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KASTAMONU INTEGRATED WOOD INDUSTRY
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Dresden, 08/03/2019

Test Report Order no. 2219009

Client: KASTAMONU INTEGRATED WOOD INDUSTRY LLC
SEZ "Alabuga", SH-3 street, building 3/3
423600 Yelabuga
Russian Federation

Date of order: 22/01/2019

Order: Determination of the antibacterial properties of laminate surfaces

Contractor: Entwicklungs- und Prüflabor Holztechnologie GmbH
Laboratory Unit Biological Testing
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Engineer in charge: Dipl.-Biol. Katharina Plaschkies



Dr Wolfram Scheiding

Head of Laboratory Biological Testing

ENTWICKLUNGS- UND
PRÜFLABOR HOLZ-
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Zellescher Weg 24 · 01217 Dresden



The test report contains 3 pages and 1 annex with 1 page. Any duplication, even in part, requires written permission of EPH. These test results are exclusively related to the tested material.

1 Task

Determination of the antibacterial properties of laminate surfaces

2 Test material

- no. 1: 8 mm 32 Cl
- no. 2: 8 mm 33 Cl
- no. 3: 7 mm 31 Cl

Manufacturer: KASTAMONU INTEGRATED WOOD INDUSTRY LLC

SEZ "Alabuga", SH-3 street, building 3/3, 423600 Yelabuga, Russian Federation

The test samples were delivered at 11 February 2019.

3 Test performance

The test was carried out according to ISO 22196 (2011): Plastics – Measurement of antibacterial activity on plastics surfaces.

A defined bacteria suspension (inoculum) was spread over the specimen's surface by covering with a polyethylene film (thickness 0,065 mm). These inoculated test specimens were incubated in a humid chamber at 36 °C for 24 hours. The antibacterial activity was determined from the number of viable bacteria after the incubation.

As reference sample without any antibacterial effect as well as for covering of the suspension on the specimens, a film from polyethylene was used.

Further details of the test:

Test strains:	<i>Escherichia coli</i> DSM 1576 <i>Staphylococcus aureus</i> subsp. <i>aureus</i> DSM 799
Size of the specimen surface:	50 mm × 50 mm
Size of the tested surface area:	40 mm × 40 mm
Film for covering:	polyethylene 40 mm × 40 mm × 0,065 mm
Cleaning of the specimens:	disinfection by 70 % ethanol
Number of replicates:	6 (3 specimens of the test material, 2 replicates of each dilution series)
Volume of test inoculum:	400 µl
Non-ionic surfactant:	Tween 80 (7 g/l)
Procedure for the determination of the viable number of bacteria:	plating of 50 µl on nutrient agar using a spiral plater, incubation at 36 °C
Period of the incubation:	24 hours <i>Escherichia coli</i> : February 13 th until 14 th 2019 <i>Staphylococcus aureus</i> : March 5 th until 6 th 2019

4 Validity of the test

Table 1: Criteria for valid values

Criteria (reference material)	Demand	Determined value in the test	
		<i>Escherichia coli</i>	<i>Staphylococcus aureus</i>
$\frac{[(\lg N_0)_{\max.} - (\lg N_0)_{\min.}]}{(\lg N_0)_{\text{average}}}$	≤ 0.20	0.04 (valid)	0.05 (valid)
$N_{0\text{average}}$ [cfu/cm ²]	6.2×10^3 up to 2.5×10^4	3.8×10^4 (deviation)*	4.4×10^4 (deviation)*
$N_{24\text{minimum}}$ [cfu/cm ²]	6.2×10^1	1.4×10^5 (valid)	4.3×10^3 (valid)
cfu: colony forming units (viable bacteria) N_0 : number of viable bacteria prior to the incubation N_{24} : number of viable bacteria after 24 h incubation			

*) The deviation does not influence essentially the test result.

5 Basis of the evaluation

The antibacterial activity R describes the reduction of the viable bacteria on the test surface within 24 hours in comparison to the reference material.

$$R = U_T - A_T$$

U_T : average of the common logarithm of the number of viable bacteria recovered from the reference material immediately after 24 hours in cfu/cm²

A_T : average of the common logarithm of the number of viable bacteria recovered from the test material immediately after 24 hours in cfu/cm²

An antibacterial activity of a material is given, if the recovery rate on it is at least 1.0 lg-stage lower than on the reference material, that means $R \geq 1$.

6 Results

On the reference material, the number of viable *Escherichia-coli*-bacteria increased by 0.9 lg-stages during 24 hours; the number of *Staphylococcus aureus* decreased by 0.7 lg-stages.

At the test materials, no bacteria were detected after 24 hours (values s. table 2 and annex).

Tab. 2 Results

	<i>Escherichia coli</i>	<i>Staphylococcus aureus</i>
Concentration of the inoculum	1.0×10^6 cfu/ml	1.0×10^6 cfu/ml
Theoretical recovery rate on the material	2.5×10^4 cfu/cm ²	2.5×10^4 cfu/cm ²
Recovery rate of viable bacteria after 0 hours on the reference material	3.8×10^4 cfu/cm ² lg = 4.6	4.4×10^4 cfu/cm ² lg = 4.6
Recovery rate of viable bacteria after 24 hours		
▪ Reference material	3.1×10^5 cfu/cm ² lg = 5.5 = U_T	8.7×10^3 cfu/cm ² lg = 3.9 = U_T
▪ Test materials no. 1, 2, 3	$< 6.0 \times 10^3$ cfu/cm ² lg < 0.8 = A_T	$< 6.0 \times 10^3$ cfu/cm ² lg < 0.8 = A_T
Antibacterial activity $R = U_T - A_T$	> 4.7	> 3.1

7 Conclusion

Three materials ("8 mm 32 Cl", "8 mm 33 Cl" and "7 mm 31 Cl") were tested according to ISO 22196:2007 with the bacteria strains *Escherichia coli* DSM 1576 and *Staphylococcus aureus* DSM 799. An clear antibacterial activity was detected for all materials.



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Dipl.-Biol. Katharina Plaschkies
Person in charge

Annex

Annex: single values

Table A1: Test results with *Escherichia coli* DSM 1576

	Number of viable bacteria [cfu/cm ²]				
	Reference material polyethylene film		Test material		
	N _{R0} 0 hours	N _{R24} 24 hours	8 mm 32 Cl N _{T24} 24 hours	8 mm 33 Cl N _{T24} 24 hours	7 mm 31Cl N _{T24} 24 hours
Geometric mean	68,000	224,561	< 6	< 6	< 6
	49,000	400,000	< 6	< 6	< 6
	61,000	510,000	< 6	< 6	< 6
	48,000	600,000	< 6	< 6	< 6
	65,000	680,000	< 6	< 6	< 6
	75,000	800,000	< 6	< 6	< 6
lg N	4.6	5.5	< 0.8	< 0.8	< 0.8
R=lgN _{R24} -lgN _{T24}			> 4.7	> 4.7	> 4.7

Table A2: Test results with *Escherichia coli* DSM 1576

	Number of viable bacteria [cfu/cm ²]				
	Reference material polyethylene film		Test material		
	N _{R0} 0 hours	N _{R24} 24 hours	8 mm 32 Cl N _{T24} 24 hours	8 mm 33 Cl N _{T24} 24 hours	7 mm 31Cl N _{T24} 24 hours
Geometric mean	42,500	7,766	< 6	< 6	< 6
	36,250	5,547	< 6	< 6	< 6
	40,625	4,931	< 6	< 6	< 6
	43,125	4,306	< 6	< 6	< 6
	60,625	21,250	< 6	< 6	< 6
	47,500	21,875	< 6	< 6	< 6
	44,507	8,672	< 6	< 6	< 6
lg N	4.6	3.9	< 0.8	< 0.8	< 0.8
R=lgN _{R24} -lgN _{T24}			> 3.1	> 3.1	> 3.1