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VOC EMISSION TEST REPORT
Formaldehyde Reduction

10 August 2021

1 Sample Information

Sample name	BIORA AIR
Batch no.	327974-201
Stated production date	24/05/2021
Product type	Paint
Sample reception	25/06/2021

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2 Applied Test Methods

2.1 General Test References

Regulation, protocol or standard	Version	Reporting limit VOC [µg/m³]	Combined uncertainty¤ [RSD(%)]
ISO 16000-23*	2018	3	22%
ISO 16000-3	2011	3	22%

2.2 Specific Laboratory Sampling and Analyses

Procedure	External Method	Internal SOP	Quantification limit / sampling volume	Analytical principle	Uncertainty¤ [RSD(%)]
Sample preparation	ISO 16000-11:2006	71M549810	-	-	-
Formaldehyde injection	ISO 16000-23	71M549813	-	Formaldehyde injection	-
Sampling of aldehydes	ISO 16000-3:2011	71M549812	35 L	DNPH	-
Analysis of aldehydes	ISO 16000-3:2011	71M548400	3 µg/m³	HPLC-UV	10%

3 Test Parameters, Sample Preparation and Deviations

3.1 Chamber Test Parameters

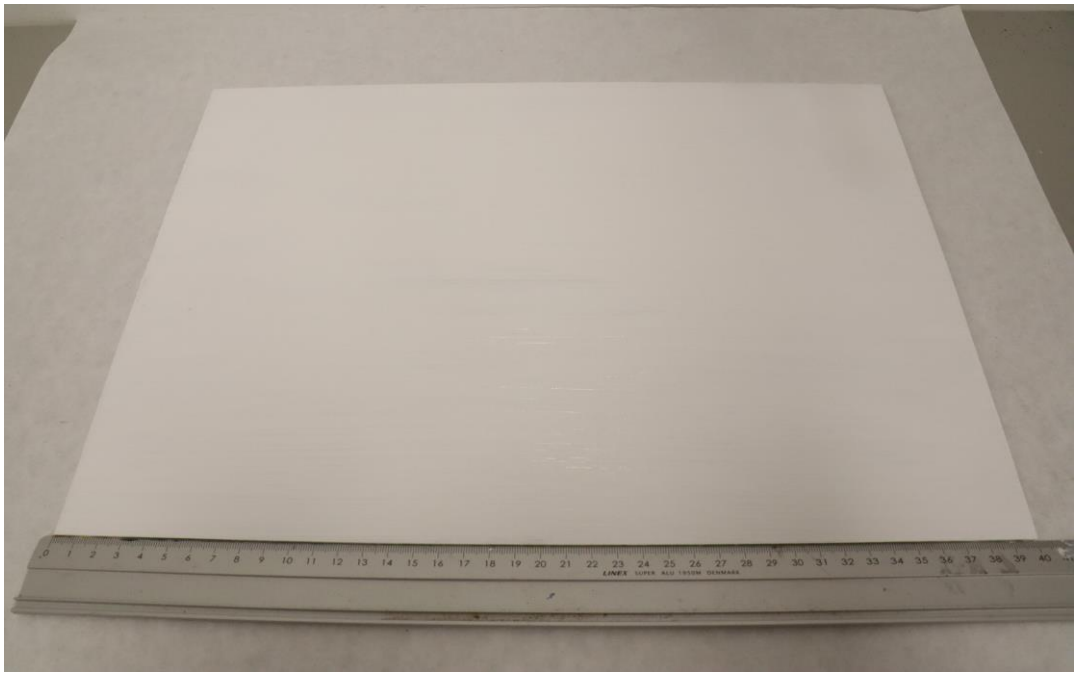
Parameter	Value	Parameter	Value
Chamber volume, V[L]	119	Preconditioning period	-
Air Change rate, n[h^{-1}]	0.5	Test period	06/07/2021 - 03/08/2021
Relative humidity of supply air, RH [%]	50 ± 3	Area specific ventilation rate, q [m/h or $m^3/m^2/h$]	0.5
Temperature of supply air, T [°C]	23 ± 1	Loading factor [m^2/m^3]	1.0
Average formaldehyde injection [µg/m^3]	100		

3.2 Preparation of the Test Specimen

The sample was homogenised and applied onto a glass plate.

Number of Layers	Application amount, g/m^2	Drying time, h
2	190	1

3.3 Picture of Sample



3.4 Deviations from Referenced Protocols and Regulations

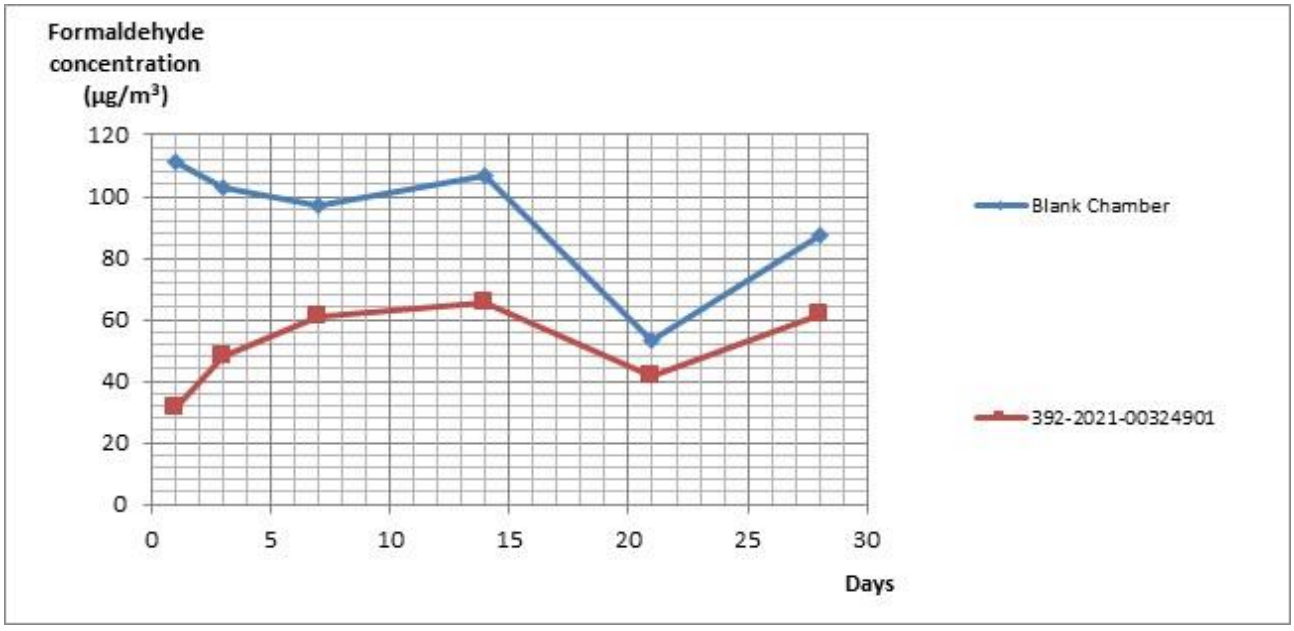
The temperature was 23 °C with an accuracy of ± 1 °C (not ± 0.5 °C).

4 Results

4.1 Formaldehyde Test Results

Sampling	Sample [µg/m³]	Empty chamber [µg/m³]	Sorption flux [µg/m²h]	Consumption [%]
1 day	32	110	40	72
3 days	48	100	28	53
7 days	61	97	18	37
14 days	66	110	21	38
21 days	41	53	6.1	22
28 days	62	88	13	29
1 day desorption	3.9	-	no injection	

4.2 Overview of the Formaldehyde Reduction



5 Appendices

5.1.1 Acronyms Used in the Report

< Means less than

> Means bigger than

* Not a part of our accreditation

¤ Please see section regarding uncertainty in the Appendices

§ Deviation from method. Please see deviation section

5.2 Description of VOC Emission Test

5.2.1 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).

5.2.2 Injection of formaldehyde

An artificial atmosphere containing a known formaldehyde concentration is continuously injected into the test chamber to create the basis of investigating the reductive properties of the tested product.

5.2.3 Expression of the Test Results

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

5.2.4 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.

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.

5.2.5 Calculation of formaldehyde consumption

Formaldehyde consumption in % was calculated with the following formula:

$$FC = (C_{in} - C_{out})/C_{in}$$

FC = formaldehyde consumption, %

5.2.6 Calculation of formaldehyde sorption flux

Sorption flux was calculated with the following formula:

$$F = (C_{in} - C_{out})Q_c / A$$

F = sorption flux, µg/m²h
C_{in} = inlet concentration, µg/m³
C_{out} = chamber concentration, µg/m³
Q_c = Air flow of chamber = 0.06 m³/h
A = Area of the test specimen

5.2.7 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.

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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.

5.3 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 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.

5.4 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.

5.5 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.

5.6 Version History

Report date	Report number	Modification
10/08/2021	392-2021-00324901_RT_EN	Current version