FINAL REPORT

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KOREA TESTING & RESEARCH INSTITUTE

Final Report

2011-TBH-000013

Book Sterilizer (Self Clean)

Bactericidal Test

KOREA TESTING & RESEARCH INSTITUTE

Test Outline

Test Title : Bactericidal test

Report Number : 2011-TBH-000013

Test Article : Book Sterilizer (Self Clean)

Purpose : To evaluate the bactericidal ability of the test article, bactericidal test was performed against E. coli and S. aureus.

Test Method : Provided by Client- This test was performed by the method provided by the client.

Sponsor

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Test Period 2011. 01. 07 ~ 2011. 02. 07

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1. Summary

To evaluate the bactericidal activity of the requested test article [book sterilizer (self clean)], a bactericidal test was performed against gram negative strain (*E. coli*) and gram positive strain (*S. aureus*). After 2 min ± 5 s in the Book Sterilizer (Self Clean), the bactericidal activity was 97.1 % at test position[1)] ① and 99.9 % at test position ② and 99.9 % at test position ③ against gram negative *E. coli*. On the same condition, the bactericidal activity was 92.9 % at test position ① and 99.9 % at test position ② and 99.9 % at test position ③ against gram positive *S. aureus*.

1) Test position (by the client) : ① Center of top of the book, ② Center of rear of the book, ③ Center of bottom of the book

2. Equipment & Materials

2.1. Equipment :

AutoClave	(Sanyo, Japan)
Dry Oven	(Jisico, Korea)
Water Bath	(Polyscience, USA)
Incubator	(Memmert, German)
pH Meter	(Thermo Orion, USA)
Stop Watch	(Time Art, Japan)
Vortex Mixer	(Thermolyne, USA)
Container	(Iwaki Pyrex, Japan)
Sterile Pipette	(FALCON, USA)
Petri Dish	(Green Cross Medical Corp. Korea)
Volumetric Flask	(Myung Sung, Korea)
Mechanical Shaker	(Jisico, Korea)
Clean Bench	(Su Gong Yang Hang, Korea)
Colony Counter	(Dukwoo Science, Korea)

2.2. Test materials

1) Test organism : *Escherichia coli* ATCC 25922
Staphylococcus aureus ATCC 6538

2) Media and test reagent

A. Nutrient Broth (DIFCO, USA)
B. Tryptic Soy Agar (DIFCO, USA)
C. SCDLP (EIKEN CHEMICAL CO. LTD, JAPAN)
D. Saline

3. Test Method

3.1. Test method : *E. coli* and *S. aureus* strains grown in liquid media was diluted to make its initial cell number be 10^6 ~ 10^7 CFU/Carrier. 15 μL of the bacterial inoculum were placed on translucent glass carriers (semitransparent) (2.5 x 1.5) cm and naturally dried at room temperature. The test book was placed at center of the third holder from the left-side in the chamber, and the top of the book was placed in inside direction. After the test carrier placed on the requested test position, the chamber was operated for 2 min ± 5 s. After operating, the test carriers were placed aseptically into test tubes, which were contained 20 mL of neutralizer (SCDLP : Eiken), they were ultrasonicated for 5 min and vortex mixed for 30 s to extract the treated inoculum. The number of viable cells was measured from this extracted solution. In the same way, initial bacterial number was measured without operating of chamber. If colonies were formed on the media, they were calculated by multiplying the dilution ratio. If colonies were not formed on the media, the dilution ratio in its neutralizing state was multiplied and the result was expressed as less than 20 (< 20). The number of viable bacteria was determined by using section 3.2 [equation 1] and the reduction rate of sterilizing ability was determined by [equation 2].

3.2. Result Calculation

1) Viable cell count : [equation 1.] $N = C \times D \times V$

N: number of viable cells

C: number of colonies (mean of 2 plates)

D: dilution factor

V: volume (20 mL) of SCDLP

2) Decrease rate of bactericidal activity (%) : [equation 2.] $R\ (\%) = [\ (\ A - B\ )\ /\ A\ ] \times 100$

R: decrease rate

A: plate count of initial time

B: plate count of designate time

4. Result

4.1. Bactericidal test against *E. coli* (Table 1)

The initial bacterial number was [1.6 x 10^7 CFU/Carrier] and after 2 min ± 5 s operation, the bacterial number reduced to [4.6 x 10^5 CFU/Carrier] at test position ①, [2.4 x 10^3 CFU/Carrier] at test position ② and [8.4 x 10^3 CFU/Carrier] at test position ③.

4.2. Bactericidal test against *S. aureus* (Table 2)

The initial bacterial number was [1.4 x 10^7 CFU/Carrier] and after 2 min ± 5 s operation, the bacterial number reduced to [1.0 x 10^6 CFU/Carrier] at test position ①, [7.6 x 10^3 CFU/Carrier] at test position ② and [2.1 x 10^4 CFU/Carrier] at test position ③.

5. Discussion & Conclusion

Microorganisms can be found in every ecosystem with a broad diversity. While pathogenic and non-pathogenic organisms coexist, sterilization is a method used to kill all the living microorganisms completely. Among several kinds of sterilization methods (heat, filtration, etc.), physical sterilization is used most widely. Disinfection is the process of eliminating or suppressing the growth of microorganisms by various chemicals. Disinfectant refers to any chemical agent that destroys most pathogens by suppressing the spread of microorganisms, but may not kill bacterial spores. Disinfectants include heavy metals, halogen chemicals, oxidizing agents, acids and bases, phenol derivatives, aliphatic compounds, surfactants, dyes, preservatives, etc. Since most microorganisms grow rapidly under suitable conditions, harmful effects such as deformation, discoloration and pigmentation can be induced by the growth of microorganisms. Furthermore, the spread of disease by pathogenic agents can occur. Therefore, to reduce the damage caused by microorganisms, materials which have antimicrobial effects have been imparted to industrial products. The effects of these antimicrobial materials sterilizing or inhibiting the growth of microbes include destruction of permeability of the cell membrane, denaturation of functional protein and disruption of nucleic acid.

As a result of bactericldal test against *E. coli* and *S. aureus* in the test sample [Book Sterilizer (Self Clean)], after 2 min ± 5 s operating, bactericidal activity against *E. coli* was 97.1 % at test position ①, 99.9 % at test position ② and 99.9 % at test position ③. In the same order, bactericidal activity against *S. aureus* was 92.9 % at test position ①, 99.9 % at test position ② and 99.9 % at test position ③.

6. References

6.1. Test method provided by the client

6.2. JIS Z 2801 : 2006, Antimicrobial products – methods for antimicrobial test · antimicrobial effect

6.3. KS J 4206 : 2008, Antimicrobial test for antimicrobacterial function product – chapter 1 : shake flask method

6.4. KS K 0639 : 2006, Antimicrobial test of fabric

6.5. The Food and Drug Administration notice No. 2006-35

6.6. EN 1276, Chemical Disinfectants and antiseptics

6.7. ISO 22196, Plastics-Measurement of antibacterial activity on plastics surfaces

6.8. ASTM E 2180-01, Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agents In Polymeric or Hydrophobic Materials

6.9. Microbiology a laboratory manual, James G, 1983

7. Tables

Table 1. Result of bactericidal test against *E. coli* (Unit : CFU/Carrier)

Test position	Initial	After 2 min ± 5 s
①	1.6×10^{7}	4.6×10^{5} (97.1 %)
②		2.4×10^{3} (99.9 %)
③		8.4×10^{3} (99.9 %)

$$* Decrease\ rate\ (\%) = \frac{(A-B)}{A}\times 100$$

where, A: plate count of initial time

B: plate count of designate time

Table 2. Result of bactericidal test against *S. aureus* (Unit : CFU/Carrier)

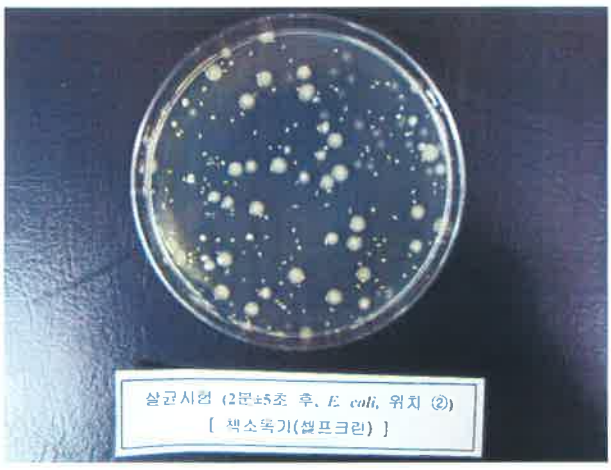
Test position	Initial	After 2 min ± 5 s
①	1.4×10^{7}	1.0×10^{6} (92.9 %)
②		7.6×10^{3} (99.9 %)
③		2.1×10^{4} (99.9 %)

8. Attachment

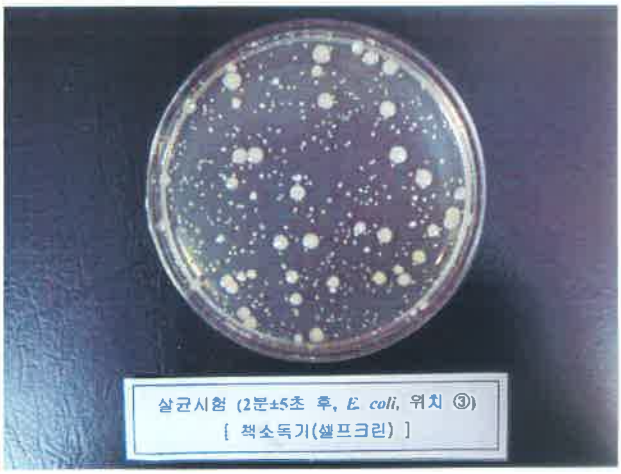
8.1. Test result pictures

Bactericidal test (Initial, *E. coli*)
[Book Sterilizer (Self Clean)]

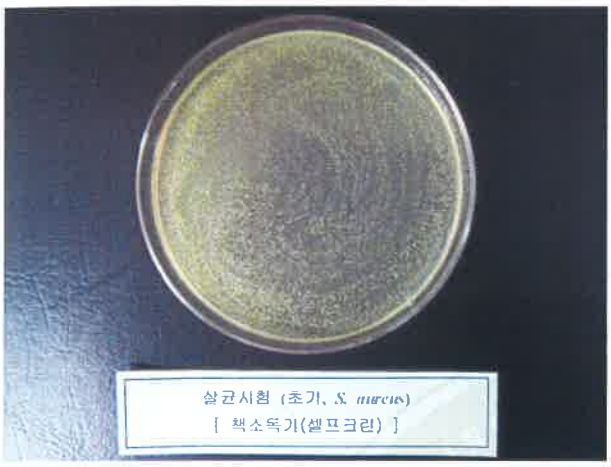
Bactericidal test (after 2 min ± 5 s,
E. coli, test position ①)
[Book Sterilizer (Self Clean)]



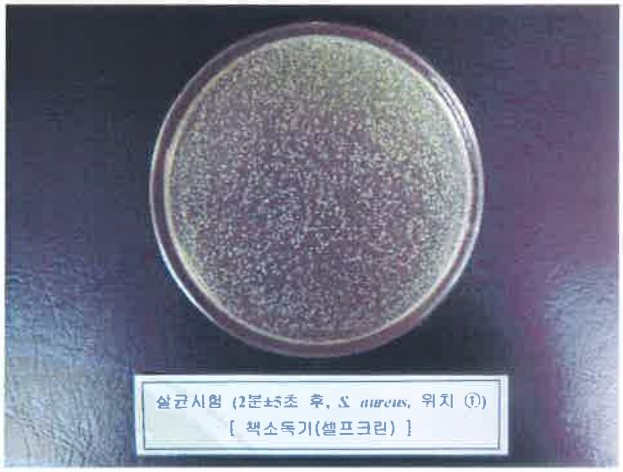
Bactericidal test (after 2 min ± 5 s,
E. coli, test position ②)
[Book Sterilizer (Self Clean)]



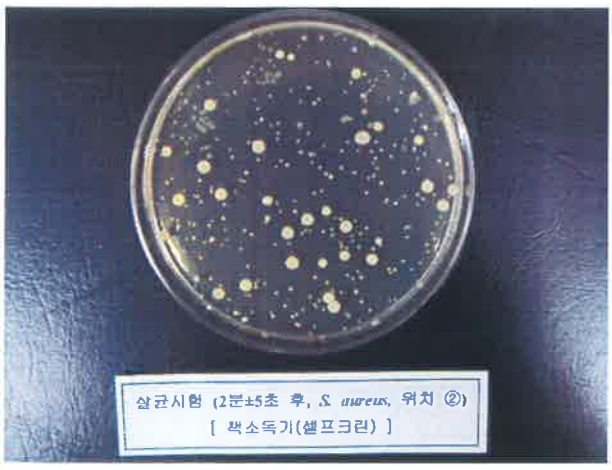
Bactericidal test (after 2 min ± 5 s,
E. coli, test position ③)
[Book Sterilizer (Self Clean)]



Bactericidal test (Initial, *S. aureus*)
[Book Sterilizer (Self Clean)]



Bactericidal test (after 2 min ± 5 s,
S. aureus, test position ①)
[Book Sterilizer (Self Clean)]



Bactericidal test (after 2 min ± 5 s,
S. aureus, test position ②)
[Book Sterilizer (Self Clean)]

Bactericidal test (after 2 min ± 5 s,
S. aureus, test position ③)
[Book Sterilizer (Self Clean)]

8.2. Test article picture

Book Sterilizer (Self Clean)

This test report is issued by Korea Testing & Research Institute(KTR). On using its results outside, it shall be assured to declare that the test results above mentioned is carried out by KTR.

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