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Date
17 October 2014

Indoor Air Comfort Test Report

1 Sample Information

Sample identification	ESK Earthwool
Product type	Insulation
Batch no.	-
Production date	-
Date when sample was received	05.09.2014
Testing (start - end)	12.09.2014 – 10.10.2014

2 Evaluation of the Results

The tested product complies with the requirements of Eurofins Indoor Air Comfort Gold Label, version 3.1 for the tested parameters.

Insulation	Test after 3 days		Test after 28 days	
	Concentration, $\mu\text{g}/\text{m}^3$	Limit value, $\mu\text{g}/\text{m}^3$	Concentration, $\mu\text{g}/\text{m}^3$	Limit value, $\mu\text{g}/\text{m}^3$
TVOC	< 5	≤ 1000	< 5	≤ 100
TSVOC	< 5	-	< 5	≤ 20
R_D-value (NIK) (dimensionless)	0	-	0	≤ 1
R_F-value (LCI) (dimensionless)	0.33	-	0	≤ 1
Total VOC without NIK or CLI	< 5	-	< 5	≤ 50
Total Carcinogens	< 1	≤ 10	< 1	≤ 1
CMR Substances (according to French CMR regulation)	TBA	TBA	< 1	≤ 1
Formaldehyde	-	-	< 3	≤ 10
French A+	-	-	complies	

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3 Test Method

Method	Principle	Parameter	Quantification limit	Uncertainty	
Eurofins Indoor Air Comfort Gold Label, version 3.1					
Internal method numbers: 9810, 9811, 9812, 2808, 8400	GC/MS	VVOC, VOC, SVOC	1 µg/m ³	22% (RSD) U _m = 2 x RSD = 45 %	
	GC/MS	TVVOC, TVOC, TSVOC	5 µg/m ³		
	HPLC	Volatile Aldehydes	3 µg/m ³		
Test chamber parameter					
Chamber volume, l	119	Temperature, °C	23±1	Relative humidity, %	50±5
Air exchange rate, h ⁻¹	0.5	Loading ratio, m ² /m ³	1		
Sample preparation					
The specimen was placed into a stainless steel tray for covering edges and back.					
Deviations from the test method:		none			

For detailed method description see page 7: 5.1 Description of the applied test method

4 Results

4.1 Emissions Test after 3 Days

	CAS No.	Retention time min	ID-Cat	Concentration $\mu\text{g}/\text{m}^3$	NIK-value $\mu\text{g}/\text{m}^3$	R _D value	LCI-value $\mu\text{g}/\text{m}^3$	R _F value	Toluene equivalent $\mu\text{g}/\text{m}^3$
TVOC (C₆-C₁₆)				< 5					< 5
VOC with NIK n.d.	-	-		< 5	-	-	-	-	< 5
Total R_D = Σ Conc_i/NIK_i						0		-	
VOC without NIK n.d.	-	-	-	< 5	-	-	-	-	< 5
Total VOC without NIK				< 5					< 5
Total VVOC (< C₆) n.d.	-	-	-	< 5	-	-	-	-	< 5
Total SVOC (> C₁₆) n.d.	-	-	-	< 5	-	-	-	-	< 5
Total Carcinogens n.d.	-	-	-	< 1	-	-	-	-	< 1
Volatile Aldehydes C₁-C₆ measured with DNPH-Method (see 5.1.4)									
Formaldehyde	50-00-0	-	-	3.3	-	-	10	0.33	-
Acetaldehyde	75-07-0	-	-	< 3	-	-	200	-	-
C ₃ – C ₆ Aldehydes	-	-	-	< 3	-	-	8	-	-
Total R_F = Σ Conc_i/LCI_i								0.33	

n.d. Not detected

< Means less than

* Not a part of our accreditation. See 5.1.7 Accreditation

a The method is not optimal for very volatile compounds. For these substances smaller results and a higher uncertainty in the measurement cannot be excluded.

4.2 Emissions Test after 28 Days

	CAS No.	Retention time min	ID-Cat	Concentration $\mu\text{g}/\text{m}^3$	NIK-value $\mu\text{g}/\text{m}^3$	R _D value	LCI-value $\mu\text{g}/\text{m}^3$	R _F value	Toluene equivalent $\mu\text{g}/\text{m}^3$
TVOC (C₆-C₁₆)				< 5					< 5
VOC with NIK n.d.	-	-		< 5	-	-	-	-	< 5
R-value = $\sum \text{Conc}_i/\text{NIK}_i$						0		-	
VOC without NIK n.d.	-	-	-	< 5	-	-	-	-	< 5
Total VOC without NIK				< 5					< 5
Total VVOC (< C₆)				< 5					< 5
n.d.	-	-	-	< 5	-	-	-	-	< 5
Total SVOC (> C₁₆)				< 5					< 5
n.d.	-	-	-	< 5	-	-	-	-	< 5
Total Carcinogens				< 1					< 1
Single CMR substances	-	-	-	< 1	-	-	-	-	< 1
Dibutylphthalate ^b	84-74-2	-	-	TBA	1	-	-	-	-
Diethylhexylphthalate ^b	117-81-7	-	-	TBA	1	-	-	-	-
Volatile Aldehydes C₁-C₆ measured with DNPH-Method (see 5.1.4)									
Formaldehyde	50-00-0	-	-	< 3	-	-	10	-	-
Acetaldehyde	75-07-0	-	-	< 3	-	-	200	-	-
C ₃ – C ₆ Aldehydes	-	-	-	< 3	-	-	8	-	-
Total R_F = $\sum \text{Conc}_i/\text{LCI}_i$								0	

n.d. Not detected

< Means less than

* Not a part of our accreditation. See 5.1.7 Accreditation

a The method is not optimal for very volatile compounds. For these substances smaller results and a higher uncertainty in the measurement cannot be excluded.

b See 5.1.5 Emissions test of phthalates after 28 days

TBA To be announced

Categories of Identity:

- 1: Identified and specifically calibrated
- 2: Identified by comparison with a mass spectrum obtained from library and supported by other information. Calibrated as toluene equivalent
- 3: Identified by comparison with a mass spectrum obtained from a library. Calibrated as toluene equivalent
- 4: Not identified, calibrated as toluene equivalent



Maria Pelle
Chemist



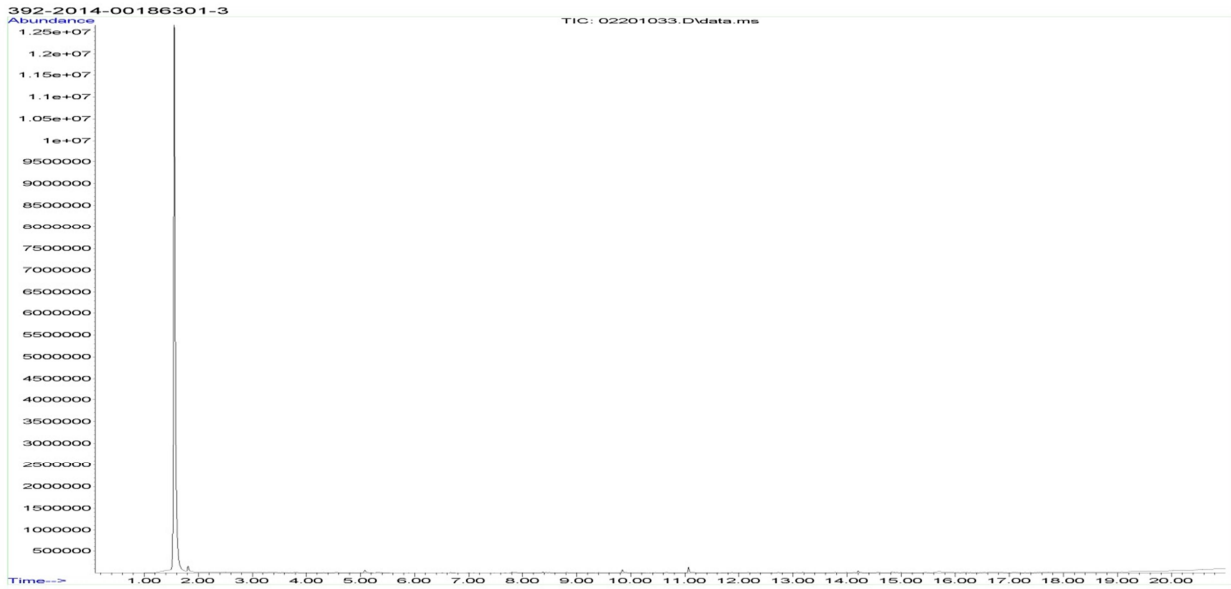
Janne R. Norup
Chemist

The results are only valid for the tested sample(s).

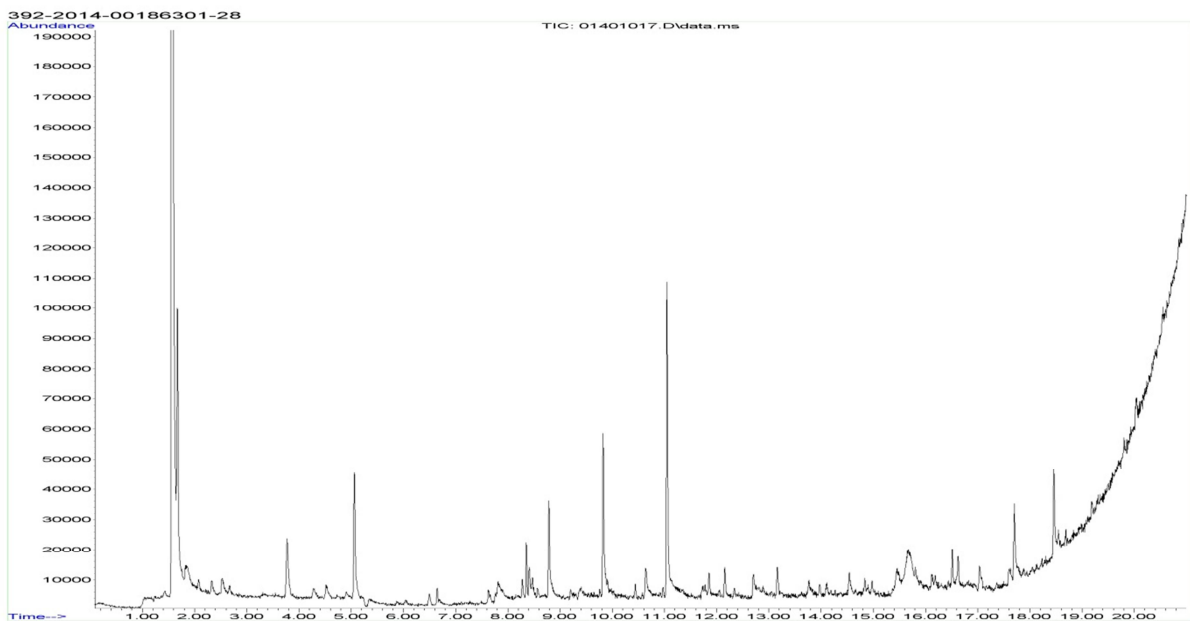
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4.3 Chromatograms

4.3.1 Chromatogram after 3 days



4.3.2 Chromatogram after 28 days



Please consider the different scales

The results are only valid for the tested sample(s).

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4.4 Image of the sample



5 Appendices

5.1 Description of the applied test method

5.1.1 Test Chamber

The test chamber is made of stainless steel. A multi-step air clean-up is performed before loading the chamber, and a blank check of the empty chamber is performed. The operation parameters are 23 °C, 50 % relative air humidity in the supply air.

5.1.2 Sampling, Desorption, Analysis

Testing for Carcinogens

The presence of carcinogens (EU Categories C1 and C2, as per the latest publication on the homepage of German BGIA Institute) was tested by drawing sample air from the chamber outlet through 2 Tenax TA tubes (main tube and backup tube). Analysis was performed by thermal desorption and gas chromatography / mass spectroscopy (30 m column, 0.25 mm ID, 0.25 µm HP-5 film, Agilent) (internal methods no.: 9812 / 2808). The absence of a listed carcinogen was stated if the specific combination of fragment ions was absent at the specific retention time in the chromatogram. If no listed carcinogens were found but the required detection limit was exceeded, the identity was checked by comparing full scan sample mass spectra with full scan standard mass spectra.

This test covered only substances that can be adsorbed on to Tenax TA and that can be thermally desorbed. If other emissions occurred, then these substances cannot be detected (or with limited reliability only).

VOC Emissions Testing

The emissions of organic compounds were tested by drawing sample air from the chamber outlet through 2 Tenax TA tubes (main tube and backup tube). Analysis was performed by thermal desorption and gas chromatography / mass spectroscopy (30 m column, 0.25 mm ID, 0.25 µm HP-5 film, Agilent) (internal methods no.: 9812 / 2808).

All single substances that are listed with a NIK value in the latest AgBB publication were identified. Quantification was done with the respective response factor and the TIC signal or in case of overlapping peaks by calculating with fragment ions. All other single substances, as well as all non-identified substances, were quantified as toluene equivalent.

The results of the individual substances were calculated in three groups depending on their appearance in a gas chromatogram when analysing with a non-polar column (HP-1):

- Volatile organic compounds VOC: All substances appearing between these limits.
- Semi-volatile organic compounds SVOC: All substances appearing after n-hexadecane (n-C16).
- Very volatile organic compounds VVOC: All substances appearing before n-hexane (n-C6).

Calculation of the TVOC (Total Volatile Organic Compounds) was performed according to the AgBB/DIBt test method, by addition of the results of all individual substances with concentrations $\geq 5 \mu\text{g}/\text{m}^3$ in the retention time interval C6-C16. Furthermore the TVOC was calculated as the toluene equivalent, as defined in ISO 16000-6.

Calculation of the TSVOC (Total Semi-Volatile Organic Compounds) was performed by addition of the results of all substances with concentrations $\geq 5 \mu\text{g}/\text{m}^3$ between C16 and C22 as toluene equivalent, as defined in ISO 16000-6.

Calculation of the TVVOC (Total Very Volatile Organic Compounds) was performed by addition of the results of all substances with concentrations $\geq 5 \mu\text{g}/\text{m}^3$ appearing before C6 as toluene equivalent, as defined in ISO 16000-6.

This test covered only substances that can be adsorbed on Tenax TA and that can be thermally desorbed. If other emissions occurred then these substances cannot be detected (or with limited reliability only).

5.1.3 Calculation of R_F and R_D Values with the CLI and German NIK List

The concentrations of all substances $\geq 5 \mu\text{g}/\text{m}^3$ in the interval between n-C6 and n-C16 were divided by their respective NIK value (if given). The sum of the quotients gives the R value:

$$R = \sum_i^n \left(\frac{c_i}{\text{NIK}_i} + \dots + \frac{c_n}{\text{NIK}_n} \right)$$

In addition, all results were summed up for the substances without published NIK value, but in the interval between n-C6 and n-C16, when concentrations were $\geq 5 \mu\text{g}/\text{m}^3$. R_F value is calculated using the French CLI (LCI) list while the R_D value is calculated using the German NIK list. Example shows calculation of R_D , calculation of R_F is analogously calculated using CLI values.

5.1.4 Testing of Aldehydes after 3 and 28 Days

The presence of aldehydes was tested by drawing air samples from the chamber outlet through DNPH-coated silicagel tubes. Analysis was done by solvent desorption, HPLC and UV-/diode array detection (ISO 16000-3, internal methods no.: 9812 / 8400).

The absence of formaldehyde was stated if the specific wavelength UV detector response was lacking at the specific retention time in the chromatogram. Otherwise it was checked whether the detection limit was exceeded. In this case the identity was finally checked by comparing full scan sample UV spectra with full scan standard UV spectra.

5.1.5 Emissions test of phthalates after 28 days

The emissions of phthalates were tested by drawing air samples from the chamber outlet through XAD-II tubes after 28 days. Analyses were carried out by thermal desorption and gas chromatography / mass spectroscopy (internal methods 9812 / 2616).

5.1.6 Quality assurance

Before loading the chamber a blank check of the empty chamber was performed and compliance with background concentrations in accordance with ISO 16000-9 was determined. Sampling at the chamber outlet and subsequent analysis was performed in duplicate. For monitoring any breakthrough or overloading of the tubes, two Tenax TA tubes were used in series.

In each sequence stability of GC system was checked by a general function test of device and column, and by use of control charts for monitoring mean values and standard deviations for individual VOCs. Reproducibility of the method was monitored for two selected VOCs per sequence.

5.1.7 Accreditation

The testing methods described above are accredited to EN ISO/IEC 17025:2005 by DANAK (no. 522). Not all parameters are covered by this accreditation. At present the accreditation does not cover the parameters marked with a note *, however analysis was performed for these parameters at the same level of quality as for the accredited parameters.

5.1.8 Uncertainty of the test method

The relative standard deviation of the test method amounts to 22% (RSD). The expanded uncertainty U_m is 45% and equals 2 x RSD%. For further information please visit www.eurofins.dk/uncertainty.