

Test report

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Fibo AS

ISO 22196:2011 / JIS Z 2801

19 test products

Antibacterial activity

SUBJECT

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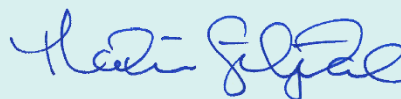
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ATTACHMENTS

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1. Objective

The objective of this report is to evaluate the antibacterial activity of High-Pressure laminates (HPL). Mycoteam AS has received samples for testing from Fibo AS.

The test was performed according to the method described in the international standard ISO 22196: 2011 (Measurement of antibacterial activity on plastics and other non-porous surfaces). In addition, an assessment of the antibacterial property has been made in accordance with the limit value stated in the standard JIS Z 2801.

Tests were performed in three rounds on a total of 19 combinations of chemistry (producer A, B, C and D), structure (EM, HG, S, STN, SL, CRESCENDO, MET, RU and GEM) and with or without a milling slot. See Tables 1, 2 and 3. Milling and sub-sheets are the same for all products with the same chemistry (producer).

Table 1. Test materials, test round 1, December 2020

Nr.	Sample	Chemistry	Structure	Milling slot
1	0530-M00 EM Kingston	A	EM	-
2	2212-F00 HG Aquamarine	A	HG	-
3	2123-M00 HG Pure White	B	HG	-

Table 2. Test materials, test round 2, February 2021

Nr.	Sample	Chemistry	Structure	Milling slot
4	0528 - M6060 EM Lima	A	EM	With milling slot
5	2123 – M6060 Pure White	B	HG	With milling slot

Table 3. Test materials, test round 3, September 2021

Nr.	Sample	Chemistry	Structure	Milling slot
6	2204-F00 Cracked Cement	A	S	-
7	0194-F00 Marina Grey Oak	A	EM	-
8	4746-F00 Grey Sahara	A	STN	-
9	5091-F00 Athen White	A	HG	-
10	4091-F00 White Slate	A	SL	-
11	1533 – Crescendo Gris Grande	A	CRESCENDO	-
12	5003-F00 Steel	A	MET	-
13	0172 S Polar Grey	B	S	-
14	2094-F00 White Silk	C	S	-
15	2898-F00 Shabby Chic	C	RU	-
16	2898-M63 Shabby Chic	C	RU	With milling slot
17	4281-F00 Abbey Shale	C	GEM	-
18	4943-F00 Grey Concrete	C	EM	-
19	1050 Sugar Sparkle	D	HG	-

2. Method summary

Anti-bacterial activity is determined in accordance with a modified version of ISO 22196:2011. See Table 4 for different test variables.

During the test, the test samples and reference samples were inoculated with 0,4 ml of test inoculum (Table 5, 6 and 7). The samples were then covered with a PPE cover film. Immediately after inoculation, the bacteria from the reference samples were recovered and the number of viable bacteria (CFU: colony-forming units) per cm² was determined (U₀).

A further set of the inoculated reference samples and test samples were incubated at (35 +/- 1) °C in (24 +/- 1) hours. After incubation, the bacteria from the remaining samples were recovered and CFU per cm² for the reference samples (U_t) and the test samples (A_t) was determined (table 8-13).

Values for antibacterial activity (R) is calculated from the formula:

$$R = [\log (U_t / U_0) - \log (A_t / U_0)]$$

Table 4. Test variables.

Dates	11.12.2020, 12.02.2021, 09.09.2021, 14.09.2021
Method of pre-cleaning	Wiped with 70% ethanol in water
Untreated test sample	Glass slide (50 mm x 50 mm x 1.20 mm)
Size of the test material	50 mm x 50 mm
Cover film	Polypropylene film (PPE) (40 mm x 40 mm x 0.05 mm)
Inoculum volume	0.4 ml
Neutralizing solution	PBS + 0.2% Tween 80
Neutralizing solution volume	10 ml

Table 5. Test organisms, test round 1

Microorganism	Strain	Test inoculum concentration
<i>Staphylococcus aureus</i>	ATCC 6538P	7.5 x 10 ⁵ cells/ml
<i>Escherichia coli</i>	ATCC 8739	8.6 x 10 ⁵ cells /ml

Table 6. Test organisms, test round 2.

Microorganism	Strain	Test inoculum concentration
<i>Staphylococcus aureus</i>	ATCC 6538P	8.8 x 10 ⁵ cells /ml
<i>Escherichia coli</i>	ATCC 8739	7.9 x 10 ⁵ cells /ml

Table 7. Test organisms, test round 3.

Microorganism	Strain	Test inoculum concentration
<i>Staphylococcus aureus</i>	ATCC 6538P	2.5 x 10 ⁵ cells /ml
<i>Escherichia coli</i>	ATCC 8739	7.5 x 10 ⁵ cells /ml

3. Results

Table 8. The number of viable bacteria in cells/cm², estimated antimicrobial activity, and the percent reduction of the evaluated samples when tested against *Staphylococcus aureus* (11.12.2020).

Nr.	Sample	Number of viable bacteria in cells/cm ² (Log10)			Antimicrobial activity R	Percent reduction %
		U ₀	U _t	A _t		
	Glass slide (untreated control) 11.12.20	4.11	3.84	-	-	-
1	0530-M00 EM Kingston	-	-	<0	4.05	>99.99
2	2212-F00 HG Aquamarine	-	-	<0	4.05	>99.99
3	2123-M00 HG Pure White	-	-	<0	4.05	>99.99

Table 9. The number of viable bacteria in cells/cm², estimated antimicrobial activity, and the percent reduction of the evaluated samples when tested against *Escherichia coli* (11.12.2020).

Nr.	Sample	Number of viable bacteria in cells/cm ² (Log10)			Antimicrobial activity R	Percent reduction %
		U ₀	U _t	A _t		
	Glass slide (untreated control) 11.12.20	3.85	4.96	-	-	-
1	0530-M00 EM Kingston	-	-	<0	5.16	>99.99
2	2212-F00 HG Aquamarine	-	-	<0	5.16	>99.99
3	2123-M00 HG Pure White	-	-	<0	5.16	>99.99

Tabell 10. The number of viable bacteria in cells/cm², estimated antimicrobial activity, and the percent reduction of the evaluated samples when tested against *Staphylococcus aureus* (12.02.2021).

Nr.	Sample	Number of viable bacteria in cells/cm ² (Log10)			Antimicrobial activity R	Percent reduction %
		U ₀	U _t	A _t		
	Glass slide (untreated control) 12.02.21	4.34	3.87	-	-	-
4	0528 - M6060 EM Lima (with milling slot)	-	-	<0	4.07	>99.99
5	2123 - M6060 HG Pure White (with milling slot)	-	-	<0	4.07	>99.99

Tabell 11. The number of viable bacteria in cells/cm², estimated antimicrobial activity, and the percent reduction of the evaluated samples when tested against *Escherichia coli* (12.02.2021).

Nr.	Sample	Number of viable bacteria in cells/cm ² (Log10)			Antimicrobial activity R	Percent reduction %
		U ₀	U _t	A _t		
	Glass slide (untreated control) 12.02.21	4.21	4.82	-	-	-
4	0528 - M6060 EM Lima (with milling slot)	-	-	<0	5.03	>99.99
5	2123 - M6060 HG Pure White (with milling slot)	-	-	<0	5.03	>99.99

Tabell 12. The number of viable bacteria in cells/cm², estimated antimicrobial activity, and the percent reduction of the evaluated samples when tested against *Staphylococcus aureus* (14.09.2021).

Nr.	Sample	Number of viable bacteria in cells/cm ² (Log10)			Antimicrobial activity R	Percent reduction %
		U ₀	U _t	A _t		
	Glassplate (ubehandlet kontroll) 14.09.21	3.79	3.38	-	-	-
6	2204-F00 Cracked Cement	-	-	<0	3.58	>99.97
7	0194-F00 Marina Grey Oak	-	-	<0	3.58	>99.97
8	4746-F00 Grey Sahara	-	-	<0	3.58	>99.97
9	5091-F00 Athen White	-	-	<0	3.58	>99.97
10	4091-F00 White Slate	-	-	<0	3.58	>99.97
11	1533 - Crescendo Gris Grande	-	-	<0	3.58	>99.97
12	5003-F00 Steel	-	-	<0	3.58	>99.97
13	0172 S Polar Grey	-	-	<0	3.58	>99.97
14	2094-F00 White Silk	-	-	<0	3.58	>99.97
15	2898-F00 Shabby Chic	-	-	<0	3.58	>99.97
16	2898-M63 Shabby Chic	-	-	<0	3.58	>99.97
17	4281-F00 Abbey Shale	-	-	<0	3.58	>99.97
18	4943-F00 Grey Concrete	-	-	<0	3.58	>99.97
19	1050 Sugar Sparkle	-	-	<0	3.58	>99.97

Tabell 13. The number of viable bacteria in cells/cm², estimated antimicrobial activity, and the percent reduction of the evaluated samples when tested against *Escherichia coli* (09.09.2021).

Nr.	Sample	Number of viable bacteria in cells/cm ² (Log10)			Antimicrobial activity	Percent reduction
		U ₀	U _t	A _t	R	%
	Glassplate (ubehandlet kontroll) 09.09.21	4.58	4.64	-	-	-
6	2204-F00 Cracked Cement	-	-	<0	4.85	>99.99
7	0194-F00 Marina Grey Oak	-	-	<0	4.85	>99.99
8	4746-F00 Grey Sahara	-	-	<0	4.85	>99.99
9	5091-F00 Athen White	-	-	<0	4.85	>99.99
10	4091-F00 White Slate	-	-	<0	4.85	>99.99
11	1533 - Crescendo Gris Grande	-	-	<0	4.85	>99.99
12	5003-F00 Steel	-	-	<0	4.85	>99.99
13	0172 S Polar Grey	-	-	<0	4.85	>99.99
14	2094-F00 White Silk	-	-	<0	4.85	>99.99
15	2898-F00 Shabby Chic	-	-	<0	4.85	>99.99
16	2898-M63 Shabby Chic	-	-	<0	4.85	>99.99
17	4281-F00 Abbey Shale	-	-	<0	4.85	>99.99
18	4943-F00 Grey Concrete	-	-	<0	4.85	>99.99
19	1050 Sugar Sparkle	-	-	<0	4.85	>99.99

4. Conclusion

The standard JIS Z 2801 provides a suggested criterion for verification of antibacterial activity. According to the standard JIS Z 2801, a product is determined to have antibacterial effectiveness when antibacterial activity (R) is ≥ 2 . All the samples tested showed an $R \geq 2$ when tested against both *Staphylococcus aureus* and *Escherichia coli*.

The percent reduction is determined by comparing the tested samples to the reference samples after 24 hours of incubation. All the tested samples showed >99.97% reduction after incubation.

The presence of a milling slot has not reduced the antibacterial property based on these tests.

References

- ISO 22196:2011 Measurement of antibacterial activity on plastics and nonporous Surfaces.
- JIS Z 2801 – Antibacterial products – Test for antibacterial activity and efficacy, 2017.

