

Emission measurements according to M1

(3 appendices)

Assignment

Emission measurement according to “M1 Emission Classification of Building Materials: Protocol for Chemical and Sensory Testing of Building Materials”, version 15.11.2017, after 28 days of conditioning regarding volatile organic compounds, carcinogenic compounds (EU Regulation No 1272/2008 Annex VI, cat 1A and 1B), formaldehyde, ammonia and sensory acceptability.

Product/test specimen

Table 1.

Product type:	Flooring adhesive
Product name:	Eurocol Fix Tack Plus
Manufacturer:	Forbo Eurocol Nederland B.V.
Manufacturing date:	2020-12-15
Sampling date:	2021-10-20
Batch No:	5421-1220
Size of sample, packaging:	Retail plastic can, 10 kg
Arrived at RISE:	2021-10-22
Test specimen preparation:	Floor scenario is used for the testing. The adhesive was applied according to the manufacturer’s instruction with a roller, 100 g/m ² . Chemical testing: The adhesive was applied to a glass plate of 200 x 200 mm, 100 g/m ² . Total applied amount was 4.1 g. Sensory testing: The adhesive was applied to glass plates of 400 x 250 and 200 x 200 mm. Total applied amount was 44 g.
Deviation from protocol:	No
Test period started, date:	2021-10-25
Conditions during ageing:	23 ± 2 °C, 50 ± 5 % RH
Emission samplings, date:	2021-11-22

RISE Research Institutes of Sweden AB

Postal address
Box 857
501 15 BORÅS
SWEDEN

Office location
Brinellgatan 4
504 62 Borås
SWEDEN

Phone / Fax / E-mail
+46 10-516 50 00
+46 33-13 55 02
info@ri.se

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Methods

The specimens were conditioned outside the testing chambers in a room with controlled climate conditions of 23 ± 2 °C and 50 ± 5 % RH. The specimens were placed in the chambers three days before the measurements of the chemical emission and the sensory evaluation.

Table 2.

Chamber conditions of the test of chemical emissions

Test chamber volume:	0.031 m ³ , stainless steel
Temperature:	23 ± 1 °C
Relative Humidity:	50 ± 3 % RH
Air exchange rate:	0.68 h ⁻¹
Air velocity at specimen surface:	0.1 – 0.3 m/s
Area of sample:	0.04 m ²
Area specific air flow rate:	0.53 m ³ /m ² h

Table 3.

Chamber conditions of the test of sensory acceptability

Test chamber volume:	1.0 m ³ , stainless steel
Temperature:	23 ± 1 °C
Relative Humidity:	50 ± 3 % RH
Supply air flow rate:	0.6 l/s = 2.2 m ³ /h
Area of sample:	0.44 m ²

Table 4.

Emission sampling and analytical methods

Test	Sampling method	Adsorbent	Sampling volume (litre)	Analysis method / Quantification	Detection limit
VOC	ISO 16000-9:2006 ¹	Tenax TA	2.6 – 7.1	ISO 16000-6 ² / FID quantification	1 µg/m ³
Formaldehyde	ISO 16000-9:2006 ¹	DNPH	21	SP 2303 ³ /HPLC-UV	0.03 µg/sampler
Ammonia	ISO 16000-9:2006 ¹	Treated silica gel	132 – 173	Liquid chromatograph with conductivity detector ⁴	1.0 µg/sampler
Sensory evaluation	ISO 16000-28:2012 ⁵	--	--	Acceptability, Untrained panel of min 15 persons	--

¹⁾ In accordance with ISO 16000-9:2006 and M1 protocol.

²⁾ In accordance with ISO 16000-6:2011 and M1 protocol.

³⁾ In accordance with ISO 16000-3:2001.

⁴⁾ Not accredited method.

⁵⁾ In accordance with M1 protocol, not accredited method.

Tenax TA was used as adsorption medium for VOC. The tubes were thermally desorbed and analysed in accordance to ISO 16000-6:2011 (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/FID). This means an analysis in a gas chromatograph and detection with a flame ionisation detector (FID) and mass selective detector (MS). The FID signals are used for compound quantification. The TVOC is quantified as toluene equivalents. The mass selective detector is used for identification of compounds. The capillary column used is coated with 5% phenyl/ 95 % methylpolysiloxane. Tenax TA was also used as adsorption

medium for testing of volatile carcinogenic compounds, according to EU Regulation No 1272/2008 Annex VI, cat 1A and 1B), (exclusive formaldehyde), 0.001 mg/m³ and above.

The sampling of formaldehyde was carried out with DNPH samplers. The samplers were analysed according to SP method 2302, similar to ISO 16000-3:2011(Indoor air--Part 3: Determination of formaldehyde and other carbonyl compounds – Active sampling method), which means analysis on a liquid chromatograph with absorbance detector.

The sampling of ammonia was carried out with silicagel treated adsorbent tubes and analysis on a liquid chromatograph with conductivity detector.

Minimum two subsequent samples were taken for the determination of VOC, formaldehyde and ammonia respectively.

Results

The results relate only to the items tested.

Decision rule: When comparing the measured results and requirement level, the average value of the measured results has been compared with the requirement level. No account is taken to the measurement uncertainty.

The results of the chemical testing are expressed as area specific emission rates and as concentrations in a model room. The model room has a base area of 3 m x 4 m and a height of 2.5 m, with an air exchange rate of 0.5 h⁻¹. The wall area is 31.4 m², floor area is 12 m², small area, like a door, is 1.6 m² and very small area, like sealant, is 0.2 m². Floor area is used for the calculation of the concentrations.

Calculation of the concentration from the emission rate:

$$Conc = \frac{SER_A \times A}{n \times V}$$

Conc = concentration of a VOC in the model room, in µg/m³
 SER_a = area specific emission rate, in µg/m²h
 A = area of sample, in m²
 n = air exchange rate, in changes per hour
 V = volume of the model room, in m³

Table 5.

Results of the chemical testing of the sample **Eurocol Fix Tack Plus**, after 28 days

Compound	Concentration in model room mg/m ³	Emission rate mg/m ² h	Criteria M1 mg/m ² h
TVOC ⁶	< 0.005	< 0.010	< 0.2
Carcinogens	< 0.001	< 0.001	< 0.001
Single VOC (µg/m ³)	< EU-LCI	--	≤ EU-LCI
Formaldehyde	< 0.001	< 0.001	< 0.05
Ammonia ⁷	< 0.003	< 0.004	< 0.03

⁶) The TVOC is the sum of the individual concentration ≥ 5 µg/m³ in model room.

⁷) Not accredited method.

Table 6.

Results of the sensory acceptability evaluation of the sample **Eurocol Fix Tack Plus**, after 28 days

Evaluator	Sensory evaluation	Criteria M1
1	0.68	
2	0.73	
3	0.9	
4	0.95	
5	0.9	
6	0.86	
7	0.93	
8	0.96	
9	0.7	
10	0.8	
11	0.93	
12	0.96	
13	0.91	
14	0.88	
15	0.82	
Arithmetic mean of acceptability ⁸	0.86	$\geq + 0.0$
Standard deviation	0.09	
90 % confidence interval of arithmetic mean	0.04	≤ 0.2

⁸⁾ Not accredited method.

The empty sensory test chamber acceptability was determined 2021-11-19. The mean acceptability vote of the empty chamber was > 0.8 .

Interpretation of the results

The tested product **Eurocol Fix Tack Plus** complies with all the requirements of M1 for the tested parameters.

Detailed results

Table 7.

Detailed results (emission rates) of the chemical testing after 28 days

Sample	TVOC (mg/m ² h) as toluene equivalents between C ₆ -C ₁₆	Formaldehyde (mg/m ² h)	Ammonia (mg/m ² h)	Carcinogens (mg/m ² h) between C ₆ -C ₁₆
1	< 0.010	< 0.001	< 0.003	< 0.001
2	< 0.010	< 0.001	< 0.004	< 0.001

Table 8.
Single VOCs in the model room (floor area scenario).

Single VOCs	CAS number	Retention time (min)	ID ⁹	Emission rate (µg/m ² h)	Concentration (µg/m ³)
Single VOCs C₆-C₁₆:	--	6.2 – 37.9			
1-Butanol	71-36-3	7.6	B	2	< 5
1-Hexanol, 2-ethyl-	104-76-7	20.4	B	2	< 5
TVOC	--	6.2 – 37.9	B	< 10	< 5
Volatile Carcinogens ¹⁰		6.2 – 37.9			
No substances detected	--	--	B	< 1	< 1
Single VOC outside C₆ – C₁₆:					
VVOC (< C ₆) ¹¹		4.5 – 6.2			
No substances detected	--	--	B	< 2	< 5
SVOC (C ₁₆ – C ₂₂) ¹²		37.9 – 51.3			
No substances detected	--	--	B	< 2	< 5

⁹⁾ ID: A = quantified compound specific, B = quantified as toluene-equivalent

¹⁰⁾ Volatile carcinogens = VOCs according to EU Regulation No 1272/2008 Annex VI, cat 1A and 1B

¹¹⁾ VVOC = very volatile organic compounds, as defined in ISO 16000-6 (not accredited)

¹²⁾ SVOC = semi-volatile organic compounds, as defined in ISO 16000-6 (not accredited)

TVOC is the sum of all individual substances with concentrations $\geq 5 \mu\text{g}/\text{m}^3$ in the model room (in toluene equivalents). Level of identification of compounds is 100 % for all compounds $\geq 5 \mu\text{g}/\text{m}^3$

There were no compounds $\geq 5 \mu\text{g}/\text{m}^3$ quantified in the model room and therefore no comparison to EU-LCI-values.

Measurements uncertainty

The expanded measurement uncertainty of VOC result is 15 % (rel) and formaldehyde is 30 % (rel). For ammonia the measurement uncertainty is estimated to 20 % (rel).

See Appendix 1 for a gas chromatogram from the VOC determination and Appendix 2 for a photo of a test specimen. Appendix 3 is the Sampling report received from the customer.

RISE Research Institutes of Sweden AB
Chemistry and Applied Mechanics - Chemical Product Safety

Performed by

Examined by

Ulrika Johansson

Marcus Gjertz

Appendices

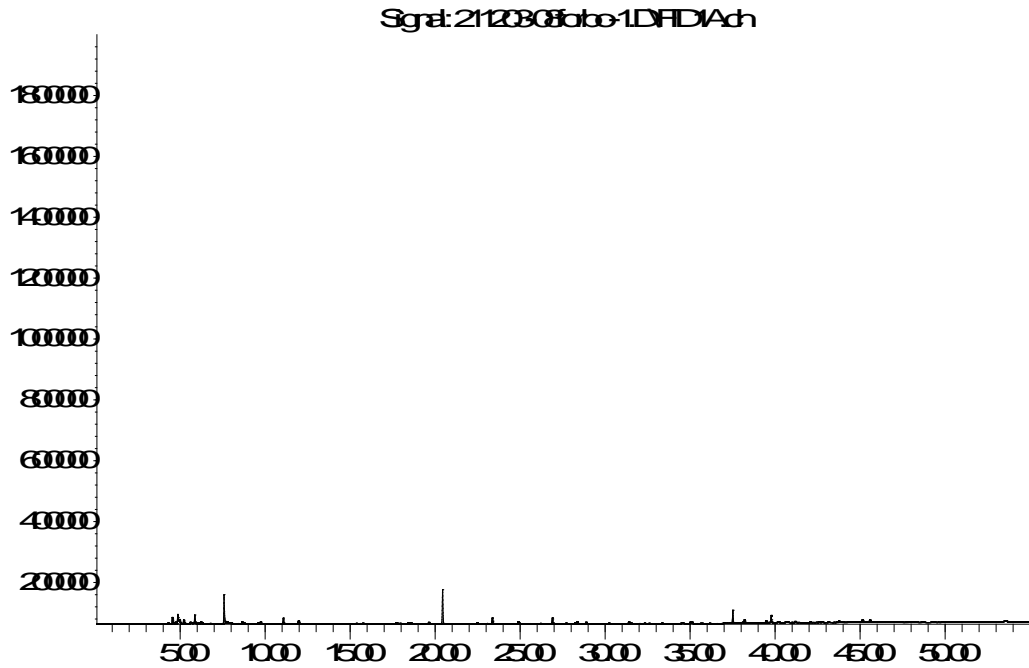
1. Gas Chromatogram
2. Photo of a test specimen
3. Sampling report

Appendix 1

Gas chromatogram

Sample: **Eurocol Fix Tack Plus**, after 28 days

Abundance



Time>

TVOC between C₆ and C₁₆, means compounds eluting between 6.2 and 37.9 minutes.

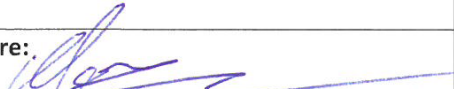
Appendix 2

Photo of a test specimen

Specimen for the chemical emission

Appendix 3

Sampling Report

<p>Sampler (Name, Company, contact info):</p> <p>Forbo Flooring AB Mikael Taberman 070-149 67 99 Mikael.taberman@forbo.com</p>	<p>Manufacturer of the product (Company, address):</p> <p>Forbo Eurocol Nederland B.V. Industrieweg 1 NL 1521 NA Wormerveer Postbus 130 NL 1520 AC Wormerveer The Netherlands Phone:+31 (0)75 6271600 Mobile: +31 (0) 614760452</p>
<p>Name of product:</p> <p>Eurocol Fix Tack Plus</p>	<p>Type of product:</p> <p>Tejplim</p>
<p>Manufacturing Date:</p> <p>2020-12-15</p>	<p>Batch No:</p> <p>5421-1220</p>
<p>Date of sampling:</p> <p>2021-10-20</p>	<p>Amount/size of material sampled:</p> <p>Packing material:</p>
<p>Sample is taken from:</p> <p>Production line <input type="checkbox"/></p> <p>Stock / Storage <input type="checkbox"/></p> <p>Miscellaneous <input type="checkbox"/></p> <p>-where, specify:</p>	<p>How was the product stored before sampling?</p> <p>Lager I Holland</p>
<p>If a sub-sample was collected from a larger material amount, describe how the sub-sample was taken:</p> <p>Full öppnad förpackning</p>	
<p>Observations and remarks:</p>	
<p>Confirmation</p> <p>I hereby confirm that the sample was selected, taken and packed in accordance with the instructions.</p>	
<p>Date:</p> <p>2021-10-20</p>	<p>Signature: </p>