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Emission analysis of material

(3 appendices)

Object

One flooring sample, sent in by the client.

Sample marking:	Marmoleum Real 2,5 mm
Arrived at SP:	2004-05-11
Manufacturing date (according to the client):	2004-04-29
Unpacking date:	2004-05-26*
Test date, 4 weeks:	2004-06-23

*) The sample was stored until it was tested in controlled climate conditions of +23 °C and 50 % RH.

Work requested

Measurement of emission factor for VOCs and identification of predominant substances.

Method

Procedure for the emission measurement is in accordance with the trade standard "Measurement of Chemical Emission from Flooring Materials" approved by GBR (the Swedish National Flooring Trade Association), SP-method 1598. Appendix 1 describes the procedure for the test cell, FLEC (=Field and Laboratory Emission Cell).

Information about measurement uncertainty is given on our homepage www.sp.se/km/sv/kmo.htm

Results

Emission factor, TVOC, after 4 weeks: 43 µg/(m² × h)

The emission factor is given as toluene equivalents.



Sample	Substances identified	Emission factor, toluene equivalents after 4 weeks
Marmoleum Real 2,5 mm	propanoic acid	9,0 $\mu\text{g}/(\text{m}^2 \times \text{h})$
	hexanal	10 $\mu\text{g}/(\text{m}^2 \times \text{h})$

Only compounds with a concentration higher than 5 $\mu\text{g}/(\text{m}^2 \times \text{h})$ were identified.
No compounds with a concentration higher than 5 $\mu\text{g}/(\text{m}^2 \times \text{h})$ have been found.

Quantification limit for TVOC: 10 $\mu\text{g}/(\text{m}^2 \times \text{h})$.

All VOC values are mean values of two successive samples.

See Appendix 1 for details of measurement of VOC concentrations in the Field and Laboratory Emission Cell.

See Appendix 2 for TVOC-definition.

Literature reference:

AMA-nytt Mark-Hus 2/91, pages 40-42:

Materialval och kemiska emissionsdata, Hans Gustafsson, SP
AB Svensk Byggtjänst 1991

SP Swedish National Testing and Research Institute
Chemistry and Materials Technology - Organic Analytical Chemistry



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Appendices

1. General description
2. TVOC-definition
3. Gas chromatogram

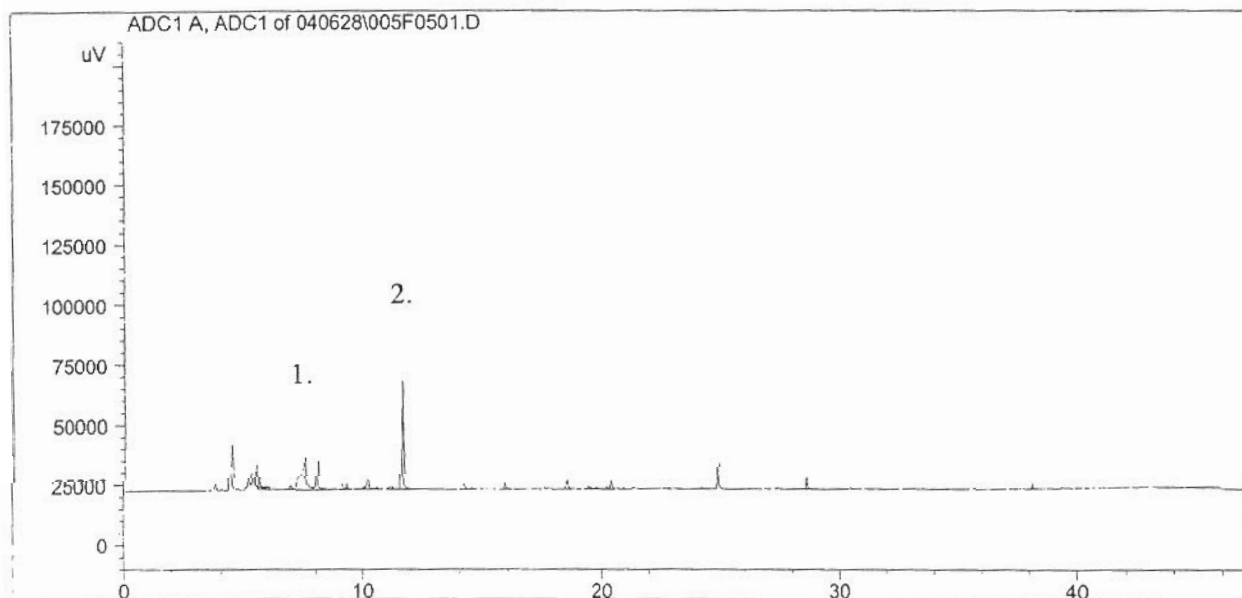


GAS CHROMATOGRAM, emission from material collected on Tenax TA

Method: FLEC Sampled volume: 3L

Sample name: Marmoleum Real 2,5 mm, after 4 weeks

1. propanoic acid
2. hexanal



Each peak in the above gas chromatogram corresponds to one (or sometimes more) organic substance(s) in the sampled air. The size (area) of the peak is in relation to the quantity of the substance concerned. Knowing the specified sample volume, the concentration can be calculated. The interval hexane to octadecane C₆-C₁₈ corresponds to 5,5 - 42,0 minutes.

Analysis date: ...040628..... Column: 50m SGE BPX 5, nr3.. Sign:.....
Desorption: 275 °C for 7 min to cold trap at -30 °C, followed by heating the cold trap at 275 °C for 10 min.
Temp. program: 2 min at 60 °C, 4 °C/min to 150 °C, 8 °C/min to 280 °C, 10 min isothermal
Transfer line: 280 °C Detection temp: 300 °C Carrier gas: Helium
Pressure: 100 kPa Response factor: ..2600..... area/ng

Determination of emission factor for various materials using the Field and Laboratory Emission Cell (FLEC) - General description

1) Before each measurement, monitor the air quality from a ventilated test cell as follows.

Clean the cell using an alkaline detergent (Extran®), and bake it in an oven. Determine the concentration of volatile compounds in the outlet air from the empty cell, using an air flow rate of 100 ml/min. The air used for this purpose shall be of high cleanliness, e.g. synthetic air from a gas bottle (containing less than 0.1 ppm hydrocarbons), or equivalent.

The test climate in the cell shall be 23 ± 1 °C, 50 % RH.

2) Place the upper part of the cell on the sample. If the surface of the sample is such as to prevent the upper part of the cell from sealing to the sample, cut the sample to a disc of the same size as the internal diameter of the cell. Seal the underside and edges of the sample. Place the sample so prepared in the lower part of the test cell and then secure the lower part of the cell to the upper part.

If there is any risk of bowing of the sample, or any other non-planarity, it may be secured to the lower part of the test cell, using emission-free material.

Place semi-solid materials, or materials in the process of curing, in a petri dish. Place the dish in the lower part of the cell and then secure the lower part of the cell to the upper part.

3) Perform the test by ventilating the test cell for 24 hours. Conclude testing by taking two samples of air leaving the cell, passing it through an adsorption medium as in Item 4 (below). These two samples shall be taken at a time of 24 ± 0.5 hours after starting the ventilation period.

4) The adsorption medium for determination of volatile organic substances shall be suitable for gas chromatography: Tenax TA® is recommended. Other adsorbants can be accepted only if they give comparable results when tested in a measurement cell.

Perform gas chromatography analysis in a non-polar column (within the boiling range of hexane-octadecane), using a flame ionisation detector.

In the case of products containing formaldehyde or ammonia, determine the emission factor using an appropriate adsorbant.

5) Express the emission factor of substances analysed by gas chromatography as the total amount of substances emitted (toluene equivalents) per square metre of the test piece and hour ($\mu\text{g}/(\text{m}^2 \times \text{h})$).

Express values of measured formaldehyde and ammonia separately in the same way.



TVOC definition

- Use Tenax TA as adsorbent.
- Use a non-polar capillary column for the GC-analysis.
- The GC oven temperature should be programmed so hexan and octadecan shall be eluated.
- Integrate all the GC-peaks in the retention interval between hexan and octadecan, determined by a flame ionization detector (FID).
- The total integrated area expressed as toluen equivalents defines TVOC.
- Treat the blank (= sample taken from empty chamber) in the same way as the sample, subtract the blank TVOC value from the sample TVOC value.
- TVOC, as toluen equivalents, is expressed either as a concentration or as an emission factor, e.g. $\mu\text{g}/\text{m}^3$ and $\mu\text{g}/(\text{m}^2 \times \text{h})$ respectively.