



Japan  
Food  
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Laboratories

# Japan Food Research Laboratories

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Page 1 of 8

September 25, 2012

## REPORT

Client: MAEDA-KOUGYOU Co., Ltd  
220-1 Norimatsu Yahatanishi ward Kitakyushu city  
Dr. Khaled Hussein

Sample(s): Included in report

Title: Antibacterial Activity Test

Received date of sample(s): April 26, 2012

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Noriko Imaizumi  
Principal Investigator

Date



## Antibacterial Activity Test

### 1. Client

MAEDA-KOUGYOU Co., Ltd  
220-1 Norimatsu Yahatanishi ward Kitakyushu city  
Dr. Khaled Hussein

### 2. Samples

- 1) MVX (Miracle Titanium Photocatalytic) Coat Stainless Steel surface
- 2) MVX (Miracle Titanium Photocatalytic) Coat Plastic surface

### 3. Outline of methods

Antibacterial activity tests were performed on the samples with reference to ISO 27447: 2009 Fine ceramics (advanced ceramics, advanced technical ceramics) - Test method for antibacterial activity of semiconducting photocatalytic materials "Film adhesion method".

The bacteria strain to be used in the test was *Staphylococcus aureus* subsp. *aureus* NBRC 12732.

### 4. Results

Table 1 shows the results. According to the request from the client, the photocatalyst antibacterial activity value after UV irradiation ( $R_L$ ) and the photocatalyst antibacterial activity value with UV irradiation ( $\Delta R$ ) were calculated and are shown in Tables 2 and 3. Table 4 expresses the test conditions.

Photos 1 to 7 show the agar plates after incubation.

$$R_L = \log [B_L / C_L]$$

$$\Delta R = \log [B_L / C_L] - \log [B_D / C_D]$$

$B_L$ : Average number of viable bacteria of non-treated specimens (glass panes), after UV irradiation for 8 hours

$C_L$ : Average number of viable bacteria of photocatalytic treated specimens (the sample), after UV irradiation for 8 hours

$B_D$ : Average number of viable bacteria of non-treated specimens (glass panes), after being kept in a dark place for 8 hours

$C_D$ : Average number of viable bacteria of photocatalytic treated specimens (the sample), after being kept in a dark place for 8 hours

Table 1: Test results of the number of viable bacteria – Film adhesion method

Bacteria species	Incubation period	Test specimen	Number of viable bacteria (per one piece of the test specimen)					
			UV irradiation *1			Dark place		
			Test 1	Test 2	Test 3	Test 1	Test 2	Test 3
<i>Staphylococcus aureus</i>	Just after inoculation *2	Control	$1.8 \times 10^5$	$1.7 \times 10^5$	$1.7 \times 10^5$	$1.8 \times 10^5$	$1.7 \times 10^5$	$1.7 \times 10^5$
		Sample 1)	<10	<10	<10	$7.0 \times 10^4$	$5.4 \times 10^4$	$6.2 \times 10^4$
	After 8 hours *3	Sample 2)	60	<10	<10	$1.5 \times 10^5$	$1.1 \times 10^5$	$1.2 \times 10^5$
		Control	$4.9 \times 10^4$	$6.9 \times 10^4$	$5.7 \times 10^4$	$1.7 \times 10^5$	$1.9 \times 10^5$	$1.4 \times 10^5$

<10: Not detected

Control: glass panes

\*1 UV intensity:  $0.25 \text{ mW/cm}^2$

\*2 The results were applied for the number of viable bacteria under UV irradiation and that in a dark place.

\*3 Stored at room temperature ( $25 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$ )

Table 2: Photocatalyst antibacterial activity value after UV irradiation ( $R_L$ )

Bacteria species	Test specimen	$R_L^*$
<i>Staphylococcus aureus</i>	Sample 1)	>3.7
	Sample 2)	3.3

\* Calculated at the request of the client.

Table 3: Photocatalyst antibacterial activity value with UV irradiation ( $\Delta R$ )

Bacteria species	Test specimen	$\Delta R^*$
<i>Staphylococcus aureus</i>	Sample 1)	>3.3
	Sample 2)	3.2

\* Calculated at the request of the client.

Table 4: Test conditions

Description		Non-treated specimen	Photocatalyst specimen
Test specimen	Type	Glass panes	Samples 1) and 2)
	Size	About 50 mm × 50 mm	About 5 cm × 5 cm
	Shape	Square	Square
	Thickness	About 2 mm	Sample 1): about 0.5 mm Sample 2): about 2 mm
Fluorescent UV light		BLB (black light blue) lamp, FL20S BLB 20 W (Sankyo Denki Co., Ltd.)	
Pre-irradiation exposure		BLB (black light blue) lamp, FL20S BLB 20 W (Sankyo Denki Co., Ltd.) Intensity: 1.0 mW/cm <sup>2</sup> Exposure duration: 24 hours 00 minutes	
Ultraviolet light radiometer		UV RADIOMETER UVR-2 UD-36 Sensor (TOPCON CORPORATION)	
Adhesive film		Transparency film, about 40 mm × 40 mm (KOKUYO Co., Ltd.)	
Moisture preservation glass		Borosilicate glass	
UV irradiation conditions		Intensity: 0.25 mW/cm <sup>2</sup> , Light exposure duration: 8 hours	
Volume of the test bacteria suspension	<i>Staphylococcus aureus</i>	0.15 mL	
Number of viable bacteria in the test bacteria suspension	<i>Staphylococcus aureus</i>	1.1 × 10 <sup>6</sup> /mL	

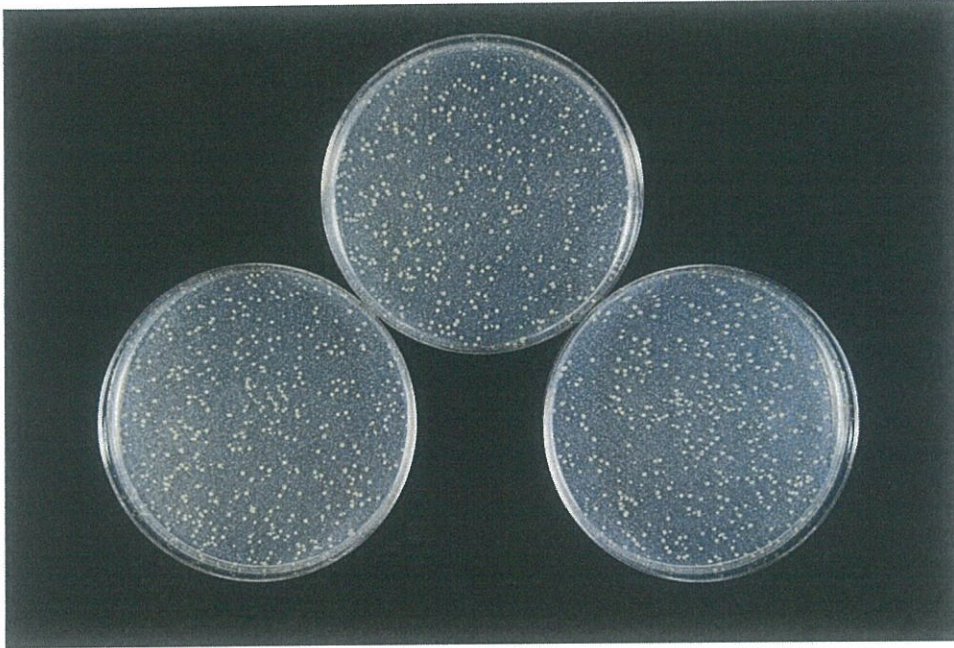


Photo 1: *Staphylococcus aureus*, Just after inoculation, Control  
(1 mL of the washout solution)



Photo 2: *Staphylococcus aureus*, UV irradiation for 8 hours, Sample 1)  
(1 mL of the washout solution)

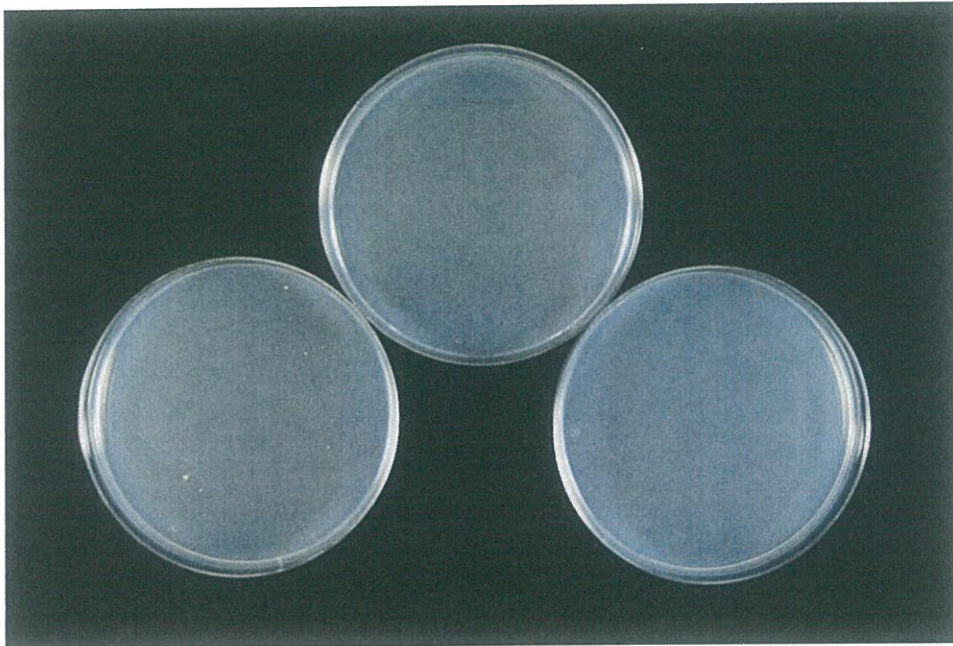


Photo 3: *Staphylococcus aureus*, UV irradiation for 8 hours, Sample 2)  
(1 mL of the washout solution)

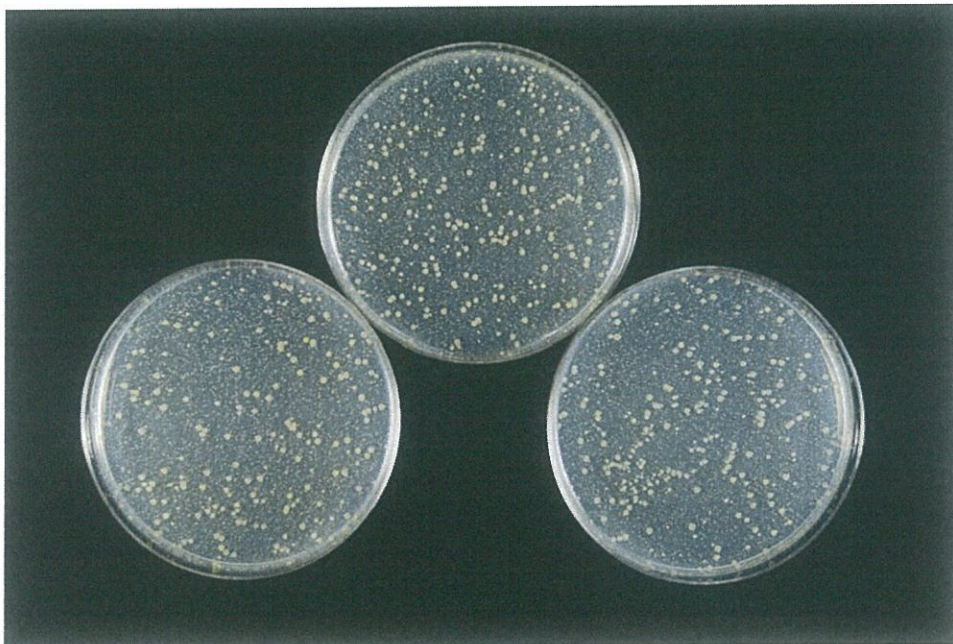


Photo 4: *Staphylococcus aureus*, UV irradiation for 8 hours, Control  
(1 mL of the washout solution)

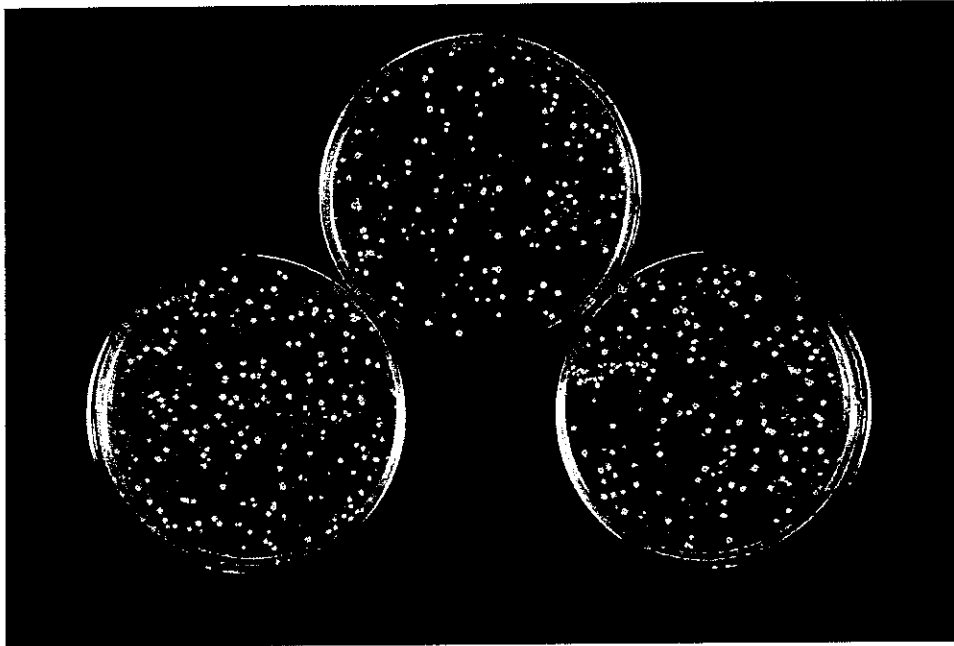


Photo 5: *Staphylococcus aureus*, In a dark place for 8 hours, Sample 1)  
(1 mL of the washout solution)

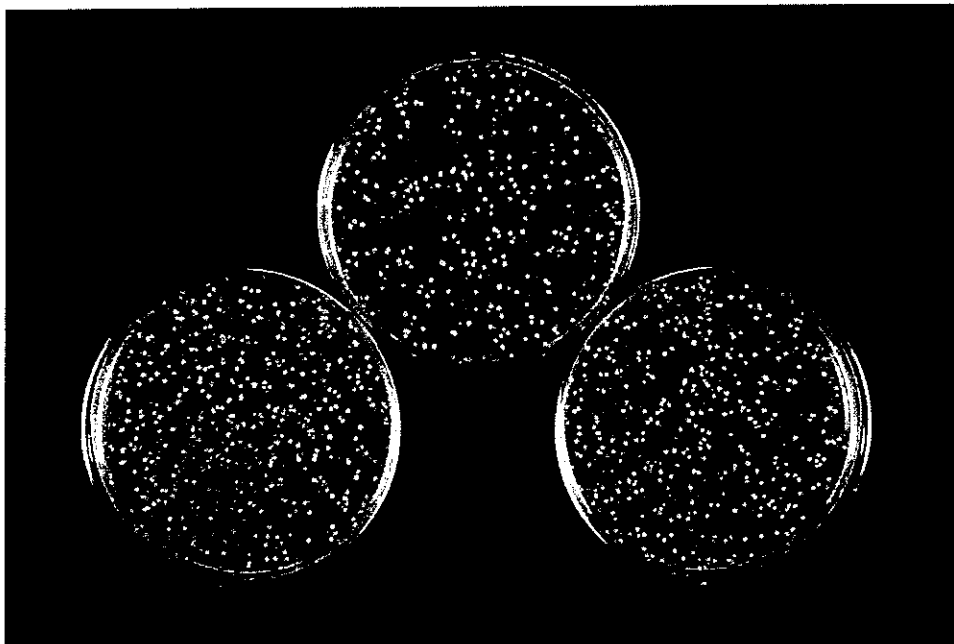


Photo 6: *Staphylococcus aureus*, In a dark place for 8 hours, Sample 2)  
(1 mL of the washout solution)

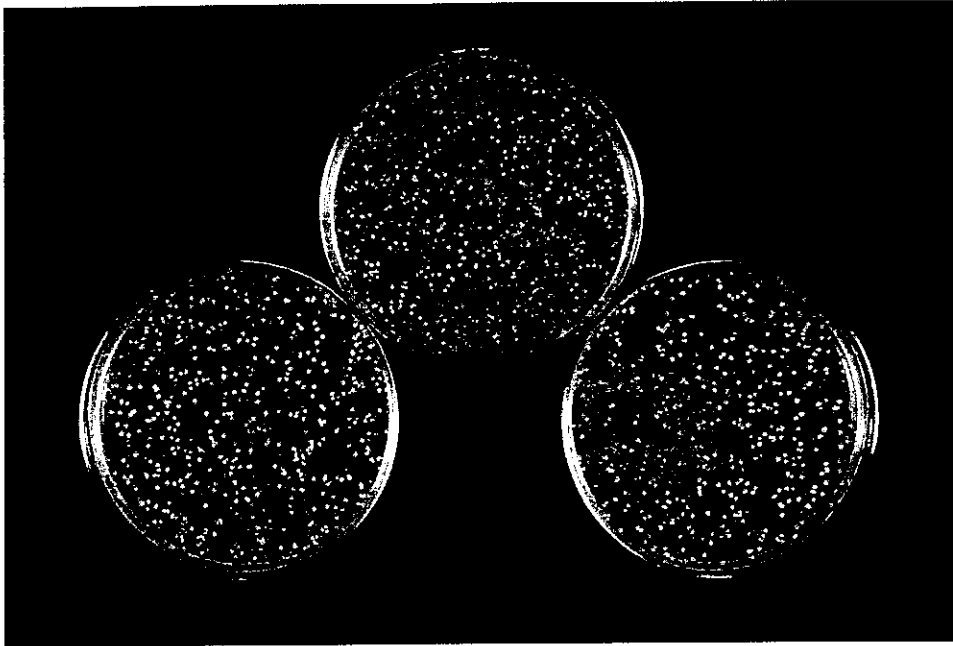


Photo 7: *Staphylococcus aureus*, In a dark place for 8 hours, Control  
(1 mL of the washout solution)

**\*\*End of Report\*\***