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Emission measurements after 28 days

(1 appendix)

Object

A sample of a casted concrete was delivered to SP.

Sample marking:

FPS Fiberbetong

Manufactured: 2014-01-10

three pieces of 0.3 x 0.3 m, thickness ca 0.01 m
wrapped in aluminium foil and plastic foil

Date of arrival:

2014-01-28

Work requested and method

Emission measurements according to SS-EN 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", regarding volatile organic compounds (VOC), formaldehyde and ammonia 28 days after manufacturing date.

All three pieces were used for the test. On the day of arrival the backsides and edges were sealed with aluminium foil and aluminium tape. Total exposed area was 0.27 m².

The test specimens were stored in a room with controlled climate conditions of 23 ± 2 °C and 50 ± 5 % RH. The specimens were placed in a chamber three days before samplings of VOC etc. The samplings were carried out on 2014-02-06.

Test conditions in the chamber:

Chamber volume:	1.0 m ³
Temperature:	23 ± 0.5 °C
Relative humidity:	50 ± 5 % RH
Area specific air flow rate:	1.84 m ³ /m ² h.
Surface area of test specimen:	0.3 m ²
Air exchange rate:	0.5 h ⁻¹

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 TVOC is quantified

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in toluene equivalents and includes all compounds $ca \geq 1 \mu\text{g}/\text{m}^3$. The mass selective detector is used for identification of single compounds, quantified in compound specific amounts when possible, otherwise in toluene equivalents. Minimum duplicate air samples were taken and the results are mean values.

The sampling of formaldehyde was carried out with DNPH samplers. The analysis of the samplers were carried out according to ISO 16000-3:2001 "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. Duplicate air samples were taken and the result is a mean value.

The sampling of ammonium was carried out with silicagel treated adsorbent tubes and analysis on a liquid chromatograph with conductivity detector. The determinations of the sampled silica gel tubes were done by Sahlgrenska Universitetssjukhuset, Miljökemiska laboratoriet, Göteborg, not accredited method. Duplicate air samples were taken and the result is a mean value.

Results

The results are expressed as area specific emission rates:

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

SER_a = area specific emission rate, in $\mu\text{g}/\text{m}^2\text{h}$
 Conc = concentration of a VOC in the chamber, in $\mu\text{g}/\text{m}^3$
 n = air exchange rate, in changes per hour
 L = loading factor, in m^2/m^3 (area of sample/volume of chamber)

Emission results of **FPS Fiberbetong**, after 28 days:

Volatile organic compounds	Retention time (min)	CAS number	ID ¹	Emission rate ($\mu\text{g}/\text{m}^2\text{h}$)
TVOC (C₆ – C₁₆)	5.5 - 36.8	--	B	150
Identified substances:				
1-Butanol	6.8	71-36-3	A	220
2-Propanol, 1-methoxy-	7.1	107-98-2	B	3
1-Methoxy-2-propyl acetate	13.0	108-65-6	B	8
1-Butanol, 3-methoxy-, acetate	17.3	4435-53-4	B	2
Substances outside TVOC:				
VVOC (< C₆)²	4.5 – 5.5			
No substances identified	--	--	--	--
SVOC (C₁₆ – C₂₂)³	36.8 - 42.0			
No substances identified	--	--	--	--
Formaldehyde	--	50-00-0	A	< 2
Ammonia	--	7664-41-7	A	< 6

¹⁾ ID: A = quantified compound specific, B = quantified as toluene equivalent

- 2) VVOC = very volatile organic compounds, as defined in ISO 16000-6, not accredited
3) SVOC = semi-volatile organic compounds, as defined in ISO 16000-6, not accredited

Only VOC-compounds with an emission rate higher than $2 \mu\text{g}/\text{m}^2\text{h}$ are listed in the table. Quantification limit for TVOC is $10 \mu\text{g}/\text{m}^2\text{h}$. Measurement uncertainty for TVOC is 15 % (rel), for ammonia 14 % (rel) and for formaldehyde 30 % (rel). Background of TVOC in the empty chamber was below $20 \mu\text{g}/\text{m}^3$. The background value is subtracted.

See Appendix 1 for gas chromatogram (FID spectra).

Summary of test results

The emission rates after 28 days of conditioning was $150 \mu\text{g}/\text{m}^2\text{h}$ regarding the TVOC, less than $2 \mu\text{g}/\text{m}^2\text{h}$ regarding formaldehyde and less than $6 \mu\text{g}/\text{m}^2\text{h}$ regarding ammonia.

Comments

Individual substances can have response factors varying widely from the toluene response factor. The emission 1-Butanol was $220 \mu\text{g}/\text{m}^2\text{h}$. This emission expressed in toluene response factor, like TVOC, is $130 \mu\text{g}/\text{m}^2\text{h}$. The sum of the emission rates of the individual substances is in most cases higher than the TVOC value.

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Performed by



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Examined by



Marcus Vestergren

Appendix

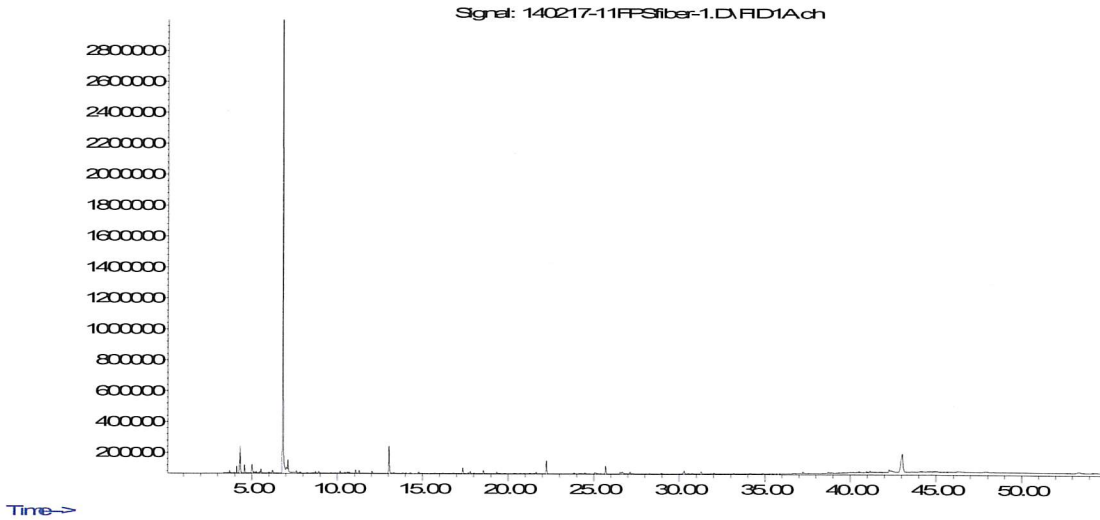
1. Gas Chromatogram

Appendix 1

Gas Chromatogram

FPS Fiberbetong, after 28 days:

Abundance



TVOC between C_6 and C_{16} , means compounds eluting between 5.5 and 36.8 minutes.

The compound with retention time 4.3 min is a contamination from the analysis system.