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Determination of VOC emissions, formaldehyde,
acetaldehyde and other CMR substances from
building products (French Legislation)

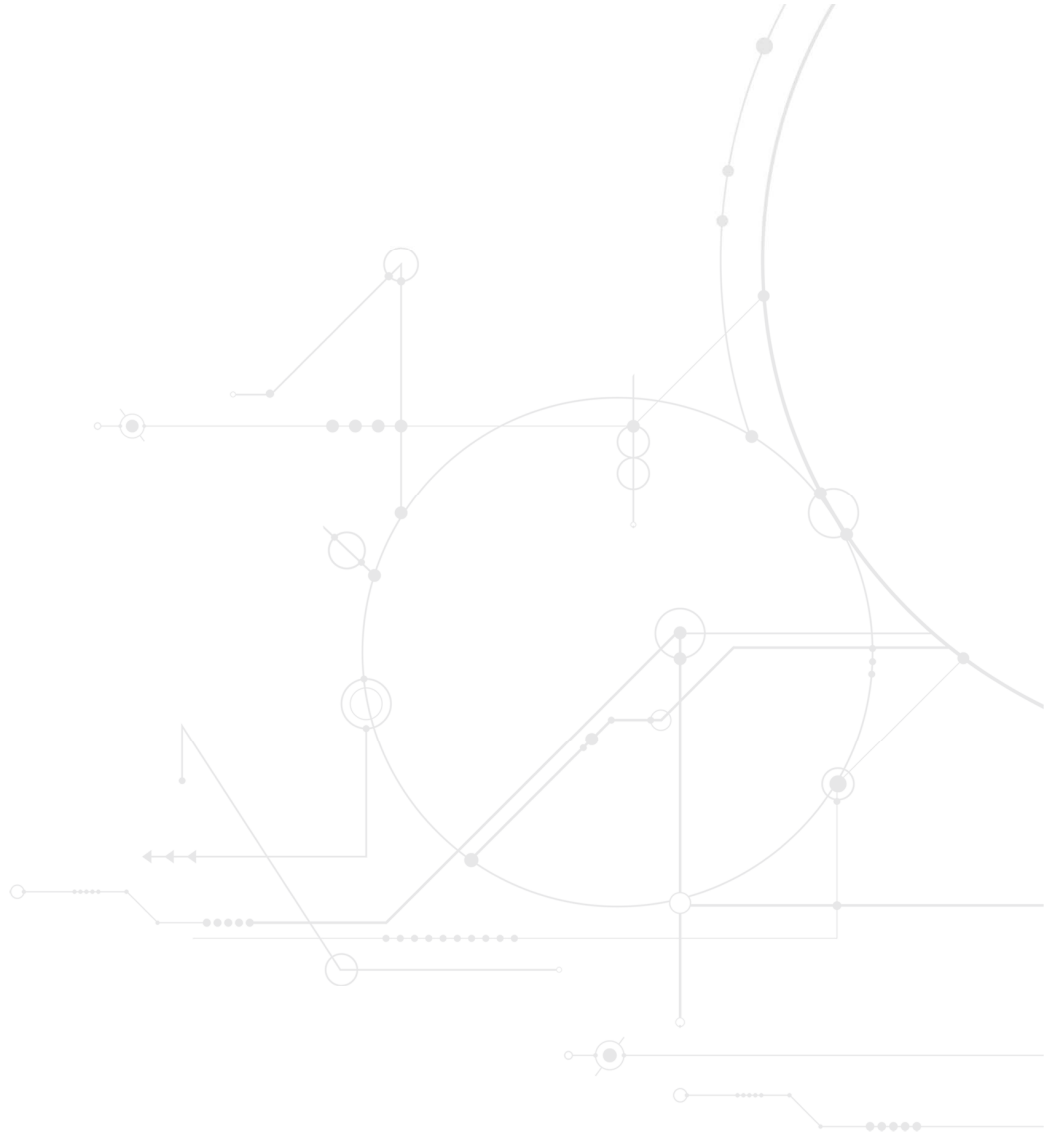
Process: LQAI.MC.25/21

Report No. LQAI.2021.176

Identification of the Material: Silicato Fachadas

Client: Industrias Juno, S.A.





IPAC is a signatory to the EA MLA and ILAC MRA for testing.

The results presented refer only to the item tested.

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0. DOCUMENTAL CONTROL

0.1 IDENTIFICATION OF DOCUMENT

Project	---
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0.2 CONTROL OF VERSIONS

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0.3 AUTHOR(S)

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1. OBJECTIVE

Determination of emitted volatile organic compounds, formaldehyde, acetaldehyde and some CMR substances (carcinogenic, mutagenic and reprotoxic) intending the material classification according to the criteria established by the French legislation.

2. CLIENT

Industrias Juno, S.A.
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España

Reference of Proposal PE30210556 by 26 May, 2021

3. METHODOLOGIES USED

The study was conducted on a sample of a building product, designated as “Silicato Fachadas”. The sample was delivered at LQAI on 2021/05/27. The selection of the product sample was the sole responsibility of the client. The tests and analysis presented were carried out in the permanent facilities of the laboratory.

The sample was applied in a glass on 2021/06/14 according ISO16000-11¹ and according to the instructions provided by the manufacturer. Note that sample preparation is outside the scope of laboratory accreditation.

The characteristics of the product are as follows:

δ_f (μm)	ρ (g/cm^3)	$\emptyset$ (%)	S (m^2/L)	n_c	m (g/m^2)
37.8 (Class medium)*	1.45	34	9	1	161

*Classification of dry film thickness according ISO16000-11¹

where, δ_f is the dry film thickness following recommendations of the manufacturer, ρ is the density of wet product, $\emptyset$ is the solid content of the product, expressed as a volume, S is the recommended spreading rate of the product, n_c is the number of coats and m is the amount of wet product to be applied per square meter

The application conditions were:

m_a (g)	A (m^2)	C (kg/m^2)	δ_r (μm)
28.7	0.180	0.16	37.4

where, m_a is the mass of the applied product, A is the glass area, C is the total amount of applied product per area, and δ_r is the real dry film thickness.

The test in the test chamber started on 2021/06/14 and was performed in accordance with standards EN 16516² and ISO 16000-9³, following the internal procedure IT.403. This test is accredited in accordance with EN ISO / IEC 17025⁴ for the compounds:

Test	Method
Determination of Benzene – method of emission in test chamber	IT.403.06
Determination of Toluene - method of emission in test chamber	IT.403.06
Determination of Ethylbenzene - method of emission in test chamber	IT.403.06

Note: IT.nnn.nn indicates internal laboratory procedure.

It should be noted that the remaining compounds determined in this test and are out the scope of Accreditation, are determined using the same quality standards that apply to them.

The VOCs samples were collected, in tubes with Tenax TA, when the test chamber was empty (2021/06/14, volume: 5.56 l) and in duplicate 28 days (2021/07/12, average volume: 4.29 l) after starting the test. The uncertainty associated with this sampling, calculated using the expansion factor of 2.01 which corresponds to a 95% confidence level, was 4.4%.

Formaldehyde and acetaldehyde were collected in cartridges impregnated with DNPH when the test chamber was empty (2021/06/14, volume: 83.4 l) and after 28 days (2021/07/12, volume: 90.5 l) after starting the test.

The experimental conditions in the chamber during the study were:

Period	T (°C)	HR (%)	v (m/s)	n (h ⁻¹)	A/V (m ² /m ³)
Test (28 days)	22.0 ± 0.2	54.4 ± 8.5	0.20	0.67	1.28

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 volume of the chamber used is 0.141 m³.

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 7890A and the mass spectrometer detector is from Agilent also, model 5975C. The thermal desorption system is from DANI, model TD Master. The analysis was conducted on 2021/07/06 and 2021/07/14 and was performed in accordance with ISO 16000-6⁵, following the internal procedure IT.401. This test is accredited in accordance with EN ISO / IEC 17025⁴ for the compounds:

Test	Method	Uncertainty
Determination of Benzene by thermal desorption and Gas chromatography with mass selective detector	IT.401.07	± 3.9
Determination of Toluene by thermal desorption and Gas chromatography with mass selective detector	IT.401.07	± 3.8
Determination of Ethylbenzene by thermal desorption and Gas chromatography with mass selective detector	IT.401.07	± 2.9
Determination of 1,2,4-trimethylbenzene by thermal desorption and Gas chromatography with mass selective detector	IT.401.07	± 5.7
Determination of styrene by thermal desorption and Gas chromatography with mass selective detector	IT.401.07	± 3.3
Determination of tetrachloroethylene by thermal desorption and Gas chromatography with mass selective detector	IT.401.07	± 3.8

Note: IT.nnn.nn indicates internal laboratory procedure.

All expanded uncertainty values presented were calculated using the expansion factor of 2.01, corresponding to a 95% confidence level.

It should be noted that the remaining compounds determined in this test which are not covered by the accreditation are determined using the same quality standards as applied to them. The emission factors of the identified compounds were determined using the specific response factor. Total volatile organic compounds (TVOC) concentration was calculated for all compounds eluted between hexane and hexadecane, using the toluene response factor.

Formaldehyde and acetaldehyde were determined according to the internal proceeding IT.402 (based on ISO 16000-3⁶). Specifically, the compounds were analysed by high performance liquid chromatography (HPLC) using a gas chromatograph Agilent Technologies brand, model 1220 Infinity LC. The emission factor of the compounds was calculated based on the specific response factor of the analytical method. The analysis took place on 2021/06/21 and 2021/07/13. The uncertainty of the analytical method for formaldehyde is $\pm 13\%$ and for acetaldehyde is $\pm 12\%$. This analysis is out the scope of accreditation.

4. RESULTS

Table 1 shows the concentrations of substances or groups of substances, obtained for a specific ventilation rate of $0.5 \text{ m}^3\text{h}^{-1}\text{m}^{-2}$, as well as the concentration limits ($\mu\text{g}/\text{m}^3$) for different classes established by the French legislation (DEVL1101903D and DEVL1104875A)⁷.

Table 1. Limit values established by the French legislation and concentrations observed for the material after 28 days of exposure for a specific ventilation rate of $0.5 \text{ m}^3\text{h}^{-1}\text{m}^{-2}$.

Compound	CAS	Concentration (µg/m³)				MC.25/21 28 days
		Classes				
		C	B	A	A+	
Formaldehyde ⁺	50-00-0	>120	<120	<60	<10	< 0.69**
Acetaldehyde ⁺	75-07-0	>400	<400	<300	<200	<0.65*
Toluene	108-88-3	>600	<600	<450	<300	< 0.451*
Tetrachloroethylene	127-18-4	>500	<500	<350	<250	< 0.334*
Xylene ⁺	1330-20-7	>400	<400	<300	<200	< 1.35 ** ^T
1,2,4-trimethylbenzene	95-63-6	>2000	<2000	<1500	<1000	< 0.71*
1,4-dichlorobenzene ⁺	106-46-7	>120	<120	<90	<60	< 0.451* ^T
Ethylbenzene	100-41-4	>1500	<1500	<1000	<750	< 0.405*
2-butoxyethanol ⁺	111-76-2	>2000	<2000	<1500	<1000	< 0.89*
Styrene	100-42-5	>500	<500	<350	<250	< 0.414*
TVOC ⁺		>2000	<2000	<1500	<1000	5.50

* Limit of Detection

** Limit of quantification

*^T Limit of detection calculated for toluene

**^T Limit of quantification calculated for toluene

⁺ Out of the scope of accreditation.

Table 2 lists the concentration limits ($\mu\text{g}/\text{m}^3$) for CMR substances, imposed by the French legislation (DEVP0908633A and DEVP0910046A)⁸ and the observed values for the material under study to a specific ventilation rate of $0.5 \text{ m}^3\text{h}^{-1}\text{m}^{-2}$.

Table 2. Limit values established by the French legislation and concentrations observed for the material after 28 days of exposure for a specific ventilation rate of $0.5 \text{ m}^3\text{h}^{-1}\text{m}^{-2}$.

Compound	CAS	Concentration ($\mu\text{g}/\text{m}^3$)	
		Limit	MC.25/21 28 days
Trichloroethylene ⁺	79-01-6	< $1 \mu\text{g}/\text{m}^3$	n.d.
Benzene	71-43-2	< $1 \mu\text{g}/\text{m}^3$	n.d.*
Bis(2-ethylhexyl) phthalate ⁺ (DEHP)	117-81-7	< $1 \mu\text{g}/\text{m}^3$	n.d.**
Dibutyl phthalate (DBP) ⁺	84-74-2	< $1 \mu\text{g}/\text{m}^3$	n.d.

n.d. – not detected, which means lower than the limit of detection.

* Limit of detection for benzene = $0.225 \mu\text{g}/\text{m}^3$.

** Although it has not been evaluated analytically it is considered that this compound is not present in the emissions of the material under study, as stated by the manufacturer in the attached declaration

⁺ Out of the scope of accreditation.

5. GENERAL CONCLUSIONS

By customer request, the results obtained are compared with the criteria established by French regulations^{7,8}. The decision rule chosen is that uncertainty is not applied to the final result. In other words, the result obtained is directly compared with the established criteria, without considering the uncertainty associated with this result.

The results presented in Table 1 and 2 shows that the material "Silicato Fachadas" is rated **A+** according to the French regulations and meets the criteria established by legislation^{7,8}.

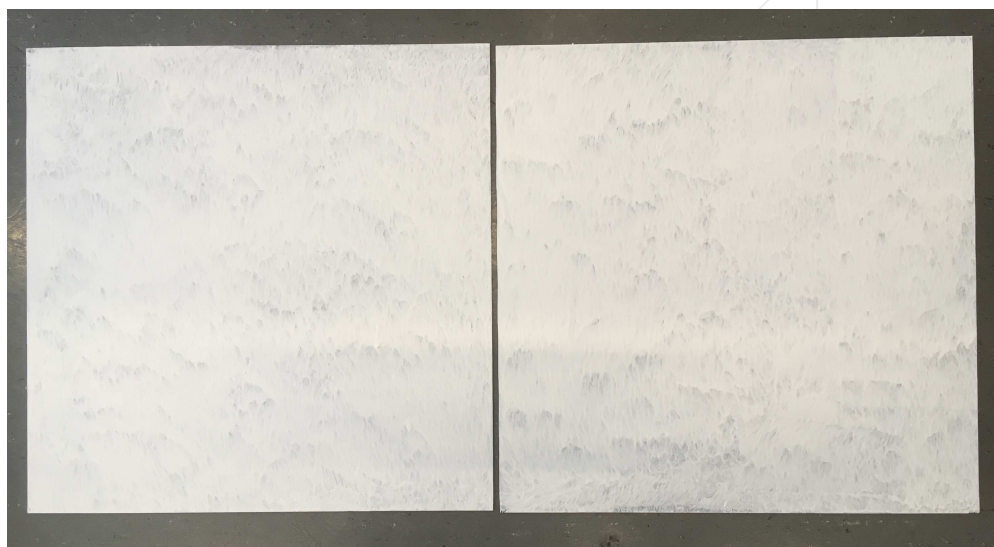
6. REFERENCES

- 1- ISO 16000-11 (2006). Determination of the emission of volatile organic compounds from building products and furnishing — Sampling, storage of samples and preparation of test specimens (2006).
- 2- EN 16516:2017. Construction products: Assessment of release of dangerous substances - Determination of emissions into indoor air
- 3- ISO 16000-9 (2006). Determination of the emission of volatile organic compounds from building products and furnishing - Emission test chamber method.
- 4- NP EN ISO/IEC 17025 – Requisitos gerais de competência para laboratórios de ensaio e calibração.
- 5- 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.
- 6- ISO 16000-3 (2011). Determination of formaldehyde and other carbonyl compounds - Active sampling method.
- 7- Décret n° 2011-321 du 23 mars 2011 (DEVL1101903D) and Arrêté du 19 avril 2011 (DEVL1104875A) 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.
- 8- Arrêté du 30 avril 2009 (DEVP0908633A) and Arrête du 28 mai 2009 (DEVP0910046A) 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, 20 july, 2021

(Head of Laboratory)

Annex: Photo of the sample of the material under study





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SU REFERENCIA

SU ESCRITO DEL

N/ESCRITO DEL

N/REFERENCIA

FECHA

ASUNTO: DEHP

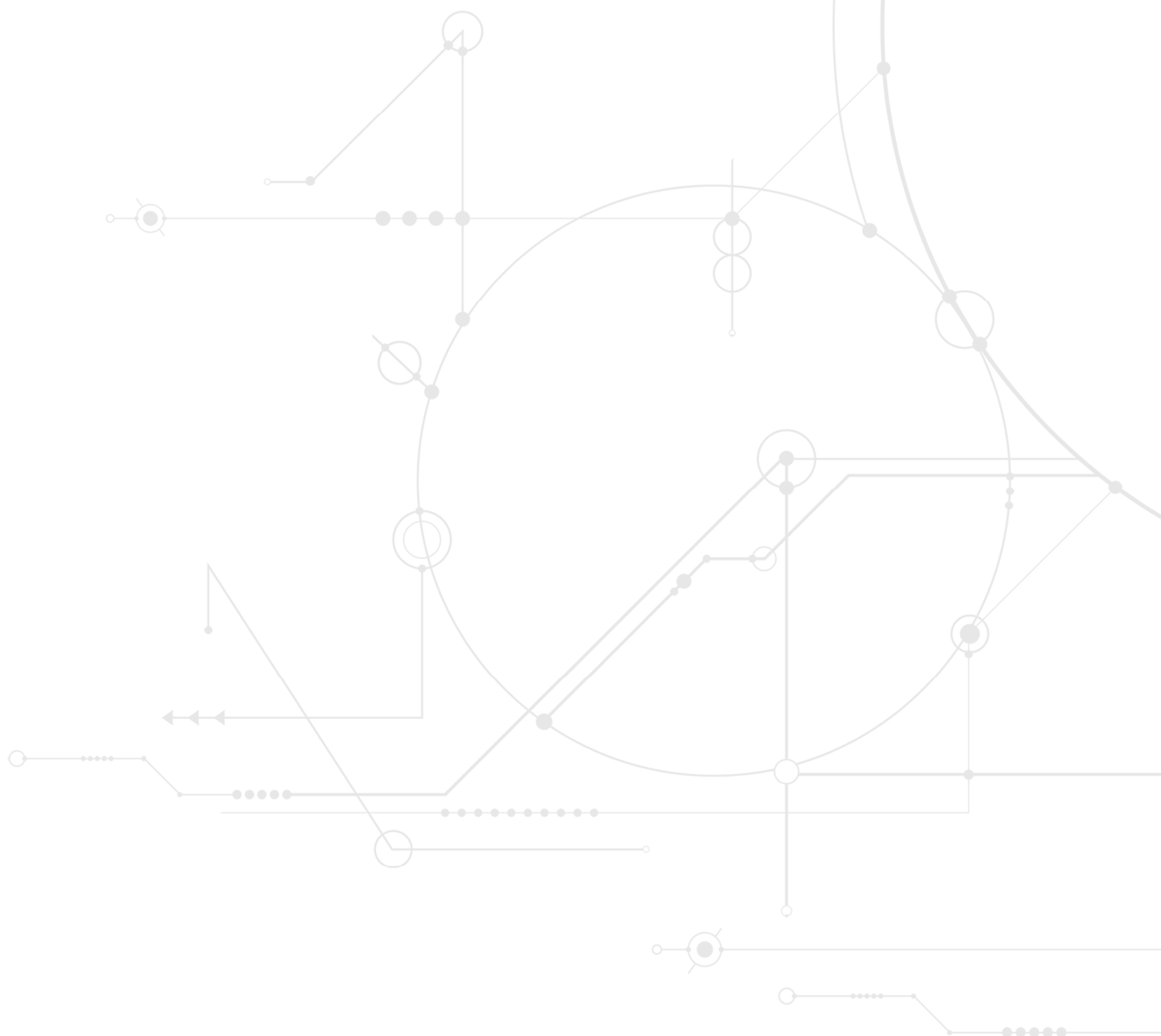
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19.07.21

To whom it may concern

We hereby certify that our product Silicato fachadas do not contain DEHP (Bis(2-ethylhexyl) phthalate).

Luis Gil
Director Técnico



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