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SWEDAC ACKREDITERING 1002 ISO/IEC 17025

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Emission measurements

(1 bilaga)

Assignment

At the request of Bostik AB an emission measurement according to "Emission Classification of Building Materials: Protocol for Chemical and Sensory Testing of Building Materials", ver 15.12.2004, has been carried out.

The measurements are made after 28 days of conditioning regarding volatile organic compounds, formaldehyde, ammonia and odour.

Product/test specimen

Product type:	Sealing compound
Product name:	**Bostik Multifog 2640**
Batch No:	99585
Manufacturing date:	2012-09-11
Packaging:	two cartridges of 300 mL each
Arrived at SP:	2012-10-09
Test specimen preparation:	Chemical testing: The sealant was applied 3 mm thick to a circular glass plate with a diameter of 150 mm. Applied amount was 105 g. The total surface area is 0.0177 m^2. Sensory testing: The sealant was applied in three U-profiles of 630 x 10 x 3 mm (length x width x depth). The total surface area is 0.02 m^2.
Deviation from protocol:	No deviations
Test period started, date:	2012-10-12 (chemical test), 2012-10-17 (odour)
Conditions during ageing:	23 ± 2 °C, 50 ± 5 % RH
Emission samplings, date:	2012-11-09 (chemical emissions), 2012-11-14 (odour)

Methods

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

Chamber conditions of the test of volatile organic compounds, formaldehyde and ammonia:

Test chamber volume:	0.000035 m^3, FLEC
Area of sample:	0.0177 m^2
Air exchange rate:	171 h^{-1}
Area specific air flow rate:	0.34 m^3/m^2h
Temperature:	23 ± 1 °C
Relative Humidity:	50 ± 3 % RH

Chamber conditions of the test of odour:

Test chamber volume:	0.051 m^3, glass (Climpaq)
Area of sample:	0.02 m^2
Supply air flow rate:	0.9 l/s = 3.24 m^3/h
Temperature:	23 ± 1 °C
Relative Humidity:	50 ± 3 % RH

Emission sampling and analytical methods:

Test	**Sampling method**	**Adsorbent**	**Sampling volume (litre)**	**Analysis method / Quantification**	**Detection limit**
VOC	SP 1598[1]	Tenax TA	3.0 – 5.0	SP 0601 [2] / FID quantification	1 µg/m^3
Formaldehyde	SP 1598[1]	DNPH	6	SP 2303[3] / HPLC-UV	0.03 µg/sampler
Ammonia	SP 1598[1]	Silica gel	40	Liquid chromatograph with conductivity detector [4]	0.9 µg/sampler
Sensory evaluation	Human nose	--	--	--	--

[1)] In accordance with ISO 16000-10:2006, accredited method.
[2)] In accordance with ISO 16000-6:2004, accredited method.
[3)] In accordance with ISO 16000-3:2001, accredited method.
[4)] The determinations of the sampled silica gel tubes were done by Sahlgrenska Universitetssjukhuset, Miljökemiska laboratoriet, Göteborg, accredited method.

Tenax TA was used as adsorption medium for VOC. The Tenax tubes were thermally desorbed and analysed in accordance to ISO 16000-6:2004 (Determination of volatile organic ompounds 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 TVOC is quantified as toluene equivalents. The mass selective detector is used for identification of compounds.

Tenax TA was also used as adsorption medium for testing of volatile carcinogenic compounds, according to IARC listing, category 1 (exclusive formaldehyde), 0.001 mg/m^2h and above.

The sampling of formaldehyde was carried out with DNPH samplers. The samplers were analysed according to ISO 16000-3 (in accordance to accredited SP method 2302), which means analysis on a liquid chromatograph with absorbance detector.

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

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

Results

The results of the chemical testing are expressed as concentrations in the chamber and area specific emission rates:

$$SER_A = \frac{Conc \times n}{L}$$

SER_a = area specific emission rate, in mg/m^2h
Conc = concentration of a volatile compound in the chamber, in mg/m^3
n = air exchange rate, in changes per hour
L = loading factor, in m^2/m^3 (area of sample/volume of chamber)

Results of the chemical testing of the sample of **Bostik Multifog 2640** after 28 days:

Compound	Concentration mg/m^3	Emission rate mg/m^2h	Criteria M1 mg/m^2h
TVOC	0.086	**0.029**	< 0.2
Carcinogens	< 0.002	**< 0.002**	< 0.005
Formaldehyde	< 0.005	**< 0.002**	< 0.05
Ammonia	0.051	**0.017**	< 0.03

See appendix 1 for gas chromatograms from VOC determination.

Results of the sensory evaluation of the sample of **Bostik Multifog 2640** after 28 days:

Evaluator	Sensory evaluation first	Sensory evaluation second	Average of acceptability	Criteria M1
1	1.00	1.00		
2	0.55	0.60		
3	0.85	0.90	**+ 0.8**	≥ + 0.1
4	1.00	1.00		
5	0.75	0.80		

Standard deviation of the sensory evaluation of the test sample was 0.17

The empty sensory test chamber acceptability was determined 2012-11-12. The mean acceptability vote of the empty chamber was > 0.5.

Interpretation of the results

The tested product **Bostik Multifog 2640** complies with the requirements of M1 for the tested parameters.

Detailed results

Detailed results of the chemical testing after 28 days:

Sample	TVOC (mg/m^2h) as toluene equivalents between C_6-C_{16}	Formaldehyde (mg/m^2h)	Ammonia (mg/m^2h)	Carcinogens [5] (mg/m^2h) as toluene equivalents between C_6-C_{16}
1	0.032	< 0.002	0.023	< 0.002
2	0.029	< 0.002	0.012	< 0.002
3	0.026	--	--	< 0.002

[5)] The emission of which exceeds 0.002 mg/m^2h.

Single VOCs:

Single VOCs of which exceed 0.005 mg/m^2h as toluene equivalent	Retention time (min)	CAS number	Emission rate (mg/m^2h)		
			Sample 1	Sample 2	Sample 3
Single VOCs C_6-C_{16}:	5.1 – 36.1				
4-Piperidinol, 2,2,6,6-tetramethyl-	23.5	2403-88-5	0.026	0.024	0.021
2-Decanone	24.6	693-54-9	0.006	0.005	0.005
		TVOC:	0.032	0.029	0.026
Single VOC outside C_6 – C_{16}:					
VVOC (< C_6) [6]	3.5 – 5.1				
No single VVOC detected	--	--	--	--	--
SVOC (C_{16} – C_{22}) [7]	36.1 - 44.0				
No single SVOC detected	--	--	--	--	--

[6)] VVOC = very volatile organic compounds, as defined in ISO 16000-6 (not accredited)
[7)] SVOC = semi-volatile organic compounds, as defined in ISO 16000-6 (not accredited)

Level of identification of compounds is 100 % for all compounds ≥ 0.005 mg/m^2h.

Measurements uncertainty

SER_{TVOC}: ± 15 %, $SER_{Formaldehyde}$: ± 30 %, SER_{NH3}: ± 14 %

SP Sveriges Tekniska Forskningsinstitut
Kemi och Material - Organisk analytisk kemi

Utfört av

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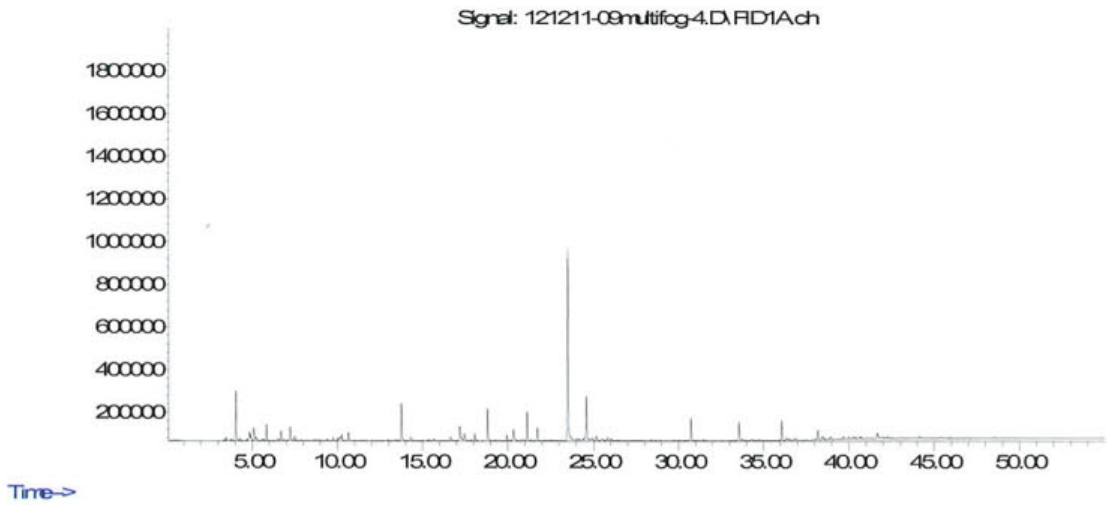
Bilaga

1. Gas Chromatograms

Bilaga 1

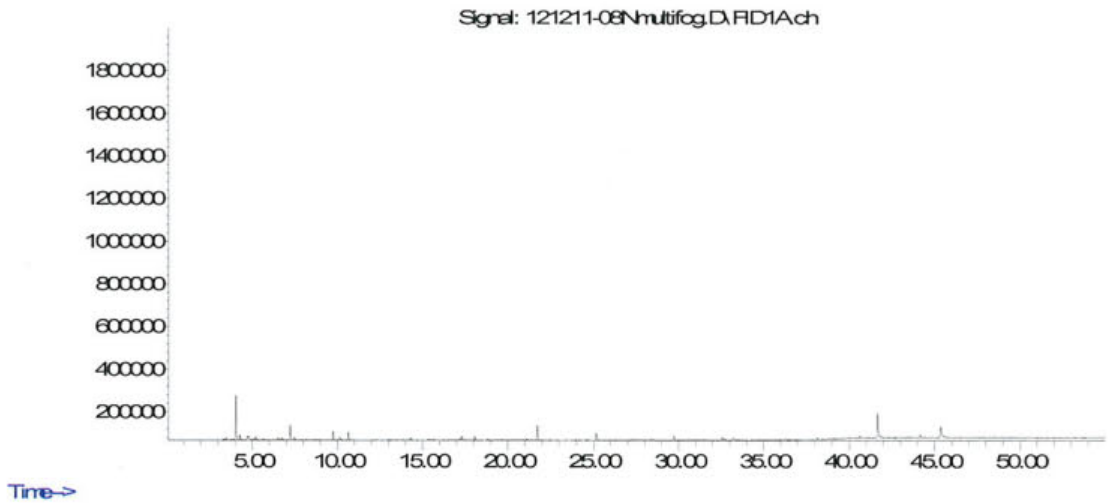
Gas chromatogram

Sample: **Bostik Multifog 2640,** after 28 days (sampled volume: 5.0 litre):



The compound with the retention time 4.1 min is a contamination from the analysis system.

Sample: Empty chamber (sampled volume: 6 litre):



$TVOC_{\text{empty chamber}} = < 20\ \mu g/m^3$