B&L Lund AB
Bolum Samuelsgården 14
52198 Broddetorp
SWEDEN

Eurofins Product Testing A/S
Smedeskovvej 38
8464 Galten
Denmark

CustomerSupport@eurofins.com
www.eurofins.com/VOC-testing

VOC TEST REPORT
Byggvarubedömningen

17 November 2020

1 Sample Information

Sample name	Qwaiet
Batch no.	-
Production date	01/10/2020
Product type	Natural fibre insulation
Sample reception	06/10/2020

2 Brief Evaluation of the Results

Regulation or protocol	Conclusion	Version of regulation or protocol
Byggvarubedömningen	Recommended	Byggvarubedömningen Assement Criteria 5.0 (July 2019), section 6.2.

Full details based on the testing and direct comparison with limit values is available in the following pages. Conclusion is only based on the VOC emission performance of the product as required in section 6.1, 6.2. Other factors may lead to an alternative overall evaluation of the product.

Rasmus Stengaard Christensen
Analytical Service Manager, MSc in Chemistry

The results are only valid for the tested sample(s).
This report may only be copied or reprinted in its entity, parts of it only with a written acceptance by Eurofins.

Table of contents

1		**Sample Information**	**1**
2		**Brief Evaluation of the Results**	**1**
3		**Applied Test Methods**	**3**
	3.1	General Test References	3
	3.2	Specific Laboratory Sampling and Analyses	3
4		**Test Parameters, Sample Preparation and Deviations**	**4**
	4.1	VOC Emission Chamber Test Parameters	4
	4.2	Preparation of the Test Specimen	4
	4.3	Picture of Sample	4
	4.4	Deviations from Referenced Protocols and Regulations	4
5		**Results**	**5**
	5.1	VOC Emission Test Results after 28 Days	5
6		**Summary and Evaluation of the Results**	**6**
	6.1	Comparison with Limit Values of Byggvarubedömningen	6
Appendices			**7**
	6.2	Chromatogram of VOC Emissions after 28 Days	7
	6.4	How to Understand the Results	8
	6.5	Qualitative Description of VOC Emission Test	9
	6.6	Quality Assurance	10
	6.7	Accreditation	11
	6.8	Uncertainty of the Test Method	11

The results are only valid for the tested sample(s).
This report may only be copied or reprinted in its entity, parts of it only with a written acceptance by Eurofins.

3 Applied Test Methods

3.1 General Test References

Regulation, protocol or standard	Version	Reporting limit VOC [µg/m³]	Calculation of TVOC	Combined uncertainty¤ [RSD(%)]
EN 16516	October 2017	5	Toluene equivalents	22%
ISO 16000 -3 -6 -9 -11	2006-2011 depending on part	2	Toluene equivalents	22%
ASTM D5116	2010	-	-	-
Byggvarubedömningen	Assement Criteria 5.0 (July 2019), section 6.2.	2	Toluene equivalents	22%

3.2 Specific Laboratory Sampling and Analyses

Procedure	External Method	Internal S.O.P.	Quantification limit / sampling volume	Analytical principle	Uncertainty¤ [RSD(%)]
Sample preparation	ISO 16000-11:2006, EN16402:2013, CDPH:2017, AgBB:2018, EMICODE:2019	71M549810	-	-	-
VOC emission chamber testing	ISO 16000-9:2006, EN 16516:2017	71M549811	-	Chamber and air control	-
Sampling of VOC	ISO 16000-6:2011, EN 16516:2017	71M549812	5 L	Tenax TA	-
Analysis of VOC	ISO 16000-6:2011, EN 16516:2017	71M542808B	1 µg/m³	ATD-GC/MS	10%
Sampling of aldehydes	ISO 16000-3:2011, EN 16516:2017	71M549812	35 L	DNPH	-
Analysis of aldehydes	ISO 16000-3:2011, EN 717-1, EN 16516:2017	71M548400	3-6 µg/m³	HPLC-UV	10%

The results are only valid for the tested sample(s).
This report may only be copied or reprinted in its entity, parts of it only with a written acceptance by Eurofins.

4 Test Parameters, Sample Preparation and Deviations

4.1 VOC Emission Chamber Test Parameters

Parameter	Value	Parameter	Value
Chamber volume, V[L]	119	Preconditioning period	-
Air Change rate, n[h^{-1}]	0.5	Test period	09/10/2020 – 06/11/2020
Relative humidity of supply air, RH [%]	50 ± 3	Area specific ventilation rate, q [m/h or $m^3/m^2/h$]	1.25
Temperature of supply air, T [°C]	23 ± 1	Loading factor [m^2/m^3]	0.4
		Loading scenario	Flooring or ceiling

4.2 Preparation of the Test Specimen

Edges and back were covered with aluminium foil.

4.3 Picture of Sample



4.4 Deviations from Referenced Protocols and Regulations

No deviations from the referenced test methods were observed.

This report may only be copied or reprinted in its entity, parts of it only with a written acceptance by Eurofins.

5 Results

5.1 VOC Emission Test Results after 28 Days

	CAS No.	Retention time [min]	ID-Cat	Specific Conc. [µg/m³]	Toluene eq. [µg/m³]	Specific SER [µg/(m²·h)]	EU-LCI 2018 [µg/m³]
VOC with LCI							
None determined							
VOC without LCI							
None determined							
Sum of VOC without LCI				< 5	< 5	< 7	
VVOC compounds							
None determined							
TVVOC				< 5	< 5	< 7	
SVOC compounds							
None determined							
TSVOC				< 5	< 5	< 7	
Carcinogens							
Total carcinogens				< 1	< 1	< 2	
Aldehydes							
Formaldehyde	50-00-0		1	< 3		< 4	100
Acetaldehyde	75-07-0		1	< 3		< 4	1200
Propionaldehyde	123-38-6		1	< 3		< 4	750
Butyraldehyde	123-72-8		1	< 3		< 4	650
Acrolein *	107-02-8		1	< 5		< 7	14
2-Butenal *	123-73-9		1	< 5		< 7	5
Glutaraldehyde *	111-30-8		1	< 5		< 7	
Octanal *	124-13-0		1	< 5		< 7	900
Nonanal *	124-19-6		1	< 5		< 7	900
Decanal *	112-31-2		1	< 5		< 7	900
TVOC				< 5	< 5	< 7	

The results are only valid for the tested sample(s).
This report may only be copied or reprinted in its entity, parts of it only with a written acceptance by Eurofins.

6 Summary and Evaluation of the Results

6.1 Comparison with Limit Values of Byggvarubedömningen

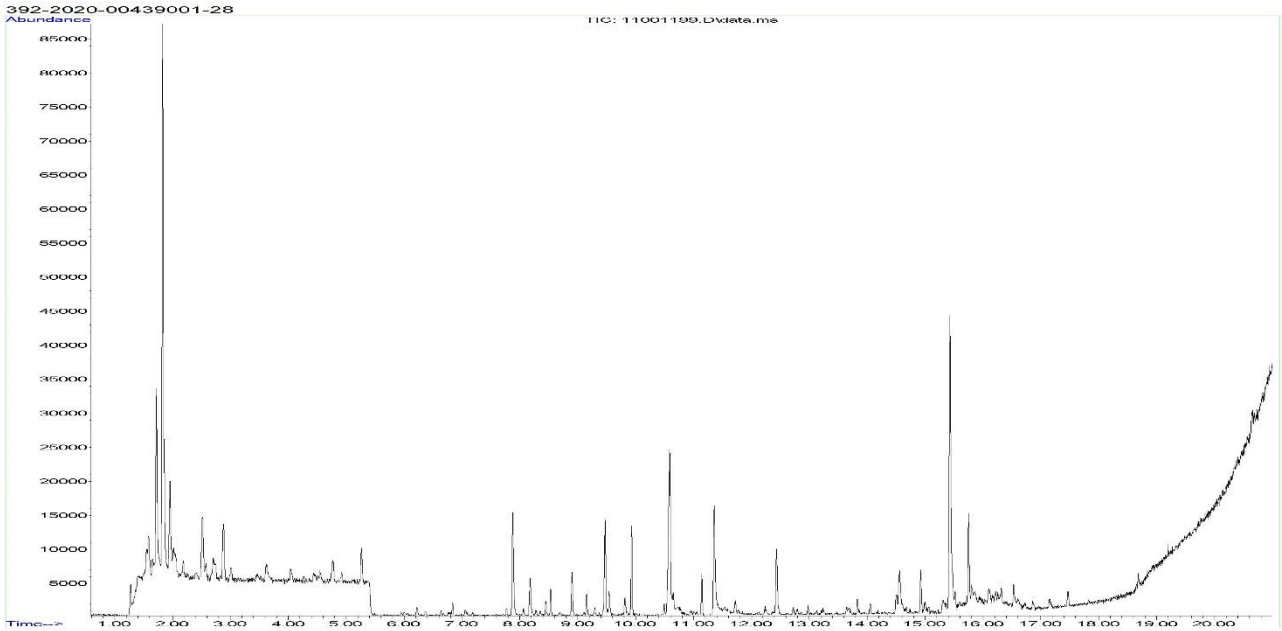
Parameter		Test after 28 days		
	Concentration µg/m³	To be Avoided µg/m³	Limit Value Accepted µg/m³	Limit Value Recommended µg/m³
TVOC [EN 16516]	< 5	> 1000	< 1000	< 100
Single values with EU-LCI	Complies	> EU-LCI	< EU-LCI	

Limit values are only based on the VOC emission performance of the product as required in section 6.1, 6.2, other factors may lead to an alternative overall evaluation of the product.

The results are only valid for the tested sample(s).
This report may only be copied or reprinted in its entity, parts of it only with a written acceptance by Eurofins.

Appendices

6.2 Chromatogram of VOC Emissions after 28 Days



6.4 How to Understand the Results

6.4.1 Acronyms Used in the Report

<	Means less than
>	Means bigger than (Tube/GC-MS overload)
*	Not a part of our accreditation
¤	Please see section regarding uncertainty in the Appendices.
§	Deviation from method. Please see deviation section
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 component originates from the substrate and is thus removed.
c	The results have been corrected by the emission from substrate.
d	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.
e	The component may be overestimated due to contribution from the system
SER	Specific emission rate.

6.4.2 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.

The results are only valid for the tested sample(s).
This report may only be copied or reprinted in its entity, parts of it only with a written acceptance by Eurofins.

6.5 Qualitative Description of VOC Emission Test

6.5.1 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 (EN 16516, ISO 16000-9, internal method no.: 71M549811).

6.5.2 Expression of the Test Results

All test results are calculated as specific emissions rate, and as extrapolated air concentration in the European Reference Room (EN 16516, AgBB, EMICODE, M1 and Indoor Air Comfort).

6.5.3 Testing of Carcinogenic VOCs

The emission of carcinogens (EU Categories C1A and C1B, as per European law) is 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 ATD-GC/MS (automated thermal desorption coupled with gas chromatography and mass spectroscopy using 30 m HP-5 (slightly polar) column with 0.25 mm ID and 0.25 µm film, Agilent) (EN 16516, ISO 16000-6, internal methods no.: 71M549812 / 71M542808B).

All identified carcinogenic VOCs are listed; if a carcinogenic VOC is not listed then it has not been detected. Quantification is performed using the TIC signal and authentic response factors, or the relative response factors relative to toluene for the individual compounds.

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

6.5.4 Testing of VOC, SVOC and VVOC

The emissions of volatile organic compounds 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 ATD-GC/MS using HP-5 column (30 m, 0.25mm ID, 0.25µm film) (EN 16516, ISO 16000-6, internal methods no.: 71M549812 / 71M542808B).

All single substances that are listed with a LCI/NIK value in the latest publications (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 is 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 are calculated in three groups depending on their retention time when analyzing using a non-polar column (HP-1):

- Volatile Organic Compounds (VOC) are defined as: All substances eluting between and including n-hexane (n-C6) and n-hexadecane (n-C16)
- 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).

Total Volatile Organic Compounds (TVOC) is calculated by summation of all individual VOCs with a

concentration ≥ 5 µg/m³. The TVOC can be expressed either in toluene equivalents as defined in EN 16516 and similar to ISO 16000-6, or as the sum of concentrations using specific or relative response factors. In the case of summation of concentrations using authentic or relative response factors, the toluene equivalent is applied to all non-target and non-identified VOCs before summing up. 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).

6.5.5 Calculation of R Values with LCI Lists

The concentrations of detected compounds ≥ 5 µg/m³ are divided by their respective LCI/NIK value (if defined in the given publication). The sum of the quotients gives the R value, which can be mathematically expressed:

$$R = \sum_{i}^{n} \left({}^{c_i}/_{NIK_i} + \ldots + {}^{c_n}/_{NIK_n} \right)$$

This R value is calculated, depending on the purpose of this test, for the European LCI list, for the German LCI/NIK list (R_D), and/or for the Belgian LCI list (R_B).

All VOCs without published LCI/NIK value and concentration ≥ 5 µg/m³ are summed up as sum of VOCs without LCI/NIK if required by the standard or protocol.

6.5.6 Testing of Aldehydes

The presence of aldehydes is tested by drawing air samples from the test chamber outlet through DNPH-coated silicagel tubes after the specified duration of storage in the ventilated test chamber. Analysis is performed by solvent desorption and subsequently by HPLC and UV-/diode array detection (EN 16516, ISO 16000-3, VDI 3862 Blatt 3, internal methods no.: 71M549812 / 71M548400).

The absence of formaldehyde and other aldehydes is stated if UV detector response at the specific wavelength is lacking at the specific retention time in the chromatogram. Otherwise it is checked whether the reporting limit is exceeded. In this case the identity is finally checked by comparing full scan sample UV spectra with full scan standard UV spectra.

6.6 Quality Assurance

Before loading the test chamber, a blank check of the empty chamber is performed and compliance with background concentrations in accordance with EN 16516 / ISO 16000-9 is determined.

Air sampling at the chamber outlet and subsequent analysis is performed in duplicate. Relative humidity, temperature and air change rate in the chambers is logged every 5 minutes and checked daily. A double determination is performed on random samples at a regular interval and results are registered in a control

The results are only valid for the tested sample(s).
This report may only be copied or reprinted in its entity, parts of it only with a written acceptance by Eurofins.

chart to ensure the uncertainty and reproducibility of the method.

The stability of the analytical system is checked by a general function test of device and column, and by use of control charts for monitoring the response of individual substances prior to each analytical sequence.

6.7 Accreditation

The testing methods described above are accredited on line with EN ISO/IEC 17025 by DANAK (no. 522). This accreditation is valid worldwide due to mutual approvals of the national accreditation bodies (ILAC/IAF, see also www.eurofins.com/galten.aspx#accreditation.

Not all parameters are covered by this accreditation. The accreditation does not cover parameters marked with an asterisk (*), however analysis of these parameters is conducted at the same level of quality as for the accredited parameters.

6.8 Uncertainty of the Test Method

The relative standard deviation of the overall analysis is 22%. The expanded uncertainty Um equals 2 x RSD. For further information please visit www.eurofins.dk/uncertainty.

The results are only valid for the tested sample(s).
This report may only be copied or reprinted in its entity, parts of it only with a written acceptance by Eurofins.