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EMISSION MEASUREMENTS FOR THE FINNISH CLASSIFICATION OF BUILDING MATERIALS (M1)

1 Sample Information

Sample name	Aspen thermowood
Batch no.	-
Production date	20.12.2023
Product type	Aspen thermowood panel
Sample reception	12.1.2024

2 Brief Evaluation of the Results

2.1 Comparison with M1 Limit Values

Parameter	Area specific emission rate	Limit Value
TVOC [mg/(m²h)]	0.091	≤ 0.2
Single VOCs with EU-LCI [mg/m³]	Do not comply	≤ EU-LCI
Formaldehyde [mg/(m²h)]	< 0.002	≤ 0.05
Ammonia [mg/(m²h)]	< 0.002	≤ 0.03
Single CMR compounds [mg/m³]	Complies	≤ 0.001
Odour (dimensionless)	- 0.3	≥ 0.0

Full details based on the testing and direct comparison with limit values are available in the following pages

Espoo, 27.02.2024

Hanna Kajander
Senior Expert

Distribution Customer

ilac-MRA FINAS Finnish Accreditation Service T001 (EN ISO/IEC 17025)

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3 Applied Test Methods

3.1 Specific Laboratory Sampling and Analyses

Procedure	External Method	Quantification limit / sampling volume	Analytical principle	Combined Uncertainty [RSD (%)]
Sample preparation	M1 testing protocol /1/	-	-	-
Emission chamber testing	EN 16516 + A1 /2/, ISO 16000-9 /3/	-	Chamber and air control	-
Sampling of VOC	EN 16516 + A1 /2/, ISO 16000-6 /4/	1.5-5 L	Tenax TA	-
Analysis of VOC	EN 16516 + A1 /2/, ISO 16000-6 /4/	1 µg/m³	TD-GC/MS	±25%
Sampling of formaldehyde*	In-house method /6/, EN 717-1 /7/	200-400 L	H_2SO_4 solution	-
Analysis of formaldehyde*	In-house method /6/, EN 717-1 /7/	5 µg/m³	Spectrophotometry	±23%
Sampling of Ammonia	EN 16516 + A1 /2, 8/	200-400 L	H_2SO_4 solution	-
Analysis of Ammonia	EN 16516 + A1 /2, 8/	5 µg/m³	Spectrophotometry	±33%
Odour/sensory testing*	ISO 16000-28 /9/	-	Odour panel	-

4 Sample Preparation, Test Parameters and Deviations

4.1 Sample Information and Preparation of the Test Specimen

Parameter	Value
Product type	interior cladding panels
Product name	Aspen thermowood
Batch number	-
Production date	20.12.2023
Sending date	10.1.2024
Sample received	12.1.2024
Packaging / transport	plastic wrapping / transportation company
Sample description	aspen thermowood panel, thickness 15 mm, width 140 mm
Test specimen preparation	three panels joined together mechanically, total length of joints 400 mm, reverse side and edges sealed with aluminium foil and tape
Test period started, date	16.1.2024
Emission sampling, date	13.2.2024
Sensory evaluation, date	13.2.2024

4.2 Emission Chamber Test Parameters

Parameter	Value	Parameter	Value
Chamber volume, V[m^3]	0.12	Test period	28 d
Air Change rate, n[h^{-1}]	0.5	Area specific ventilation rate, q [m/h or m^3/m^2h]	0.50
Relative humidity of supply air, RH [%]	50 ± 5	Loading factor [m^2/m^3]	1.0
Temperature of supply air, T [°C]	23 ± 1	Test scenario	Wall

4.3 Deviations from Referenced Protocols and Regulations

No significant deviations from the referenced test methods were observed.

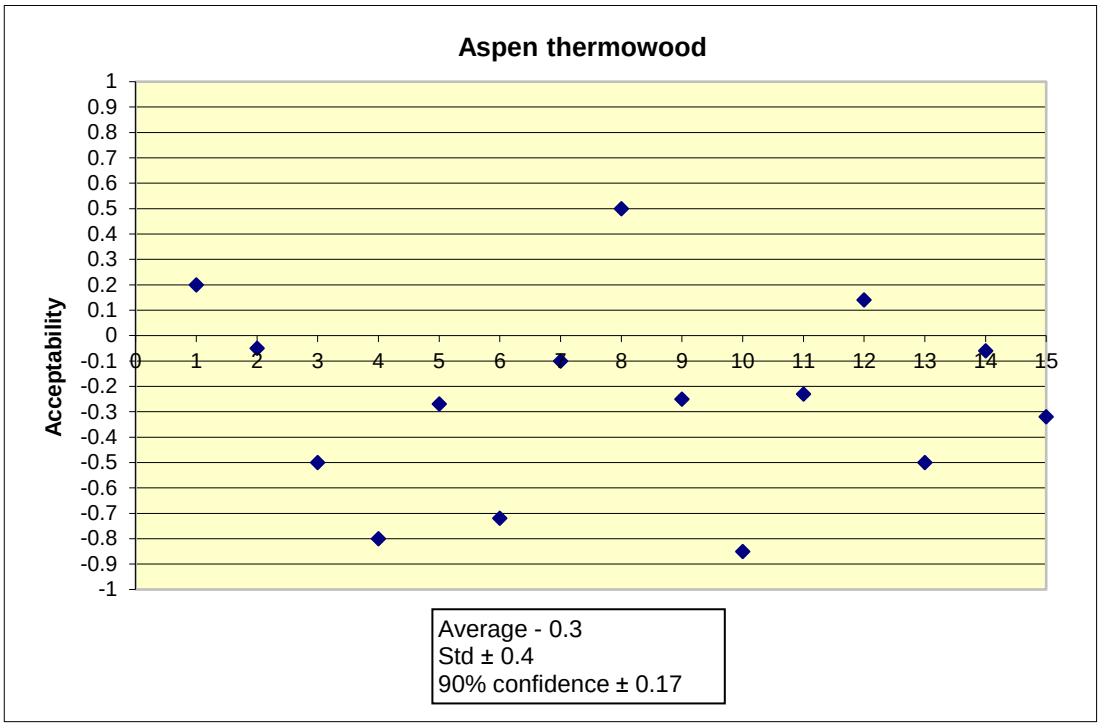
4.4 Picture of Sample

5 Results

5.1 Emission Test Results after 28 Days

	CAS No.	Retention time	ID-Cat	Toluene eq.	Toluene SER	Specific Conc.	SER	EU-LCI
		[min]		[µg/m³]	[µg/(m²·h)]	[µg/m³]	[µg/(m²·h)]	[µg/m³]
VOC compounds								
Acetic acid	64-19-7	5.0 - 6.0	1	160	74	630	300	1200
2-Butenal	123-73-9	6.73	1	< 5	< 2	5	2	5
1-Hydroxyacetone	116-09-6	7.05	1	< 5	< 2	28	13	2100
Propanoic acid	79-09-4	7.9 - 8.1	1	< 5	< 2	18	9	1500
Hexanal	66-25-1	11.97	1	< 5	< 2	< 5	1	900
Furfural	**98-01-1**	**13.29**	**1**	**35**	**17**	**98**	**47**	**10**
5-Methylfurfural	620-02-0	18.00	2	< 5	< 2			
Phenol	108-95-2	18.42	1	< 5	< 2	< 5	< 2	70
Octanal	124-13-0	19.26	1	< 5	< 2	< 5	< 2	900
TVOC				190	91			
VVOC compounds								
Acetone	67-64-1	4.01	1	< 5	< 2	< 5	< 2	120000
Methyl acetate	79-20-9	4.36	2	7	3			
TVVOC				7	3			
SVOC compounds								
None determined								
TSVOC				< 5	< 2			
CMR substances								
None determined								
Total CMR				< 5	< 2			
Formaldehyde	50-00-0		1			< 5	< 2	100
Ammonia	7664-41-7		1			< 5	< 2	

5.2 Sensory Testing



6 General Test References

1. Protocol for Chemical and Sensory Testing of Building Materials. Version 15.11.2017 (https://cer.rts.fi/en/m1-emission-class-for-building-material/)

2. EN 16516 + A1 Construction products: Assessment of release of dangerous substances. Determination of emissions into indoor air.

3. ISO 16000-9 Determination of the emission of volatile organic compounds from building products and furnishing. Emission test chamber method.

4. ISO 16000-6 Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA ® sorbent, thermal desorption and gas chromatography using MS or MS-FID.

5. EU-LCI VOC-compound emission https://ec.europa.eu/growth/sectors/construction/eu-lci/values_en

6. EN 717-1. Wood based panels - Determination of formaldehyde release - Part 1: Formaldehyde emission by the chamber method.

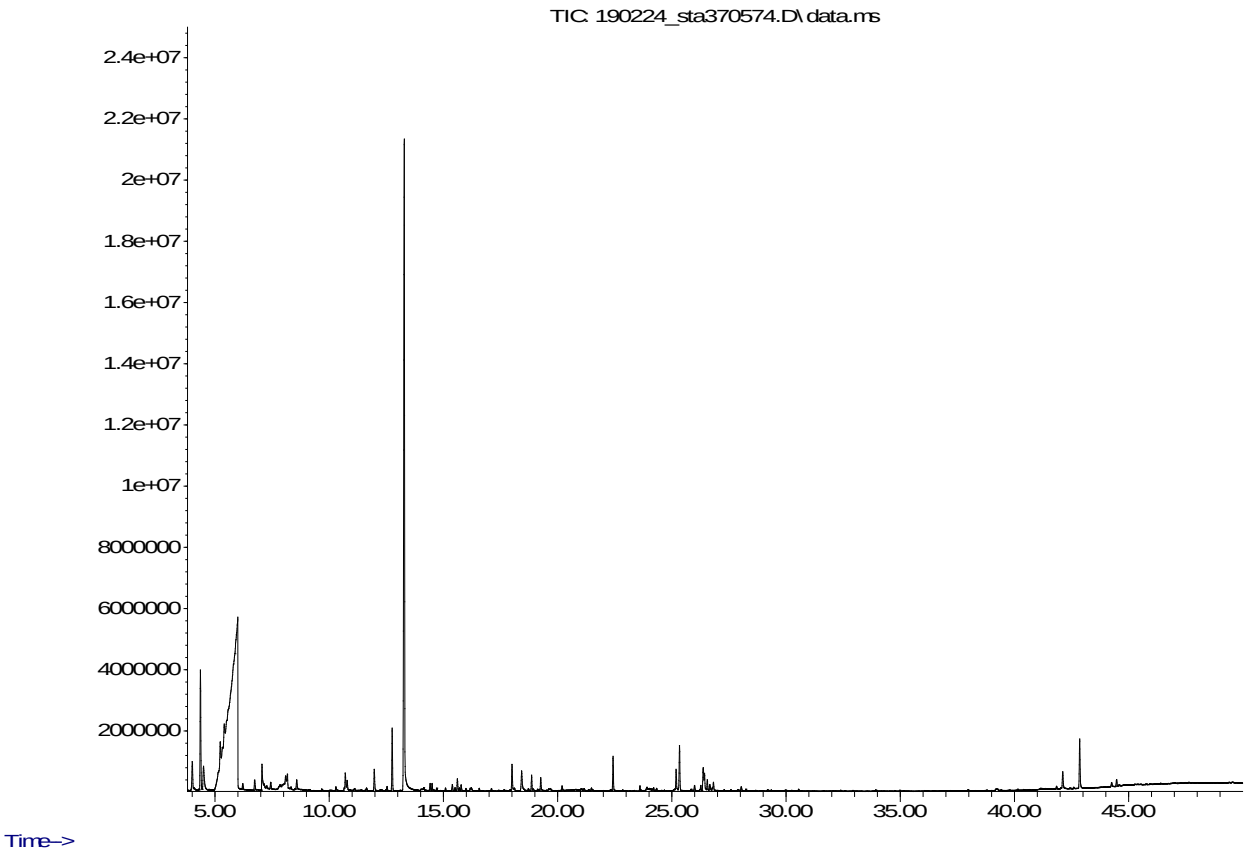
7. In-house method. Determination of formaldehyde using spectrometric acetyl acetone -method.

8. In-house method. Determination of ammonium concentration with ammonium cell test.

9. ISO 16000-28 Determination of odour emissions from building products using test chambers.

7 Appendices

7.1 Chromatogram



7.2 Sampling Report

Customer name / Contact person	Manufacturer (if deviating from customer)
Standwood Ou / Ulo Tambek	
Name of the product	**Type of the product**
Aspen thermowood	Glued construction
Date of production	**Batch number**
20.12.2023	
Date of sampling	**Amount of material sampled**
02.01.2024	12 psc (15x140x650mm)
The sample is taken from	**How was the product stored prior to sampling**
Production line ☒ Stock / storage ☐ Miscellaneous, specify ☐	Stored dry and warm store
If a sub-sample was collected from a larger material amount, please describe how the sub-sample was taken	
We apply also M1 seftificate all our thermo aspen products Panels: thickness 12,15,18 x width 68,90,120,140,185mm Bench boards thickness 21,28,33 x width 42,65,90,120,140,160,185mm	
Observations and remarks (date of assembly of office chairs and furniture, etc.)	
Confirmation	
I hereby confirm that the sample was selected, taken and packed in accordance with M1 testing protocol (version 15.11.2017): https://cer.rts.fi/en/materials-2/	
Date	**Signature**
02.01.2024	Ulo Tambek

7.3 How to Understand the Results

7.3.1 Acronyms Used in the Report

* Not a part of FINAS T001 accreditation

< Means less than

> Means bigger than

§ Deviation from method. Please see deviation section

SER Specific emission rate

a The method is not optimal for very volatile compounds. For these substances smaller results and a higher measurement uncertainty cannot be ruled out.

b The results have been corrected by the emission from untreated product specific substrate. Possible secondary emissions from the substrate cannot be excluded.

c Very polar organic compounds are not suitable for reliable quantification using Tenax TA adsorbent and HP-5 GC column. A high degree of uncertainty must be expected.

d The component may be underestimated due to exceeding the linear calibration range (contribution from the system) SER Specific Emission Rate.

7.3.2 Explanation of ID Category

Categories of Identity:

1: Identified by comparison with a mass spectrum obtained from library and supported by other information and quantified through specific calibration.

2: Identified by comparison with a mass spectrum obtained from library and supported by other information. Quantified as toluene equivalent.

3: Identified with a lower match by comparison with a mass spectrum obtained from a library. Quantified as toluene equivalent.

4: Not identified, quantified as toluene equivalent.

7.4 Description of VOC Emission Test

7.4.1 Test Chamber

The test chamber is made of stainless steel. A multi-step air clean-up is performed before loading the chamber, and a blank check of the empty chamber is performed. The chamber operation parameters are as described in the test method section. /1,2,3/

7.4.2 Expression of the Test Results

All test results are calculated as specific emission rate (SER), and as extrapolated air concentration in the European Reference Room. /1,2/

7.4.3 Testing of VOC, SVOC and VVOC

The emissions of volatile organic compounds including volatile CMR substances (EU Class 1A and 1B, as per European law) are tested by drawing sample air from the test chamber outlet through Tenax TA tubes

after the specified duration of storage in the ventilated test chamber. Analysis is performed by TD-GC/MS using HP-5 column (50 m, 0.2mm ID, 0.33µm film) /2,4/.

All CMR substances and single substances that are listed with a EU-LCI value in the latest publications /5/ (hereafter referred to as target compounds) are identified if present. All other appearing VOCs are identified as far as possible. Quantification of target compounds is done using the TIC signal and authentic response factors, or the relative response factors relative to toluene. For certain compound groups, which differ significantly in chemistry from toluene, quantification can be performed relative to a representative member of the group for more accurate and precise results. This can include quantification of for example glycols and acids. In addition to that, all results are also expressed in toluene equivalents. All non-target compounds, as well as all non-identified substances, are quantified in toluene equivalents.

The results of the individual substances (CMR substances not included) are calculated in three groups depending on their retention time when analyzing using a non-polar column (HP-5):

- Volatile Organic Compounds (VOC) are defined as: All substances eluting between n-hexane (n-C6) and n-hexadecane (n-C16) including n-hexane, n-hexadecane, acetic acid and 2,2,4-trimethyl-1,3-pentanediol-di-isobutyrate
- Semi-Volatile Organic Compounds (SVOC) are defined as: All substances eluting after n-hexadecane (n-C16) and before and including n-docosane (n-C22)
- Very Volatile Organic Compounds (VVOC) are defined as: All substances eluting before n-hexane (n-C6).

The results of the CMR substances are calculated in their own group.

Total Volatile Organic Compounds (TVOC) is calculated by summation of all individual VOCs between n-hexane and n-hexadecane with a concentration ≥ 5 µg/m³. Compounds regarded as VOC in line with the above definition but elute before n-C6 or after n-C16 on the HP-5 column are treated as VOC, and are thus added to the TVOC.

Total Semi-Volatile Organic Compounds (TSVOC) is calculated by the summation of all individual SVOCs expressed in toluene equivalents with a concentration ≥ 5 µg/m³, as defined in EN 16516. VOCs that are regarded as VOC in line with the above definition, but elute after n-C16 in this test, are not added to the TSVOC.

Total Very Volatile Organic Compounds (TVVOC) is calculated by the summation of all individual VVOCs with a concentration ≥ 5 µg/m³ and expressed in toluene equivalents. VOCs that are regarded as VOC in line with the above definition, but elute before n-C6 in this test, are not added to the TVVOC.

This test only covers substances which can be adsorbed on Tenax TA and can be thermally desorbed. If emissions of substances outside these specifications occur then these substances cannot be detected (or with limited reliability only).

7.4.4 Testing of Formaldehyde and Ammonia

Formaldehyde and ammonia are absorbed in dilute sulphuric acid. Formaldehyde is analysed spectrophotometrically with acetyl acetone method /6, 7/. Ammonia is analysed spectrophotometrically with ammonium cell test /2, 8/.

7.4.5 Sensory Testing

An untrained panel of 15 members is performed the sensory evaluation of the product /1, 9/. The panellists evaluate the acceptability of the chamber air in scale clearly unacceptable … fully acceptable (-1…+1).