (D-LIMONENE, H₂O₂) and OFF (control) condition.

	0 min	20 min	40 min	60 min	120 min
Control	230000	17200	3672	1441	1000
D-LIMONENE	270000	12400	2160	159	112
H ₂ O ₂	228000	10300	1100	118	10

Unit: cfu/l





4) Summary: Number of colonies at 20, 60 min

