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Rouen, le 24/03/2021

RAPPORT D'ESSAI / REPORT
RN21-00039.001/.002 Page 1 sur 11

***Evaluation sanitaire des émissions de composés
volatils par des peintures.***
***Health evaluation of emissions of volatile compounds
by paints.***

I. Description de l'échantillon / Sample Description

Référence échantillon <i>Sample reference</i>	Désignation <i>Designation</i>	Photos	Date de réception au laboratoire <i>Reception date in the laboratory</i>
RN21-00039.001/.002	SIMILAR		08/01/2021

II. But des analyses / Objective of analysis

L'objectif de cet essai est de caractériser les émissions de composés organiques volatils (COV) et d'aldéhydes (dont formaldéhyde) sur des peintures et d'en réaliser l'évaluation sanitaire selon le protocole européen ECA/IAQ (1997). La classe des émissions de chaque produit doit être déterminée suivant les critères des arrêtés du 19 avril 2011 et du 20 février 2012.

The objective of this test is to characterize the emissions of volatile organic compounds (VOCs) and aldehydes (including formaldehyde) on paints and to carry out the health evaluation according to the European protocol ECA / IAQ (1997). The class of emissions for each product must be determined according to the criteria of the Orders of April 19, 2011 and February 20, 2012.

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III. Références Méthodes / Method References

Essai réalisé selon les méthodes d'essais suivantes :

- Conditionnement du produit de construction en chambre d'essai de 50.9 litres selon la norme NF EN ISO 16000-9 (08/2006), le décret n°2011-321 du 23 mars 2011 et l'arrêté du 19 avril 2011 modifié par l'arrêté du 28 mai 2009 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.
- Mesure des COV : prélèvement sur tube TENAX TA et analyse chromatographique par TD/GC/MS selon la norme ISO 16000-6 (03/2012).
- Mesure du formaldéhyde : prélèvement sur cartouche DNPH et analyse chromatographique par HPLC/UV selon la norme ISO 16000-3 (12/2011).

Préparation de l'éprouvette d'essai selon la norme NF EN ISO 16000-11 (08/2006)

- Préparation de l'éprouvette d'essai afin de recréer le scénario type défini dans l'annexe B de la norme NF EN ISO 16000-9, au décret n°2011-321 du 23 mars 2011 et l'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.

Test carried out according to the following tests methods:

- Construction product conditioning in an emission test chamber of 50.9 liters according to standard NF EN ISO 16000-9 (08/2006) and the decree nr. 2011-321 of March 23, 2011 and the by-law of April 19, 2011 modified by the by-law of May 28, 2009 regarding the labelling of construction products and covering the wall or floor and paint and varnish on their emissions of volatile pollutants.
- Measurement of VOC: sampling on TENAX TA tubes and chromatographic analysis by TD / GC / MS according to standard ISO 16000-6 (2012-03).
- Measurement of formaldehyde: sampling on DNPH cartridge and chromatographic analysis by HPLC /UV according to the standard ISO 16000-3 (2011-12)

Preparation of test sample according to standard NF EN ISO 16000-11 (08/2006)

- Preparation of test sample to recreate the scenario type as defined in Annex B of the standard NF EN ISO 16000-9, the decree nr. 2011-321 of March 23, 2011 and the by-law of April 19, 2011 regarding the labelling of construction products and covering the wall or floor and paint and varnish on their emissions of volatile pollutants.

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Les limites en fonction des étiquetages sont résumées ci-dessous :
The limits according to the labels are summarized below:

CLASSES	C	B	A	A+
Formaldéhyde	> 120	< 120	< 60	< 10
Acétaldéhyde	> 400	< 400	< 300	< 200
Toluène	> 600	< 600	< 450	< 300
Tétrachloroéthylène	> 500	< 500	< 350	< 250
Xylène	> 400	< 400	< 300	< 200
1,2,4-Triméthylbenzène	> 2000	< 2000	< 1500	< 1000
1,4-Dichlorobenzène	> 120	< 120	< 90	< 60
Ethylbenzène	> 1500	< 1500	< 1000	< 750
2-Butoxyéthanol	> 2000	< 2000	< 1500	< 1000
Styrène	> 500	< 500	< 350	< 250
COVT	> 2000	< 2000	< 1500	< 1000

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IV. Analyses / Analysis.

1) Préparation de l'éprouvette d'essai (1) / *Preparation of the test sample (1)*

Méthode de préparation selon la norme NF EN ISO 16000-11 (08/2006) adaptée :

- Produits liquides : 2 couches de peinture ont été appliquées sur un intervalle de 24 heures sur un support inerte en verre (7.0 g ± 10% par couche).
- Après application, séchage de 72 heures avant début de l'essai et conditionnement en chambre d'essai de 50.9 litres.

Method of preparation according to standard NF EN ISO 16000-11 (2006-08) adapted:

- Liquids product: 2 layers of paint were applied to an interval of 24 hours on an inert support glass (7.0 g ± 10% per layer).
- After applying, drying 72 hours before beginning the test and conditioning in the test chamber 50.9 litres.

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2) Conditionnement en chambre d'essai d'émission (1) / Conditioning in emission test chamber (1):

L'éprouvette d'essai a été conditionnée sous une chambre d'essai d'émission en verre d'un volume de 50.9 litres. Les paramètres d'essai retenus, proches du scénario d'émission « murs » de la norme NF EN ISO 16000-9 adaptée, sont présentés dans le tableau ci-dessous.

The test sample was conditioned under a glass emission test chamber with a volume of 50.9 liters. The selected test parameters, close to the "walls" emission scenario of the NF EN ISO 16000-9 adapted standard, are presented in the table below.

Paramètres Parameters	Conditions d'essai Test conditions
Scénario Scenario	MUR WALL
Chambre d'essai d'émission Emission test chamber	Cuve en verre glass vat
Volume de la chambre Chamber volume	0.0509 m ³
Température Temperature	23 ± 2°C
Humidité relative Relative humidity	50 ± 5 %
Surface de l'éprouvette Sample area	500 cm ²
Débit d'air Air flow	0.42 l.min ⁻¹
Taux de renouvellement d'air Air renewal rate	0.50 h ⁻¹
Taux de charge Load rate	1.00 m ² .m ⁻³
Débit d'air spécifique surfacique Specific air flow per surface	0.50 m ³ .m ⁻² .h ⁻¹
Durée de l'essai Test duration	28 jours 28 days

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3) Conditions de prélèvement des COV et aldéhydes (1) / VOC and aldehyde sampling conditions (1):

Les prélèvements des COV et des aldéhydes par pompage sur support adsorbant spécifique ont été réalisés à 28 jours ± 1 jour (J28). Les conditions de prélèvement sont présentées dans le tableau ci-dessous.

Samples of VOCs and aldehydes by pumping on a specific adsorbent support were made at 28 days ± 1 jour(D28). The sampling conditions are shown in the table below.

Prélèvements Sampling	COV VOC	Aldéhydes Aldehydes
Nombre de tubes Tubes number	2	2
Support adsorbant Adsorbent base	TENAX TA	DNPH
Durée de prélèvement Sampling duration	20 min.	90 min.
Débit Flow	200 ml.min ⁻¹	330 ml.min ⁻¹
Volume prélevé Sampled volume	4 l	30 l

Suivi métrologique de l'essai

Paramètres d'essai	Moyenne sur 28 jours
Température (°C)	22.85
Humidité (% HR)	49.81
Taux de renouvellement d'air (l/min)	0.42

Paramètres d'essai	
Surpression (Pa)	41
Vitesse de l'air (m/s)	0.17

Metrological monitoring of test

Test parameters	Average on 28 days
Temperature (°C)	22.85
Moisture (% HR)	49.81
Air change rate (l/min)	0.42

Test parameters	
Pressure (Pa)	41
Air velocity (m/s)	0.17

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4) Méthodes de mesure des COV et aldéhydes / VOC and aldehyde measurement methods:

Les prélèvements et analyses des COV sont réalisés conformément à la norme NF ISO 16000-6 adaptée.

Les équipements utilisés pour l'analyse des COV dans notre laboratoire sont un thermo-désorbent Markes et un chromatographe en phase gazeuse Agilent couplé à un spectromètre de masse (MS) pour l'identification et à un détecteur à ionisation de flamme (FID) pour la quantification. Chaque composé individuel est quantifié par étalonnage spécifique.

La concentration en COV totaux (TVOC) est calculée, pour les composés éluant entre le n-C6 hexane et le n-C16 hexadécane (inclus), avec le facteur de réponse du toluène.

Les prélèvements et analyses des aldéhydes sont réalisés conformément à la norme NF ISO 16000-3 adaptée.

Les prélèvements sont effectués sur des cartouches contenant du gel de silice garni de 2,4-dinitrophénylhydrazine (DNPH). Au laboratoire, les cartouches sont éluées dans 5 ml d'acétonitrile. Cette solution d'éluion est ensuite analysée par chromatographie liquide hautes performances (HPLC) sur un système WATERS Alliance ou équivalent.

Les aldéhydes sont identifiés et quantifiés par étalonnage spécifique.

Les concentrations de fond en COV et en composés carbonyles de la chambre d'essai sont contrôlées par prélèvement sur tube TENAX et sur cartouche DNPH avant l'essai. Selon les niveaux de contamination mesurés, les blancs ont été soustraits aux résultats.

Sampling and analysis of VOCs are carried out in accordance with standard NF ISO 16000-6 adapted. The equipment used for VOC analysis in our laboratory is a Markes thermo-desorber and an Agilent gas chromatograph coupled to a mass spectrometer (MS) for identification and a flame ionization detector (FID) for quantification. Each individual compound is quantified by specific calibration.

The total VOC concentration (TVOC) is calculated for the compounds eluting between n-C6 hexane and n-C16 hexadecane (included) with the toluene response factor.

Samples and analysis of aldehydes are carried out in accordance with standard NF ISO 16000-3 adapted.

Sampling are done on cartridges containing silica gel coated with 2,4-dinitrophenylhydrazine (DNPH). In the laboratory, the cartridges are eluted in 5 ml of acetonitrile. This elution solution is then analyzed by high performance liquid chromatography (HPLC) on a WATERS Alliance system or equivalent.

Aldehydes are identified and quantified by specific calibration.

The background concentrations of VOCs and carbonyl compounds in the test chamber are controlled by sampling on TENAX tube and the DNPH cartridge before testing. According to levels of contamination measured, the blanks were subtracted from the results.

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5) Résultats des essais à l'émission / Result of the emission test

Les résultats des analyses selon les normes NF ISO 16000-6 (2012) adaptée et NF ISO 16000-3 adaptée (2011) sont présentés dans le tableau ci-dessous.

Les résultats sont fournis comme la moyenne des 2 prélèvements.

Les concentrations d'exposition (C) sont calculées selon la formule $C = (SER \cdot q) / Q$ avec :

- SER : la concentration dans la chambre d'essai
- q : le débit d'air spécifique au moment de l'essai
- Q : le débit d'émission spécifique.

Selon le décret n°2011-321 du 23 mars 2011 et l'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, le scénario et le débit d'émission spécifique indiqués dans le tableau ci-dessous ont été appliqué pour ces échantillons.

Les résultats sont présentés dans les tableaux des pages suivantes.

The analysis results according to NF ISO 16000-6 (2012) adapted and NF ISO 16000-3 (2011) adapted are presented in the table below.

Results are provided as the average of 2 sampling.

Exposure concentrations (C) are calculated using the formula $C = (SER \cdot q) / Q$ with

- SER: the concentration in the chamber emission
- q: the specific air flow at the time of testing
- Q: the specific emission rate.

According to the decree n° 2011-321 of March 23, 2011 and the order of April 19, 2011 regarding the Labelling of construction products and covering the wall or floor and paint and varnish on their emissions of volatile pollutants, the scenario and the specific emission rates indicated in the bellow table were applied for these samples:

The results are presented in the tables in the following pages.

Débit d'air spécifique au moment de l'essai « q » en $m^3 \cdot h^{-1} \cdot m^{-2}$ Specific air flow at the time of testing "q" in $m^3 \cdot h^{-1} \cdot m^{-2}$	Scénario Scenario	Débit d'émission spécifique « Q » (demandé par le client) en $m^3 \cdot h^{-1} \cdot m^{-2}$ Specific emission rate "Q" in $m^3 \cdot h^{-1} \cdot m^{-2}$
0.50	Murs / Walls	0.50

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RESULTATS / RESULTS

Paramètre testé Tested parameters	Concentration d'exposition ($\mu\text{g.m}^{-3}$) Exposure concentration ($\mu\text{g.m}^{-3}$)	Classe d'émission Class of emission
TVOC (28j)	168	A+
Toluène	<30	A+
Tétrachloroéthylène	<25	A+
Ethylbenzène	<75	A+
Xylène	<20	A+
Styrène	<25	A+
1,2,4-Triméthylbenzène	<100	A+
1,4-Dichlorobenzène	<6	A+
2-Butoxyéthanol	<100	A+
Formaldéhyde	<5	A+
Acétaldéhyde	<20	A+
Emissions dans l'air intérieur* (classe la plus pénalisante) Emissions to indoor air* (the most critical class)		A+

La classe d'émission est établie sur la base des mesures réalisées après 28 jours en chambre d'essai.

The class of emission is established based on measurements made after 28 days.

(1) Assays subcontracted in a SGS laboratory

(2) Assays subcontracted in a partner laboratory.

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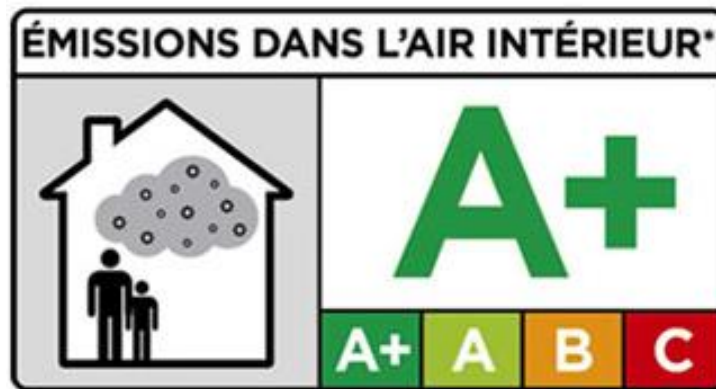
V. Conclusion / Conclusion.

Les COV totaux n'ont pas été quantifiés au-delà de 1000 µg/m³, les 10 substances de l'arrêté n'ont pas été quantifiées au-delà des seuils de la classe A+.

Ainsi, l'échantillon analysé répond à la classe A+ du Décret no 2011-321 du 23 mars 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.

The total VOCs have not been quantified above 1000 µg / m³, the 10 substances of the decree have not been quantified beyond the thresholds of class A +.

Thus, the sample analyzed meets Class A + of Decree No. 2011-321 of 23 March 2011 on the labeling of construction products or wall or floor coating and paints and varnishes on their pollutant emissions.



* Information sur le niveau d'émission de substances volatiles dans l'air intérieur, présentant un risque de toxicité par inhalation, sur une échelle de classe allant de A+ (très faibles émissions) à C (fortes émissions).

Approuvé par **Responsable Prestations Clients**
Approved by Customer Project Manager

Maïmiti BONNEL

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