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Testing
ISO/IEC 17025

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Emission measurements after 28 days

(2 appendices)

Object

One sample of a sealant was delivered to SP by the client.

Sample name:	**Pyrocoustic brannfugemasse** two tubes, à 310 mL
Date of arrival:	2016-03-04

Work requested and method

Emission measurements according to accredited ISO 16000-9:2006 (Indoor air – Part 9: Determination of the emission of volatile organic compounds from building products and furnishing – Emission test chamber method) after 28 days regarding volatile organic compounds (VOC and VVOC/SVOC) and aldehydes (ISO 16000-3:2011).

The test was started 2016-03-07. The sealant was applied in six aluminium U-profiles of 630 x 10 x 3 mm (length x width x depth). The total surface area of the test specimen was 0.038 m^2. The test specimen was stored in a room with controlled climate conditions of 23 ± 2 °C and 50 ± 5 % RH. The specimen was placed in a chamber three days before samplings. The emission samplings were carried out on 2016-04-04.

Test conditions in the chamber:

Chamber volume:	1.0 m^3
Temperature:	23 ± 0.5 °C
Relative humidity:	50 ± 5 % RH
Surface area of test specimen:	0.038 m^2
Air exchange rate:	0.5 h^{-1}
Area specific air flow rate:	13 m^3/m^2 h.
Air velocity at specimen surface:	0.1 – 0.3 m/s

Tenax TA was used as adsorption medium for VOC. The Tenax 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), accredited SP method 0601. 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 total volatile organic compounds (TVOC) means compounds eluting between and including n-hexane to hexadecane, having boiling points in the range of about 70-260 °C. The emission

rate of TVOC is quantified in toluene equivalents and includes all compounds ca ≥ 1 µg/m^3 in the chamber. The mass selective detector is used for identification of single compounds, quantified in compound specific amounts when possible, otherwise in toluene equivalents. Quantification limit for carcinogenic substances is 1 µg/m^{2}h. Minimum duplicate air samples were taken and the results are mean values. Sampled volumes were 4 to 10 L.

The samplings of the aldehydes/ketones formaldehyde, acetaldehyde, acetone and propanal were carried out with DNPH samplers. The samplers were analysed according to ISO 16000-3:2011 -Indoor air--Part 3:Determination of formaldehyde and other carbonyl compounds – Active sampling method, accredited SP method 2302. This means analysis on a liquid chromatograph with absorbance detector. The other aldehydes (butanal, pentanal, hexanal, benzaldehyde, 3-methylbenzaldehyde, 2-methylbenzaldehyde, 4-methylbenzaldehyde and 2,5-dimethylbenzaldehyde) were analyzed on GC-MS/FID by sampling on Tenax TA. Duplicate air samples were taken and the results are mean values. Sampled volumes were 64 and 110 L.

Results

The results in table 1 are expressed as area specific emission rates and as concentrations in a reference room (according CEN/TS 16516:2013) when using a wall area scenario. The reference 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 sealant area is 0.2 m^2.

Calculation of the concentration from the emission rate:

$$C = \frac{E_a \times A}{n \times V}$$

C = concentration of VOC in the reference room, in µg/m^3
E_a = area specific emission rate, in µg/m^{2}h
A = surface area of the tested product, in m^2
n = air exchange rate, in changes per hour, here 0.5 h^{-1}
V = volume of the model room, in m^3, here 30 m^3

Table 1.
Emission results of **Pyrocoustic brannfugemasse**, after 28 days

Volatile organic compounds	Retention time (min)	CAS number	ID [1]	Emission rate (µg/m²h)	Concentration in reference room (µg/m³)
TVOC (C_6 – C_{16})	6.2 – 37.9	--	B	**1 100**	**< 10**
Identified substances:					
1-Butanol	71-36-3	7.5	A	320	< 5
Probably: 2-Propanol, 1-(2-propenyloxy)-	13.3	21460-36-6	B	57	< 5
n-Butyl ether	14.7	142-96-1	A	140	< 5
Propanoic acid, butyl ester	15.6	590-01-2	B	34	< 5
Probably: 2-Propanol, 1-[1-methyl-2-(2-propenyloxy)ethoxy]-	24.6+24.7	55956-25-7	B	140	< 5
1-Heptanol, 2-propyl-	26.7	10042-59-8	B	290	< 5
Probably an alcohol	33.0	--	B	77	< 5
Tripropylene glycol monomethylether	33.5+33.6 +33.8	20324-33-8	B	75	< 5
Carcinogenic substances [2]					
No substances identified	6.2 – 37.9	--	--	< 5	< 1
Substances outside TVOC:					
VVOC (< C_6) [3]	4.5 – 6.2				
No VVOC substances identified	--	--	--	--	--
SVOC (C_{16} – C_{22}) [4]	37.9 - 42.0				
No SVOC substances identified	--	--	--	--	--
Formaldehyde	--	50-00-0	A	< 10	< 5
Σ Aldehydes [5]	--	--	A	< 10	< 5

[1)] ID: A = quantified compound specific, B = quantified as toluene-equivalent
[2)] VOC-substances, according to EU Regulation No 1272/2008 Annex VI, cat 1A and 1B
[3)] VVOC = very volatile organic compounds, as defined in ISO 16000-6 (not part of accreditation)
[4)] SVOC = semi-volatile organic compounds, as defined in ISO 16000-6 (not part of accreditation)
[5)] Aldehydes = Aldehydes and ketones according to EN ISO 16000-3:201: formaldehyde, acetaldehyde, acetone, propanal, butanal, pentanal, hexanal, benzaldehyde, 3-methylbenzaldehyde, 2-methylbenz-aldehyde, 4-methylbenzaldehyde and 2,5-dimethylbenzaldehyd.

Only VOC-compounds with an emission rate higher than 20 µg/m²h are listed in the table (carcinogenic compounds ≥ 5 µg/m²h). The concentration of TVOC in the reference room is the sum of single VOC compounds ≥ 5 µg/m³ (in toulene equivalents).

Quantification limit for TVOC is 10 µg/m²h. Measurement uncertainty for TVOC is 15 % (rel) and for formaldehyde 30 % (rel). Background of TVOC in the empty chamber was below 20 µg/m³. The background value is subtracted.

See Appendix 1 for gas chromatogram (FID spectra) and appendix 2 for a photo of the test specimen.

Summary of the test results

The emission rates after 28 days of conditioning were 1100 µg/m^{2}h regarding the TVOC, less than 10 µg/m^{2}h regarding formaldehyde and less than 10 µg/m^{2}h regarding aldehydes. There were no carcinogenic substances detected in the emission.

Calculated as concentrations in reference room the concentration of TVOC was less than 10 µg/m^3 and formaldehyde less than 5 µg/m^3.

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Appendices

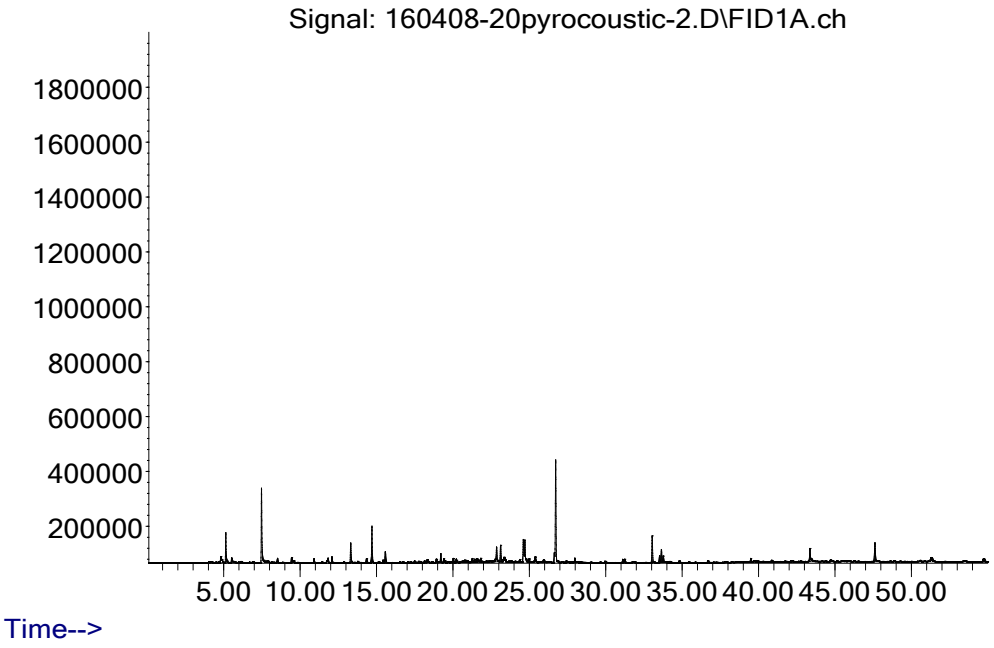
1. Gas Chromatogram

2. Photo of test specimen

Appendix 1

Gas Chromatogram

Pyrocoustic brannfugemasse, after 28 days:



TVOC between C_6 and C_{16}, means compounds eluting between 6.2 and 37.9 minutes.

Appendix 2

Photo of test specimen

Pyrocoustic brannfugemasse