

Tecnia Research & Innovation  
Mikeletegi Pasealekua, 2  
20009 Donostia - San Sebastian  
ES

## Test Report No. 53732-002 III

<b>Test objective:</b>	<b>Evaluation according to French VOC-regulation</b>
<b>Sample description by client:</b>	<b>LignumStrand treated</b>
Sampled by:	Tecnia Research & Innovation
Date of sampling:	15.10.2018
Location of sampling:	at the client
Date of production:	not specified
Date of arrival of sample:	26.10.2018
Test period:	26.10.2018 - 05.12.2018
Date of report:	05.12.2018
Number of pages of report:	12
Testing laboratory:	eco-INSTITUT Germany GmbH, Cologne except ‡ subcontracted # outside accreditation
Test objective fulfilled:	✓ Class A+

## Content

Sample View.....	2
Expert Evaluation.....	3
Summary evaluation.....	3
Evaluation d'expert.....	4
Résumé d'évaluation.....	4
Laboratory report.....	5
1 Emission analysis.....	5
1.1 Sample A001, Volatile Organic Compounds after 28 days.....	6
Appendix.....	8
I Sampling sheet.....	8
II Definition of terms.....	9
III Commentary on emission analysis.....	11
IV Explanation of Specific Emission Rate SER.....	12

## Sample View

Internal Sample-no.	Description by customer	Condition upon delivery	Type of sample
A002	LignumStrand treated	without objection	Wood based structures (with boric acid)



A002: LignumStrand treated

Remark: The test results refer to the submitted test sample exclusively. The validity of the report is three years at most and will end immediately at any alternation of material composition or in manufacturing process. Publishing in parts requires authorization.

## Expert Evaluation

The product **LignumStrand treated** has been tested on behalf of **Tecnalia Research & Innovation**.

This evaluation bases on the test criteria of the decree no. 2011-321 of March 23<sup>rd</sup>, 2011 (VOC regulation) of the French Ministry of Ecology, Sustainable Development, Transport and Housing.

The results documented in the test report were evaluated as follows.

Emission analysis	Concentration (Test chamber air) [µg/m³]	Class			
		C	B	A	A+
Substance	after 28 days				
Formaldehyde	3	> 120	< 120	< 60	< 10
Acetaldehyde	22	> 400	< 400	< 300	< 200
Toluene	< 1	> 600	< 600	< 450	< 300
Tetrachlorethylene	< 1	> 500	< 500	< 350	< 250
Xylene	< 1	> 400	< 400	< 300	< 200
1,2,4-Trimethylbenzene	< 1	> 2000	< 2000	< 1500	< 1000
1,4-Dichlorbenzene	< 1	> 120	< 120	< 90	< 60
Ethylbenzene	< 1	> 1500	< 1500	< 1000	< 750
2-Butoxyethanol	< 1	> 2000	< 2000	< 1500	< 1000
Styrene	< 1	> 500	< 500	< 350	< 250
<b>TVOC<sub>tot</sub></b>	110	<b>&gt; 2000</b>	<b>&lt; 2000</b>	<b>&lt; 1500</b>	<b>&lt; 1000</b>

## Summary evaluation

The product **LignumStrand treated** meets the requirements of the **Class A+** of the decree no. 2011-321 of March 23, 2011 (VOC regulation) of the French Ministry of Ecology, Sustainable Development, Transport and Housing.

Cologne, 05.12.2018



Marc-Anton Dobaj, M.Sc. Crystalline Materials  
(Project Manager)

## Evaluation d'expert

Le produit **LignumStrand treated** a été testé sous la responsabilité du **Tecnalia Research & Innovation**.

Cette évaluation est basée sur les critères du décret n° 2011-321 du 23 mars 2011 (COV décret) par le Ministère de l'écologie, du développement durable, des transports et du logement.

Les résultats documentés dans le rapport du test sont évalués comme suit.

Analyse des émissions	Concentration (air de la chambre d'essai) [µg/m³]	Classe			
		C	B	A	A+
<b>Substance</b>	<b>au bout de 28 jours</b>				
Formaldéhyde	3	> 120	< 120	< 60	< 10
Acétaldéhyde	22	> 400	< 400	< 300	< 200
Toluène	< 1	> 600	< 600	< 450	< 300
Tétrachloréthylène	< 1	> 500	< 500	< 350	< 250
Xylène	< 1	> 400	< 400	< 300	< 200
1,2,4-Triméthylbenzène	< 1	> 2000	< 2000	< 1500	< 1000
1,4-Dichlorobenzène	< 1	> 120	< 120	< 90	< 60
Ethylbenzène	< 1	> 1500	< 1500	< 1000	< 750
2-Butoxyéthanol	< 1	> 2000	< 2000	< 1500	< 1000
Styrène	< 1	> 500	< 500	< 350	< 250
<b>COVT<sub>tol</sub></b>	<b>110</b>	<b>&gt; 2000</b>	<b>&lt; 2000</b>	<b>&lt; 1500</b>	<b>&lt; 1000</b>

## Résumé d'évaluation

Le produit **LignumStrand treated** correspond aux exigences de la **classification A+** sur les critères du décret n° 2011-321 du 23 mars 2011 (COV décret) par le Ministère de l'écologie, du développement durable, des transports et du logement.

Cologne, 05.12.2018



Marc-Anton Dobaj, M.Sc. Crystalline Materials  
(Chef de projet)

# Laboratory report

## 1 Emission analysis

### Test method

DIN EN 16516	Testing and evaluation of the release of dangerous substances; determination of emissions into indoor air
--------------	---

### A002, Preparation of test sample

Date:	02.11.2018
Pre-treatment:	not applicable
Masking of backside:	yes
Masking of edges:	yes, 100 %
Relationship of unmasked edges to surface:	not applicable
Loading:	related to area
Dimensions:	41.8 cm x 41.8 cm

### A002, Test chamber conditions according to DIN ISO 16000-9

Chamber volume:	0.125 m <sup>3</sup>
Temperature:	23°C ± 1°C
Relative humidity:	50 % ± 1 %
Air pressure:	normal
Air:	cleaned
Air change rate:	0.5 h <sup>-1</sup>
Air velocity:	0.3 m/s
Loading:	1.4 m <sup>2</sup> /m <sup>3</sup>
Specific air flow rate:	0.357 m <sup>3</sup> /(m <sup>2</sup> · h)
Air sampling:	28 days after test chamber loading

### Analytcs

Aldehydes and Ketones	DIN ISO 16000-3
Limit of determination:	2 µg/m <sup>3</sup>
Volatile Organic Compounds	DIN ISO 16000-6
Limit of determination:	1 µg/m <sup>3</sup> (1,4-Cyclohexanedimethanol, Diethylene glycol, 1,4-Butanediol, Linalyl acetate, BIT: 5 µg/m <sup>3</sup> )
Note for analysis:	not specified

## 1.1 Fehler! Verweisquelle konnte nicht gefunden werden. Volatile Organic Compounds after 28 days

### Test objective:

Volatile Organic Compounds according to „Arrêté du 19 avril 2011 relatif à l'étiquetage des produits de construction ou de revêtement de mur ou de sol et des peintures et vernis sur leurs émissions de polluants volatils“ (french VOC-regulation, 10 substances), test chamber, air sampling 28 days after test chamber loading

### Test result:

Sample: A002: LignumStrand treated

No.	Substance	CAS No.	RT [min]	Concentration+ (test chamber air)	Toluene- equivalent
				Substances ≥ 1 µg/m³ 28 days [µg/m³]	Substances ≥ 5 µg/m³ 28 days [µg/m³]
<b>1</b>	<b>Aromatic hydrocarbons</b>				
1-1	Toluene	108-88-3		< 1	< 5
1-2	Ethyl benzene	100-41-4		< 1	< 5
1-3	Xylene, mix of o-, m- and p-xylene isomers	1330-20-7		< 1	< 5
1-4	p-Xylene (including m-Xylol)	106-42-3		< 1	< 5
1-6	o-Xylene	95-47-6		< 1	< 5
1-11	1.2.4-Trimethylbenzene	95-63-6		< 1	< 5
1-25	Styrene	100-42-5		< 1	< 5
<b>6</b>	<b>Glycols, Glycol ethers, Glycol esters</b>				
6-3	Ethylene glycol-monobutylether (2-Butoxyethanol)	111-76-2		< 1	< 5
<b>7</b>	<b>Aldehyde</b>				
7-20	Acetaldehyde	75-07-0		22	n.d.
7-22	Formaldehyde	50-00-0		3	n.d.
<b>13</b>	<b>Other identified substances in addition to LCI list</b>				
	Benzene	71-43-2		< 1	< 5
	1,4-Dichlorobenzene	106-46-7		< 1	< 5
	Trichlorethene	79-01-6		< 1	< 5

+ identified and calibrated substances, substance specific calculated

**Remark:** The test results refer to the submitted test sample exclusively. The validity of the report is three years at most and will end immediately at any alternation of material composition or in manufacturing process. Publishing in parts requires authorization.

n.d. = not determinable

<b>TVOC, Total volatile organic compounds</b>	<b>Concentration after 28 days [<math>\mu\text{g}/\text{m}^3</math>]</b>	<b>SERa [<math>\mu\text{g}/(\text{m}^2 \cdot \text{h})</math>]</b>
Sum of VOC according to ISO 16000-6	<b>110</b>	<b>40</b>

Cologne, 05.12.2018



Michael Stein, Dipl.-Chem.  
(Deputy Technical Manager)

# Appendix

## I Sampling sheet

Produktprüfung Product testing Zertifizierung Certification Beratung Consulting	53732-001-002	
---	---------------	--

### Sampling Sheet\*

<b>Testing laboratory</b> eco-INSTITUT Germany GmbH Schanzenstr. 6-20, D-51063 Cologne Germany Tel. +49 (0)221 - 931245-0 Fax +49 (0)221 - 931245-33	<b>Sampler</b> Same as manufacturer. (Name, Company, Phone number)
<b>Name of manufacturer / distributor at place of sampling</b> (Address / Stamp) TABSAL CIF: B71307292 Paraje cerradora s/n 31840 Uharte-Arakil (Navarra) Spain	<b>Customer/ Invoice recipient</b> (if different from manufacturer) TECNALIA CIF: G48975767 Parque Científico y Tecnológico de Bizkaia C\Geldo, Edificio 700 E-48160 Derio (Bizkaia) Spain

<b>Product name</b> LignumStrand LignumStrand treated	<b>Product type</b> Wood based structures (e.g. parquet, floor covering)
<b>Model / programme / series</b> --	<b>Batch</b> --
<b>Article number</b> --	<b>Production date of batch</b> --

<b>Samples are taken from</b> <input checked="" type="checkbox"/> current production <input type="checkbox"/> storage	<b>Sampling date</b> 15.10.18
<b>Storage location before sampling</b> <input checked="" type="checkbox"/> in production <input type="checkbox"/> storage <input type="checkbox"/> other	<b>Storage conditions before sampling</b> <input type="checkbox"/> open <input checked="" type="checkbox"/> packaged
<b>Storage location:</b> Manufacturer location	<b>Packaging material:</b> Plastic

<b>Special features</b> (possible negative effects through emissions at place of sampling (e.g. benzine, exhaust fumes), unclarities, questions etc.)	Treated sample is the one labelled "bórico" Non treated sample is the one labelled "no bórico" Possible uses walls and ceilings (use worst case)
---	--

<b>Validation</b> Hereby the signer affirms the accuracy of the above-mentioned statements. The sample was chosen, sampled and packaged according to the sampling guidelines.	
Date: 22.10.18	Signature: (Company stamp) Fundación TECNALIA Research & Innovation

\* Please take one sampling sheet for each sample! The sampling instruction must be strictly maintained.

<b>Order</b> (Please insert quote number, or - if not available, please enter the desired analysis)	<b>Reference from Tecnalia:</b> Test required: According to email attached (02179+02181+02182+02183+02178) Official order: To be provided. It will include the reference number
--	--

**Remark:** The test results refer to the submitted test sample exclusively. The validity of the report is three years at most and will end immediately at any alternation of material composition or in manufacturing process. Publishing in parts requires authorization.



## II Definition of terms

VOC (volatile organic compounds)	All individual compounds with a concentration $\geq 1 \mu\text{g}/\text{m}^3$ in the retention range C <sub>6</sub> (n-Hexane) to C <sub>16</sub> (n-Hexadecane)
TVOC	Total volatile organic compounds
TVOC according to DIN EN 16516	Sum of all VOC $\geq 5 \mu\text{g}/\text{m}^3$ in the retention range C <sub>6</sub> to C <sub>16</sub> , calculated as toluene equivalent
TVOC according to AgBB/DIBt	Sum of all identified and calibrated VOC $\geq 5 \mu\text{g}/\text{m}^3$ , SVOC $\geq 5 \mu\text{g}/\text{m}^3$ with LCI and not calibrated VOC $\geq 5 \mu\text{g}/\text{m}^3$ calculated as toluene equivalent
TVOC according to eco-INSTITUT-Label	Sum of all identified and calibrated VOC $\geq 1 \mu\text{g}/\text{m}^3$ , SVOC $\geq 5 \mu\text{g}/\text{m}^3$ with LCI and not calibrated VOC $\geq 1 \mu\text{g}/\text{m}^3$ calculated as toluene equivalent
TVOC according to ISO 16000-6	Total area of chromatogram in the retention range C <sub>6</sub> to C <sub>16</sub> , calculated as toluene equivalent
TVOC without LCI according to AgBB/DIBt and Belgian regulation	Sum of all VOC without NIK $\geq 5 \mu\text{g}/\text{m}^3$ in the retention range C <sub>6</sub> to C <sub>16</sub>
TVOC without LCI according to eco-INSTITUT-Label	Sum of all VOC without NIK $\geq 1 \mu\text{g}/\text{m}^3$ in the retention range C <sub>6</sub> to C <sub>16</sub>
CMR-VOC (carcinogenic, mutagenic, reproduction-toxic VOC, VVOC and SVOC)	All individual substances with the following categories: Regulation (EC) No. 1272/2008: Category Car.1A and 1B, Muta. 1A and 1B, Repr. 1A and 1B TRGS 905: K1A, K1B, M1A, M1B, R1A, R1B IARC: Group 1 and 2A DFG (MAK lists): Category III1 and III2
VVOC (very volatile organic compounds)	All individual substances with a concentration $\geq 1 \mu\text{g}/\text{m}^3$ in the retention range $< C_6$
TVVOC	Total very volatile organic compounds
TVVOC according to AgBB/DIBt and Belgian regulation	Sum of all identified and calibrated VVOC $\geq 5 \mu\text{g}/\text{m}^3$ with LCI
TVVOC according to eco-INSTITUT-Label	Sum of all identified and calibrated VVOC $\geq 1 \mu\text{g}/\text{m}^3$ with LCI
SVOC (semi volatile organic compounds)	All individual substances $\geq 1 \mu\text{g}/\text{m}^3$ in the retention range C <sub>16</sub> to C <sub>22</sub>
TSVOC	Total semi volatile organic compounds
TSVOC according to DIN EN 16516	Sum of all SVOC in the retention range C <sub>16</sub> to C <sub>22</sub> , calculated as toluene equivalent
TSVOC without LCI according to AgBB/DIBt	Sum of all SVOC $\geq 5 \mu\text{g}/\text{m}^3$ without LCI
TSVOC without LCI according to eco-INSTITUT-Label	Sum of all SVOC $\geq 1 \mu\text{g}/\text{m}^3$ without LCI
TSVOC with LCI according to AgBB/DIBt	Sum of all identified and calibrated SVOC $\geq 5 \mu\text{g}/\text{m}^3$ with LCI
SER	Specific emission rate (see appendix IV)

**Remark:** The test results refer to the submitted test sample exclusively. The validity of the report is three years at most and will end immediately at any alternation of material composition or in manufacturing process. Publishing in parts requires authorization.

LCI value	Lowest Concentration of Interest; calculated value for the evaluation of VOC, established by the Committee for Health-related Evaluation of Building Products (Ausschuss zur gesundheitlichen Bewertung von Bauprodukten - AgBB)
R value	The quotient of the concentration and the LCI value is generated for every substance which is detected in the test chamber air. The sum of the calculated quotients results in the R value.
R value according to eco-INSTITUT-Label	R value for all identified and calibrated VOC $\geq 1 \mu\text{g}/\text{m}^3$ with LCI, established by the AgBB in 2018
R value according to AgBB 2018/DIBt	R value for all identified and calibrated VOC $\geq 5 \mu\text{g}/\text{m}^3$ with LCI, established by the AgBB in 2018
R value according to Belgian regulation	R value for all identified and calibrated VOC $\geq 5 \mu\text{g}/\text{m}^3$ with LCI, established by the Belgian regulation
R value according to AFSSET	R value for all identified and calibrated VOC $\geq 5 \mu\text{g}/\text{m}^3$ with LCI, established by ANSES (French National Agency on Food Safety, Environment, and Workplace Security)
RT (retention time)	Time for a particular analyte to pass through the system (from the column inlet to the detector)
CAS No. (Chemical Abstracts Service)	International unique numerical identifier for a chemical substance
Toluene equivalent	Concentration, calculated as toluene equivalent

### III Commentary on emission analysis

#### Test method

Measurement of the volatile organic compounds takes place in the test chamber in conditions similar to those applying in practice. Standardized test conditions are defined for the test chamber regarding loading, air exchange, relative humidity, temperature and incoming air, based on the type of test specimen and the required guideline. These conditions and the underlying standards are to be found in the section on test methods in the laboratory report.

Air samples are taken from the test chamber at defined points in time during the continuously running test. To this end, approximately 5 L of air are collected from the test chamber with an air flow rate of 100 mL/min for Tenax and approx. 100 L with an air flow rate of 0.8 L/min for DNPH (dinitrophenylhydrazine).

After thermal desorption, the substances adsorbed on Tenax are analysed using gas chromatographic separation and mass spectrometric determination. The gas chromatographic separation is performed with a slightly polar capillary column of 60 m in length.

The substances derivatized with DNPH for the determination of formaldehyde and other short-chain carbonyl compounds (C1 - C6) are analysed using high-performance liquid chromatography.

Over 200 compounds, including volatile organic compounds (C6 - C16), semi-volatile organic compounds (C16 - C22) and – insofar as possible with this method – also very volatile organic compounds (less than C6) are determined and quantified individually.

All other substances – insofar as is possible – are identified through comparison with a library of spectra. The quantification of these substances and non-identified substances is performed through a comparison of their signal area with the signal of the standard d8 toluene. As far as feasible, identification and quantification limit of any substance shall be 1 µg per m<sup>3</sup> for substances adsorbed on Tenax and 2 µg/m<sup>3</sup> for DNPH-derivatized substances (limit of quantification).

#### Quality assurance

The eco-INSTITUT Germany GmbH is granted flexible scope of accreditation pursuant to DIN EN ISO/IEC 17025. The accreditation covers the analytical determination of all volatile organic compounds, including the test chamber method.

In each analysis the analytical system is checked using an external standard based on the specifications in standard DIN EN 16516. The stability of the analytical systems is documented based on the test standard using control charts.

Laboratory performance is assessed at least once a year in inter-laboratory comparisons by comparing the results with those obtained by other laboratories for identical samples.

A blank is run prior to introducing the test specimen into the test chamber to check for the possible presence of volatile organic compounds.

## IV Explanation of Specific Emission Rate SER

Emission measurements are accomplished in test chambers under defined physical conditions (temperature, relative humidity, room loading, air change rate etc.).

Test chamber measurement results are directly comparable only if the investigations were accomplished under the same basic conditions.

If the differences of the physical conditions refer only to the change of air rate and/or the loading, the "SER" or "specific emission rate" can be used for comparability of the measurement results. The SER indicates how many volatile organic compounds (VOC) are released by the sample for each material unit and hour (h).

The SER can be calculated using the formula below for each proven individual component of the VOC from the data in the test report.

As material units the following are applicable:

l = unit of length (m)	relation between emission and length
a = unit area (m <sup>2</sup> )	relation between emission and surface
v = unit volume (m <sup>3</sup> )	relation between emission and volume
u = piece unit (unit = piece)	relation between emission and complete unit

From this the different dimensions for SER result:

length-specific	SER <sub>l</sub> in µg/(m·h)
surface-specific	SER <sub>a</sub> in µg/(m <sup>2</sup> ·h)
volume-specific	SER <sub>v</sub> in µg/(m <sup>3</sup> ·h)
unit specific	SER <sub>u</sub> in µg/(u·h)

SER thus represents a product specific rate, which describes the mass of the volatile organic compound, which is emitted by the product per time unit at a certain time after beginning of the examination.

$$\text{SER} = q \cdot c$$

- q specific air flow rate (quotient from change of air rate and loading)  
c concentration of the measured substance(s)

The result can be indicated in milligrams (mg) in place of micro grams (µg), whereby 1 mg = 1000 µg.