Test report

Determination of VOC emissions, formaldehyde, acetaldehyde and some CMR substances from an insulation material

Requester: AMORIM ISOLAMENTOS, S.A.

Identification of the Material: 'Expanded Insulation Corkboard'

Process: LQAI.MC.26/11

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Test report

Determination of VOC emissions, formaldehyde, acetaldehyde and some CMR substances from an insulation material

Requester: Amorim Isolamentos, S.A.
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Process: LQAI.MC.26/11

Identification of the Material tested: Expanded Insulation Corkboard (ICB)

In response to the request of Eng. Joaquim Carvalho from the company Amorim Isolamentos, S.A. a study was conducted on a sample of insulation material, designated as 'expanded insulation corkboard'.

The sample was delivered at LQAI and the emissions were monitored, from a test chamber, for 3 and 28 days of exposure, according to the norm ISO 16000-9[1]. The air samples were collected in tubes with Tenax TA. For the analysis, thermal desorption on line with gas chromatography coupled to a mass spectrometer detector for VOC identification and quantification (GC/MSD) was used. The GC used is from Agilent Technologies, model 6890N and the mass spectrometer detector is from Agilent also, model 5973. The thermal desorption system is from DANI, model STD 33.50. The analysis was conducted according to the norm ISO 16000-6[2]. The emission factors of the major compounds were determined using the specific response factor of each identified compound. Total volatile organic compounds (TVOC) concentration was calculated for all compounds eluted between hexane and hexadecane, using the specific response factor, for each identified compound, and the response factor of toluene for the remainders.

Formaldehyde and acetaldehyde were determined, only at 28 days of exposure, according to the norm ISO 16000-3[3]. The compounds were collected by adsorption onto cartridges impregnated with 2,4-dinitrophenylhydrazine (DNPH) and subsequent analysed by liquid chromatography (HPLC) with ultraviolet absorption detection.

Between the tests for 3 and 28 days the material was placed in a conditioning chamber, with suitable ventilation and temperature control, and re-introduced in the test chamber 72 h before the 28 days sampling test. The average experimental conditions in the chamber during the study were:

T (°C)	HR (%)	v (m/s)	n (h^{-1})	A/V (m^2/m^3)
22.9 ± 0.1	48.3 ± 0.8	0.12	0.88	0.71

where *T* is the temperature, *HR* the relative humidity, *v* the air velocity at the surface of the material, *n* the air exchange rate and *A/V* the ratio of sample area to chamber volume (loading factor).

The aim of the study was the measurement of the chemical emissions of volatile organic compounds, formaldehyde, acetaldehyde and some CMR (carcinogenic, mutagenic and reprotoxic) substances, intending the material classification under the criteria established by European Collaborative Action, Indoor Air Quality & Its Impact on Man (ECA-IAQ)[4] and also according to the recent French Legislation[5,6].

Table 1 shows the obtained emission factors as well as the results of the application of the ECA-IAQ criteria.

Table 1. Emission factors for all the compounds quantified in the emissions from the material as a function of time of exposure and application of the ECA-IAQ criteria.

Compound	**CAS**	**LCI (µg/m³)**	**Emission factor (µg/(m²h))**	
			3 days	**28 days**
Ethyl acetate	141-78-6	5000	8.79	4.43
Butanol	71-36-3	1000	3.28	2.26
Toluene	108-88-3	1000	n.d.	15.2
Butyl acetate	123-86-4	7000	53.3	9.94
Ethylbenzene	100-41-4	1000	15.0	4.95
m/p-xylene	108-38-3/106-42-3	1000	66.2	19.1
o-xylene	95-47-6	1000	29.7	6.36
α-pinene	80-56-8	1000	4.98	8.43
Formaldehyde	50-00-0	10	n.e.	n.d.
TVOC			188	92.7

Parameter to be assessed	**Condition to be fulfilled**	**Specific ventilation rate q_e (m³ h⁻¹m⁻²)**		
		0.625	**1.25**	**2.50**
VOCs carcinogens (3 d) (µg/m³)		-	-	-
TVOC (3 d) (µg/m³)	< 5000	301	151	75.3
TVOC (28 d) (µg/m³)	< 200	148	74.1	37.1
$R = \Sigma (C_i/LCI_i)$	< 1	0.09	0.05	0.02
ΣC_n (µg/m³)	< 20	0	0	0
EVALUATION		Positive	Positive	Positive

LCI – Lowest concentration of interest.
n.d. – not detected
n.e. – not evaluated
R - Index summarising the estimated health risk of a material emission; Ci – concentration of an individual compound for which a LCI value is know; $C_i = FE / q_e$
$\Sigma (C_n)$ - Sum of the concentrations of the compounds, after 28 days of exposure, for which a LCI value is not know. $C_n = FE / q_e$

Table 2 shows the concentrations of the substances or group of substances obtained for a specific ventilation rate of 1.25 $m^3h^{-1}m^{-2}$, as well as the concentration limits (expressed in $\mu g/m^3$) for the different classes established by the French Regulation[5].

Table 2. Thresholds established by the French Regulation[5] and concentrations of the compounds emitted by the material at 28 days of exposure for the specific ventilation rate of 1.25 $m^3h^{-1}m^{-2}$.

		Concentration ($\mu g/m^3$)				
		Classes				MC.26/11
Compound	**CAS**	**C**	**B**	**A**	**A+**	**28 days**
Formaldehyde	50-00-0	>120	<120	<60	<10	n.d.
Acetaldehyde	75-07-0	>400	<400	<300	<200	32.0
Toluene	108-88-3	>600	<600	<450	<300	12.2
Tetrachloroethylene	127-18-4	>500	<500	<350	<250	n.d.
Xylene	1330-20-7	>400	<400	<300	<200	20.4
1,2,4-trimethylbenzene	95-63-6	>2000	<2000	<1500	<1000	n.d.
1,4-dichlorobenzene	106-46-7	>120	<120	<90	<60	n.d.
Ethylbenzene	100-41-4	>1500	<1500	<1000	<750	3.96
2-butoxyethanol	111-76-2	>2000	<2000	<1500	<1000	n.d.
Styrene	100-42-5	>500	<500	<350	<250	n.d.
COVsT		>2000	<2000	<1500	<1000	74.1

n.d. – not detected

Table 3 shows the concentration limits (expressed in $\mu g/m^3$) for the CMR substances, set by the French Regulation[6] and the values observed for the studied material, for a specific ventilation rate of 1.25 $m^3h^{-1}m^{-2}$.

Table 3. Limits established by the French Regulation[6] and concentrations observed for the material after 28 days of exposure at a specific ventilation rate of 1.25 $m^3h^{-1}m^{-2}$.

		Concentration ($\mu g/m^3$)	
Compound	**CAS**	**Limit**	**MC.26/11 28 days**
Trichloroethylene	79-01-6	< 1 $\mu g/m^3$	n.d.
Benzene	71-43-2	< 1 $\mu g/m^3$	n.d.
Bis(2-ethylhexyl)phthalate (DEHP)	117-81-7	< 1 $\mu g/m^3$	n.d.*
Dibutyl phthalate (DBP)	84-74-2	< 1 $\mu g/m^3$	n.d.

n.d. – not detected
* It is considered that this compound is not present in the emissions of the material under study, although it has not been evaluated analytically, as attached statement from the manufacturer of this material.

Discussion of the Results and Conclusions

Based on Table 1, it can be concluded that the material has positive evaluation by the ECA-IAQ criteria for all specific ventilation rates studied.

Based on Table 2 and 3 it can be concluded that the material has an A+ evaluation according to the French Regulation.

References:

1.- ISO 16000-9 (2006). Determination of the emission of volatile organic compounds from building products and furnishing - Emission test chamber method.

2.- ISO 16000-6 (2004). 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.

3.- ISO 16000-3 (2001). Determination of formaldehyde and other carbonyl compounds - Active sampling method.

4.- ECA (European Collaborative Action "Indoor Air Quality and Its Impact on Man"), 1997. Evaluation of VOC emissions from building products - Solid flooring materials. Report Nr.18, EUR17334 EN. Luxembourg: Office for Official Publications of the European Communities.

5.- Arrêté du 19 avril 2011 relatif à l'étiquetage des produits de construction ou de revêtement de mur ou de sol et des peintures et vernis sur leurs émissions de polluants volatils.

6.- Arrêté du 30 avril 2009 relatif aux conditions de mise sur le marché des produits de construction et de décoration contenant des substances cancérigènes, mutagènes ou reprotoxiques de catégorie 1 ou 2.

Porto, 8 June 2011

Gabriela Ventura Alves da Silva

Gabriela Ventura Alves da Silva
(Director of LQAI)

AMORIM

Amorim Isolamentos, S.A.

DECLARATION

AMORIM ISOLAMENTOS, SA located at Vendas Novas – Portugal, manufacturer of EXPANDED INSULATION CORKBOARD (black), wish to declare during their industrial process, don't use the composition DEHP or any other type of additives.

The used raw material is cork coming directly from Cork Forest without any previous treatment

The industrial process consist uniquely steam temperature and pressure, means the final product is 100% natural

Administration
2011.06.06

AMORIM ISOLAMENTOS, S.A
Administração

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Capital Social: EUR 100.000,00
Registo na C.R.C.P. de Vendas Novas
e NIF N.º PT 502 863 145

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