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Test Report 2217011/A1 (Results with Batch 1)

Client: Vastern Timber Company Ltd.
Wootton Bassett, Swindon
Wiltshire SN4 7PD
United Kingdom

Date of order: 11 March 2017

Order: Test of thermally modified timber (TMT): durability against wood-decay fungi and selected physical and mechanical properties

Contractor: Entwicklungs- und Prüflabor Holztechnologie GmbH
Laboratory Unit Biological Testing
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Engineer in charge: Dipl.-Ing. Kordula Jacobs



Dr. Wolfram Scheiding
Head of Laboratory Unit Biological Testing

This test report contains data from test report 2217011 of 20/06/2018. It has 6 pages. Any duplication, even in part, requires written permission of EPH. These test results are exclusively related to the tested material.

1 Task

The EPH was engaged to determine the biological durability and selected physical and mechanical properties of thermally modified poplar and ash timber (TMT). Parts of the tests should be also done on untreated poplar and ash for comparison reasons. The wood of batches 1 and 2 was treated by different methods.

2 Test material

TMT poplar, first batch, delivered 08 May 2017

TMT ash, first batch, delivered 08 May 2017

untreated poplar, delivered September 2017

untreated ash, delivered September 2017

3 Test procedures

This report summarizes the test results of the positions 1 to 5 of order 2217011 (table 1) with materials of batch 1.

Table 1: Test procedures

Pos.	Test, property	Test standard
1	Biological durability against wood decay basidiomycetes (relevant for wood in use class 3)	EN 350 CEN/TS 15083-1
2	Bending strength (MOR) and bending modulus of elasticity (MOE)	EN 408
3	Impact bending strength (IBS) for indirect measure of brittleness	DIN 52189-1
4	Equilibrium moisture content (EMC) at climate 20/65 (as indicator for modification intensity)	EN 13183-1
5	Maximum swelling ratio α_{\max} and anti-swelling efficiency (ASE)	DIN 52184, AA-20-38

4 Biological durability against wood decay basidiomycetes (order position 1)

4.1 Test specification

Test method	CEN/TS 15083-1:2005 Durability of wood and wood products – determination of natural durability of solid wood against wood decay fungi, test methods – part 1: basidiomycetes.
Test material:	TMT poplar TMT ash
Reference timber:	Reference: <i>Fagus sylvatica</i> L.; oven-dry density (621 ± 14) kg/m ³
Test fungi:	<i>Coniophora puteana</i> , strain DSM 3085 <i>Trametes (Coriolus) versicolor</i> , strain CTB 863A
Replicates:	30 specimens of each material for each test fungus
Specimen size:	50×25×15 mm ³
Ageing prior to test:	Leaching according to EN 84:1997 22 June 2017 – 06 July 2017
Sterilisation:	Water damp
Test duration:	16 weeks
Emplacement/Removal of specimens:	09 August 2017 / 29 November 2017

4.2 Validity of the test

Both test series were valid. The demanded values of mean mass losses with reference wood were exceeded by both test fungi with both batches. Summarized validity data are given in table 1.

Table 1: Virulence values

test fungus	mean mass loss (n=15)	required minimum mass loss (DIN CEN/TS 15083-1)
<i>Coniophora puteana</i>	32.0 %	≥ 30 %
<i>Trametes versicolor</i>	29.4 %	≥ 20 %

4.3 Results

Summarized results of dry mass loss and assigned durability classes are given in table 2. Single values are given in the annex, table A1 to A4.

Table 2: Results of the durability test according to CEN/TS 15083-1 (basidiomycetes)

test fungus	test material	median dry mass loss [%] (n = 30)	durability classification (see scheme table 3)
<i>Coniophora puteana</i>	TMT poplar	0.29	1 "very durable"
	TMT ash	0.32	1 "very durable"
<i>Trametes versicolor</i>	TMT poplar	0.95	1 "very durable"
	TMT ash	1.14	1 "very durable"

Table 3: Scheme for preliminary classification of durability (CEN/TS 15083-1:2005 Annex D)

Durability class	Description	Median mass loss
1	very durable	≤ 5 %
2	durable	> 5 % up to ≤ 10 %
3	moderately durable	> 10 % up to ≤ 15 %
4	slightly durable	> 15 % up to ≤ 30 %
5	not durable	> 30 %

4.4 Evaluation

The basis for the classification is the result of that fungus, which caused the highest mass loss. According to the durability test CEN/TS 15083-1:2005 (wood destroying basidiomycetes), both TMT materials (poplar and ash) achieved durability class 1 (very durable).

5 Bending strength characteristics (order positions 2 and 3)

Summarized results of bending properties are given in tables 4 (poplar) and 5 (ash). Single values of the results are deposited at EPH and can be handed out after request.

Table 4: Bending strength of poplar

test method	material	number of specimens	mean value	coefficient of variation [%]
Modulus of rupture (MOR) according to DIN EN 408, flatwise [N/mm ²]	treated	5	50.56	26.3
	untreated	5	58.66	35.5
Modulus of elasticity (MOE) according to DIN EN 408, flatwise [N/mm ²]	treated	4	14,965	66.8
	untreated	5	12,775	9.1
Impact bending strength (IBS) for indirect measure of brittleness	treated	5	26.7	43.9
		3 specimens with blunt, 2 with fibrous fracture		
	untreated	5	29.5	33.6
		all specimens with blunt fracture		

Table 5: Bending strength of ash

test method	material	number of specimens	mean value	coefficient of variation [%]
Modulus of rupture (MOR) according to DIN EN 408, flatwise [N/mm ²]	treated	5	49.48	47.3
	untreated	5	88.42	12.8
Modulus of elasticity (MOE) according to DIN EN 408, flatwise [N/mm ²]	treated	5	21,840	17.7
	untreated	5	13,035	10.7
Impact bending strength (IBS) for indirect measure of brittleness	treated	5	21.8	48.9
		all specimens with blunt fracture		
	untreated	5	73.9	30.8
		all specimens with blunt fracture		

6 Equilibrium moisture content and swelling behavior (order positions 4 and 5)

Summarized results of EMC and swelling characteristics are given in table 6 (poplar) and 7 (ash). Single values of the results are deposited at EPH and can be handed out after request.

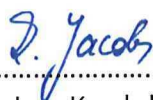
Table 6: Poplar - Equilibrium moisture content and swelling behavior

test method	material	number of specimens	mean value	coefficient of variation [%]
Equilibrium moisture content at 20/65 [%] acc. to EN 13183-1	treated	10	7.1	15.8
	untreated	10	10.2	5.1
Raw density at 20/65 [kg/m ³] acc. to DIN 52182	treated	10	377	7.9
	untreated	10	395	8.8
Maximum swelling ratio α_{\max} radial [%] acc. to DIN 52184	treated	10	1.8	24.5
	untreated	10	3.6	10.8
Maximum swelling ratio α_{\max} tangential [%] acc. to DIN 52184	treated	10	3.8	12.1
	untreated	10	9.0	5.4
ASE (anti-swelling efficiency) radial [%] acc. to AA-20-38	treated	10	49.9	-
ASE (anti-swelling efficiency) tangential [%] acc. to AA-20-38	treated	10	58.3	-

Table 7: Ash - Equilibrium moisture content and swelling behaviour

test method	material	number of specimens	mean value	coefficient of variation [%]
Equilibrium moisture content at 20/65 [%] acc. to EN 13183-1	treated	10	8.7	4.7
	untreated	10	13.5	5.7
Raw density at 20/65 [kg/m ³] acc. to DIN 52182	treated	10	563	9.9
	untreated	10	664	9.6
Maximum swelling ratio α_{\max} radial [%] acc. to DIN 52184	treated	10	2.6	20.3
	untreated	10	6.1	13.9
Maximum swelling ratio α_{\max} tangential [%] acc. to DIN 52184	treated	10	4.8	23.3
	untreated	10	11.4	29.6
ASE (anti-swelling efficiency) radial [%] acc. to AA-20-38	treated	10	57.2	-
ASE (anti-swelling efficiency) tangential [%] acc. to AA-20-38	treated	10	58.0	-

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