

Herrljunga Terrazzo Design AB
Anders Lundell
Box 13
524 21 HERRLJUNGA

Emission measurements after 28 days

(3 appendices)

Object

One sample of a resin marble terrazzotile was delivered to RISE by the customer.

Product name:	ht-calacatta
Date of sampling:	2017-03-08
Size of sample:	six pieces, 300 x 300 x 12 mm
Date of arrival to RISE:	2017-03-09
Date of analysis:	week 11 – 18, 2017

Assignment

Emission measurement according to 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), carcinogenic substances (VOC-substances, EU Regulation No 1272/2008 Annex VI, cat 1A and 1B), formaldehyde and acetaldehyde (ISO 16000-3:2011). Evaluation according to CEN/TS 16516:2013 (EU-LCI values).

For evaluation of test results the principle of shared risk is applied, i.e. for a max limit (\leq) a result \leq the limit complies and a result $>$ the limit does not comply (ILAC G8 section 2.7).

Method

The test was started 2017-03-13 by unwrapping one of the test pieces. Backside and edges were sealed with aluminium foil and aluminium tape.

Open surface area was 0.09 m². The specimen was placed in a room with controlled climate conditions of 23 ± 2 °C and 50 ± 5 % RH. The test specimen was put into the chamber three days prior to air samplings. Air samplings after 28 days of conditioning were carried out on 2017-04-10.

RISE Research Institutes of Sweden AB

Postal address	Office location	Phone / Fax / E-mail
Box 857 SE-501 15 BORÅS Sweden	Brinellgatan 4 SE-504 62 BORÅS	+46 10 516 50 00 +46 33 13 55 02 info@ri.se

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Test conditions in the chamber:

Chamber volume:	0.25 m ³
Temperature:	23 ± 0.5 °C
Relative humidity:	50 ± 5 % RH
Surface area of test specimen:	0.09 m ²
Air exchange rate:	0.5 h ⁻¹
Area specific air flow rate:	1.4 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 RISE method 0601, similar 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 capillary column used is coated with 5% phenyl/ 95 % methylpolysiloxane. 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. Minimum duplicate air samples were taken and the results are mean values. Sampled volumes are 3 to 8 L.

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), 1 µg/m³ and above.

The samplings of aldehydes were carried out with DNPH samplers. The samplers were analysed according to RISE method 2302, similar to ISO 16000-3:2011 (Indoor air - Part 3: Determination of formaldehyde and other carbonyl compounds – Active sampling method). This means analysis on a liquid chromatograph with absorbance detector. Duplicate air samples were taken and the results are mean values. Sampled volumes were 30 to 50 L.

Results

The results in Table 1 are expressed as area specific emission rates and as concentrations in a reference room (according to CEN/TS 16516:2013). 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 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:

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

C = concentration of VOC in the reference room, in µg/m³
E_a = area specific emission rate, in µg/m²h
A = surface area of product in reference room, in m²
n = air exchange rate, in changes per hour, here 0.5 h⁻¹
V = volume of the reference room, in m³, here 30 m³

Table 1.
Emission results of **ht-calacatta** after 28 days

Volatile organic compounds	CAS number	Retention time (min)	ID ¹	Emission rate ($\mu\text{g}/\text{m}^2\text{h}$)	Concentration in reference room ($\mu\text{g}/\text{m}^3$)	LCI _i ($\mu\text{g}/\text{m}^3$)	R _i (c_i/LCI_i)
TVOC ($C_6 - C_{16}$)	--	6.2 – 37.9	B	60	43	--	--
Volatile Carcinogens ²		6.2 – 37.9					
No substances detected	--	--	B	< 1	< 1	--	--
VOC with LCI ³		6.2 – 37.9					
Styrene	100-42-5	15.5	A	54	43	250	0.17
Σ VOC with LCI	--	--	A	54	43	--	0.17
VOC without LCI ⁴							
2-Pentanone, 4-hydroxy-4-methyl-	123-42-2	13.2	B	4	< 5	--	--
Σ VOC without LCI	--	--	B	4	< 5	--	--
SVOC ($C_{16} - C_{22}$) ⁵		37.9 - 50.0					
No substances detected	--	--	B	< 2	< 5	--	--
Σ SVOC	--	--	B	< 2	< 5	--	--
VVOC ($< C_6$) ⁶		4.5 – 6.2					
Formaldehyde ⁷	50-00-0		A	< 1	< 5	100	--
Acetaldehyde ⁷	75-07-0	--	A	< 1	< 5	1 200	--
Σ VVOC	--	--	A	< 1	< 5	--	--
R = $\Sigma C_i / \text{LCI}_i$ ⁸	--	--	--	--	--	--	0.17

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

²) Volatile carcinogens = VOCs according to EU Regulation No 1272/2008 Annex VI, cat 1A and 1B

³) VOC with LCI = identified VOC-compound with LCI-value according to EU-LCI, Dec 2016

⁴) VOC without LCI = VOC-compound without LCI-value or not identified.

⁵) SVOC = semi-volatile organic compounds, as defined in ISO 16000-6 (not part of accreditation)

⁶) VVOC = very volatile organic compounds, as defined in ISO 16000-6 (not part of accreditation)

⁷) VVOC-aldehydes measured with DNPH samplers (ISO 16000-3)

⁸) All VVOC, VOC, SVOC and carcinogens with LCI

Only VOC-compounds with an emission rate higher than $2 \mu\text{g}/\text{m}^2\text{h}$ are listed in Table 1, carcinogenic compounds $\geq 1 \mu\text{g}/\text{m}^2\text{h}$. Quantification limit for TVOC is $10 \mu\text{g}/\text{m}^2\text{h}$. Measurement uncertainty for VOC is 15 % (rel) and for formaldehyde 30 % (rel). Background of TVOC in the empty chamber was below $20 \mu\text{g}/\text{m}^3$ and is subtracted.

Only the compounds with a concentration in the reference room $> 5 \mu\text{g}/\text{m}^3$ are evaluated based on LCI (= lowest concentration of interest). TVOC expressed in $\mu\text{g}/\text{m}^3$ is the sum of all individual substances with concentrations $\geq 5 \mu\text{g}/\text{m}^3$ (in toluene equivalents).

See Appendix 1 for a gas chromatogram (FID spectra) and Appendix 2 for a photo of the test specimen. Appendix 3 is the sampling report received from the customer.

Summary of the test results

The test results are summarized in Table 2.

Table 2.
Summary of the emission results after 28 days of **ht-calacatta**

Compounds	Emission rate ($\mu\text{g}/\text{m}^2\text{h}$)	Concentration in reference room (floor scenario) ($\mu\text{g}/\text{m}^3$)
TVOC	60	43
Σ Carcinogenic VOCs	< 1	< 1
Σ VOC with LCI	54	43
Σ VOC without LCI	4	< 5
Σ VVOC	< 1	< 5
Σ SVOC	< 2	< 5
$R = \Sigma C_i / \text{LCI}_i$	0.17	

Evaluation of the test results

Byggarubedömningen has criteria regarding Emissions to indoor environment. The emissions are to be measured according to a standard method such as ISO 16000-9. The requirements for the *Recommended class* is that the requirements to one of the following systems are being met: Emissioncode EC1, Emissioncode EC1^{PLUS}, Blue Angel, M1 (RTS) or GUT.

Table 3.
The test results can be compared to the requirements after 28 days in Emissioncode EC1^{PLUS}

Compounds	Requirement EC1 ^{PLUS} ($\mu\text{g}/\text{m}^3$)	Test Results ($\mu\text{g}/\text{m}^3$)	Pass / Fail
TVOC after 28 days	≤ 60	43	PASS
TSVOC after 28 days	≤ 40	< 5	PASS
R-value after 28 days	≤ 1	0.17	PASS
Sum of non-assessable VOC after 28 days	≤ 40	< 5	PASS
Any CMR 1A+1B after 28 days	≤ 1	< 1	PASS

The test results are in compliance with the requirements after 28 days of Emissioncode EC1^{PLUS}.

RISE Research Institutes of Sweden AB
Chemistry, Materials and Surfaces - Chemistry

Performed by

Examined by

Maria Rådemar

Tove Malin

Appendices

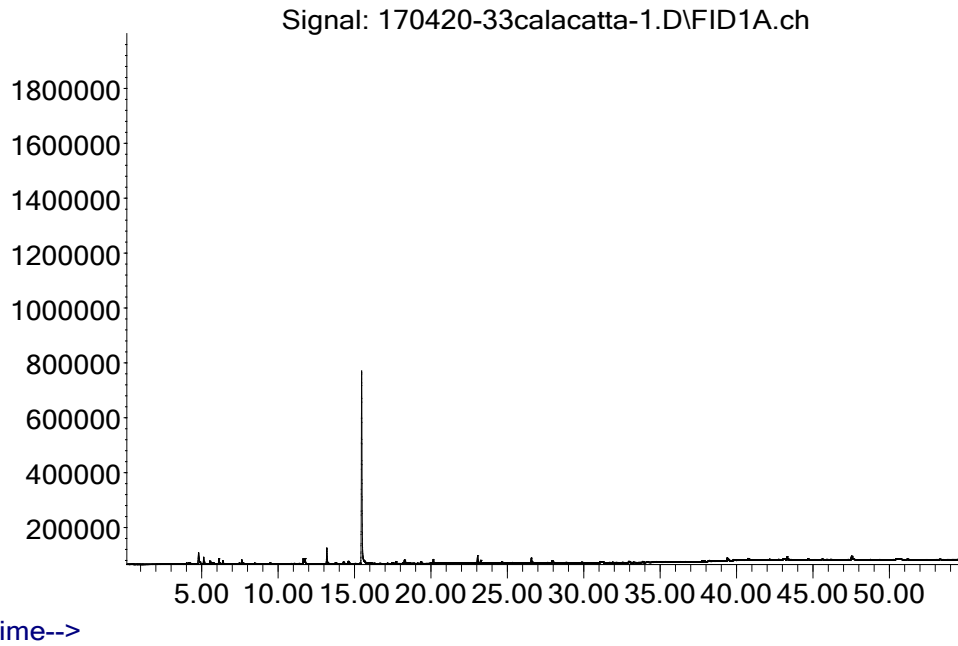
1. Gas Chromatogram
2. Photo of the test specimen
3. Sampling report

Appendix 1

Gas chromatogram**ht-calacatta**, after 28 days:

Sampled volume = 5 L

Abundance

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

Appendix 2

Photo of test specimen**ht-calacatta**

Appendix 3

Sampling Report

Sampler (Name, Company, contact info): Herrljunga Terrazzo design AB Box 13 SE-524 21 HERRLJUNGA Anders Lundell 0513-785000	Manufacturer of the product (Company, address): Marmi Scala SRL Via Prealpi 21 I-37023 Stallavena
Name of product: ht-calacatta	Type of product: Resin marble terrazzotile
Manufacturing Date:	Batch No:
Date of sampling: 2017-03-08	Amount of material sampled: 6 tiles 300x300x12mm Packing material: Plastic film
Sample is taken from: Production line <input type="checkbox"/> Stock / Storage <input checked="" type="checkbox"/> Miscellaneous <input type="checkbox"/> -where, specify:	How was the product stored before sampling? Yes
If a sub-sample was collected from a larger material amount, describe how the sub-sample was taken: 6 pcs. floor tiles 300x300x12mm are taken in the middle of a pallet designed for delivery to the customer	
Observations and remarks:	
Confirmation I hereby confirm that the sample was selected, taken and packed in accordance with the instructions.	
Date:	Signature: