

MAIS DE 35 ANOS
A CONVERTER
CONHECIMENTO
EM VALOR

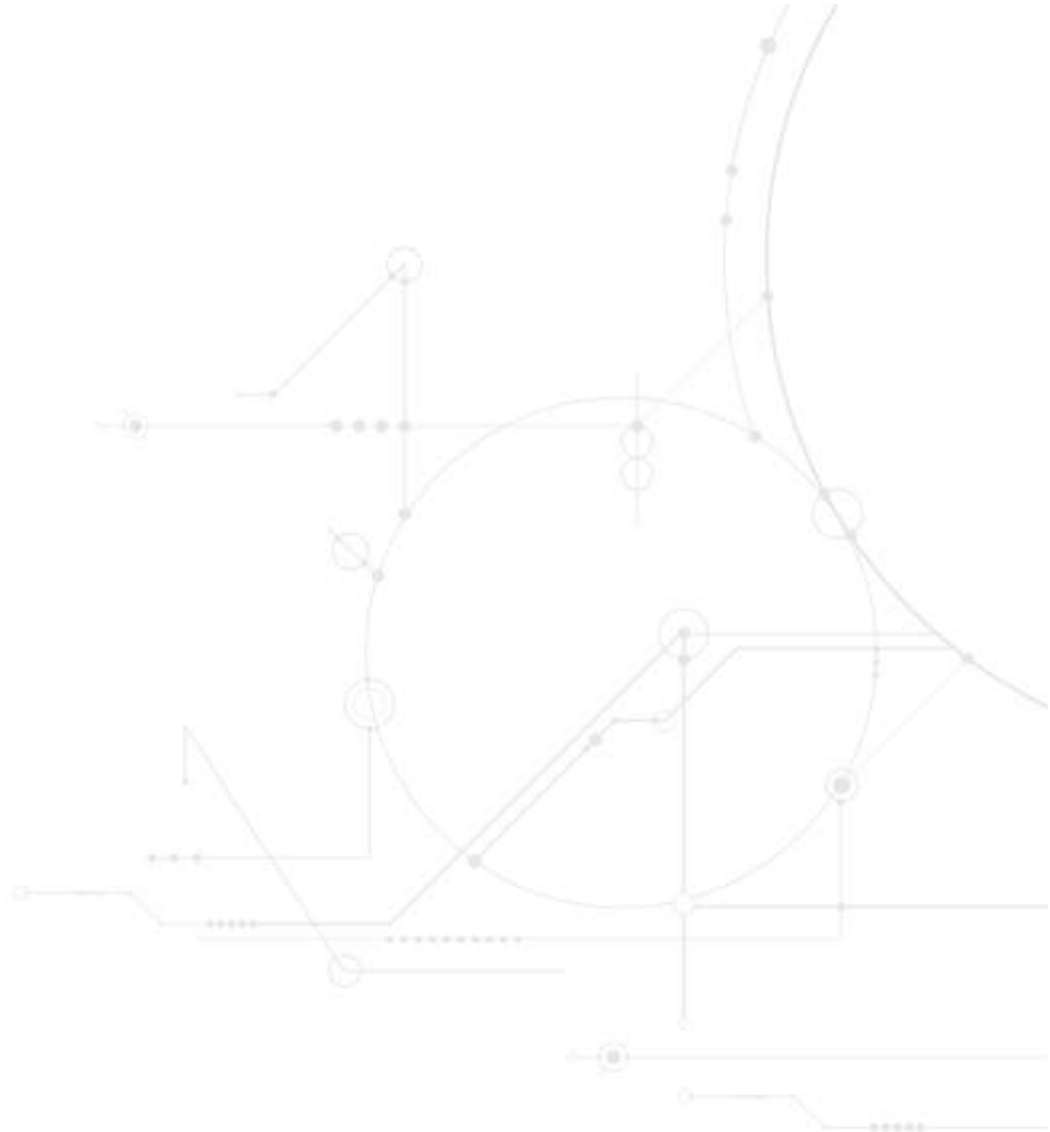
Laboratório Qualidade do Ar Interior



Determination of VOC, SVOC and VVOC emissions
from building products – AgBB requirements

Process: LQAI.MC.68/23
Report Nr. LQAI.2023.476

Identification of the Material: Esmalte Waterplus
Client: Indústrias 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.

This document may not be reproduced except in full, without written agreement of INEGI.

0. DOCUMENTAL CONTROL

0.1 IDENTIFICATION OF DOCUMENT

Projet	---
Name of Document	Determination of VOC, SVOC and VVOC emissions from building products - AgBB requirements
Name of file	---

0.2 CONTROL OF VERSIONS

Version	Edition	Revision	Date	Description	Approved by
1	1	0	2023-12-19	Original version	SM

0.3 AUTHOR(S)

Name	Entity	Initials
Susana Martins / Responsável Técnico do Laboratório	INEGI	SM

0.4 REVISER(S)

Name	Entity	Initials
Anabela Martins / Técnico de Laboratório Coordenador		

0.5 LIST OF DISTRIBUTION

Name	Entity	Initials
Laboratório Qualidade Ar Interior	INEGI	LQAI
---	Indústrias Juno, S.A	

TABLE OF CONTENTS

1. SAMPLE IDENTIFICATION.....	6
2. OBJECTIVE.....	5
3. CLIENT.....	5
4. METHODOLOGIES USED	6
5. RESULTS.....	10
6. GENERAL CONCLUSIONS	10
7. REFERENCES	11

1. OBJECTIVE

Determination of emissions of Volatile Organic Compounds (VOC), Semi Volatile Organic Compounds (SVOC) and Very Volatile Organic Compounds (VVOC) from a sample of material in order to obtain the material classification under the criteria established by AgBB - Evaluation procedure for VOC emissions from building products – 2021.

2. CLIENT

Indústrias Juno S.A.
Barrio Saconi 10 s/n
48950 Erandio – Espanha

Reference of Proposal: PE30231037 by 04/10/2023

3. SAMPLE IDENTIFICATION

Sample name: Esmalte Waterplus

Product type: door

Production date: ---

Batch no.: ---

Sampling: client

Sampling date: ---

Packing material: aluminium foil + cling film

number of packages: 1

Sample reception at LQAI: 2023/10/16

For more information see Annex A: Sampling report completed by the client.

4. METHODOLOGIES USED

The selection of the product sample was the sole responsibility of the client. Results apply to sample as received. The tests and analysis presented were carried out in the permanent facilities of the laboratory.

The sample was applied in a glass on 2023/11/06 according ISO16000-11¹ and according to the instructions provided by the manufacturer (picture of sample in annex B). 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)
39 (Class medium*)	1,27	39	10	1	127

*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)
1,2	0,009	0,13	39

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. Note that sample preparation is outside the scope of laboratory accreditation.

The test in the test chamber started on 2023/11/06 and was performed in accordance with the internal procedure IT.403 (annex C). This test is accredited in accordance with EN ISO/IEC 17025² for the compounds:

Test	Method
Determination of the emission of benzene from building products and furnishing — Emission test chamber method	IT.403.07
Determination of the emission of toluene from building products and furnishing — Emission test chamber method	IT.403.07
Determination of the emission of ethylbenzene from building products and furnishing — Emission test chamber method	IT.403.07
Determination of the emission of 2-ethyl-1-hexanol from building products and furnishing — Emission test chamber method	IT.403.07
Determination of the emission of limonene from building products and furnishing — Emission test chamber method	IT.403.07
Determination of the emission of tridecane from building products and furnishing — Emission test chamber method	IT.403.07
Determination of the emission of 1,2,4-trimethylbenzene from building products and furnishing — Emission test chamber method	IT.403.07

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 and SVOCs samples were collected, in tubes with Tenax TA, when the test chamber was empty (2023/11/06, volume: 5.56 l) and in duplicate 3 days (2023/11/09, average volume: 5.78 l) and 28 days (2023/12/04, average volume: 6.21 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 5.3%.

Formaldehyde, acetaldehyde and acetone were collected in cartridges impregnated with DNPH when the test chamber was empty (2023/11/06, volume: 85,1 l) and 3 days (2023/11/09, volume: 87,4 l) and 28 days (2023/12/04, volume: 94,2 l) after starting the test. The collection of formaldehyde, acetaldehyde and acetone is out the scope of accreditation.

The experimental conditions in the chamber during the conditioning time and the study were:

Period	T (°C)	HR (%)	v (m/s)	n (h ⁻¹)	A/V (m ² /m ³)
Test (28 days)	22.3±0,4	52.2±2.0	0.17	0.64	0.06

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 7890 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 2023/11/13, 2023/12/07 and 2023/12/12 and was performed in accordance to the internal procedure IT.401 (annex C). This test is accredited in accordance with EN ISO/IEC 17025² for the compounds:

Test	Method
Determination of Benzene by thermal desorption and Gas chromatography with mass selective detector	IT.401.09
Determination of Toluene by thermal desorption and Gas chromatography with mass selective detector	IT.401.09
Determination of Octane by thermal desorption and Gas chromatography with mass selective detector	IT.401.09
Determination of Ethylbenzene by thermal desorption and Gas chromatography with mass selective detector	IT.401.09
Determination of 2-Ethoxyethylacetate by thermal desorption and Gas chromatography with mass selective detector	IT.401.09
Determination of 1,2,4-trimethylbenzene by thermal desorption and Gas chromatography with mass selective detector	IT.401.09
Determination of 2-ethyl-1-hexanol by thermal desorption and Gas chromatography with mass selective detector	IT.401.09
Determination of limonene by thermal desorption and Gas chromatography with mass selective detector	IT.401.09
Determination of dodecane by thermal desorption and Gas chromatography with mass selective detector	IT.401.09
Determination of 2-phenoyethanol by thermal desorption and Gas chromatography with mass selective detector	IT.401.09
Determination of tridecane by thermal desorption and Gas chromatography with mass selective detector	IT.401.09
Determination of styrene by thermal desorption and Gas chromatography with mass selective detector	IT.401.09
Determination of tetrachloroethylene by thermal desorption and Gas chromatography with mass selective detector	IT.401.09
Determination of 2-butoxyethanol by thermal desorption and Gas chromatography with mass selective detector	IT.401.09
Determination of <u>naphthalene</u> by thermal desorption and Gas chromatography with mass selective detector	IT.401.09

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

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, when possible. Total volatile organic compounds (TVOC) concentration was calculated as the sum of the emission factors of all compounds with retention times between hexane and hexadecane, with concentrations greater than 5 µg/m³, using the specific response factor for the identified compounds and the toluene response in the remaining cases. Total semi volatile organic compounds (COSVT) concentration was calculated as the sum of the emission factors of all compounds with retention times between hexadecane and docosane, with concentrations greater than 5 µg/m³, using the toluene response factor.

The global expanded uncertainties (resulting from the combination of sampling and analysis uncertainties – IT401 and IT.403) obtained for each of the compounds are shown below. The expanded uncertainty was calculated using the expansion factor of 2.01, corresponding to a 95% confidence level.

Compound	Global Expanded Uncertainty
Benzene (IT401 and IT403)	34%
Toluene (IT401 and IT403)	28%
Ethylbenzene (IT401 and IT403)	28%
2-ethyl-1-hexanol (IT401 and IT403)	28%
Limonene (IT401 and IT403)	27%
Tridecane (IT401 and IT403)	28%
1,2,4-Trimethylbenzene (IT401 and IT403)	26%

Formaldehyde, acetaldehyde and acetone were determined according to ISO 16000-3³ and the internal procedure IT.402. Specifically, the compounds were analysed by high performance liquid chromatography (HPLC) using a 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 2023/11/13, 2023/11/21 and 2023/12/13. The uncertainty of the analytical method is ±8.4% for formaldehyde and ±8.6% for acetaldehyde. This analysis is out the scope of accreditation.

5. RESULTS

Table 1 show the emission factor for TVOC, TSVOC and individual compounds quantified as well as the results of the application of the AgBB (2021)⁴, considering the specific ventilation rate (q_e) of $10 \text{ m}^3 \text{ h}^{-1} \text{ m}^{-2}$ (test scenario: doors).

Table 1. Emission factors for the compounds quantified in the emissions from the sample of the material for 3 and 28 days of exposure for a specific ventilation rate of $10 \text{ m}^3 \text{ h}^{-1} \text{ m}^{-2}$.and application of AgBB criteria.

Compound	CAS	LCI ($\mu\text{g}/\text{m}^3$)	Emission Factor ($\mu\text{g}/(\text{m}^2\text{h})$)	
			3 days	28 days
Propylene glycol ⁺	57-55-6	2100	832	a)
2-Propanol, 1-(2-butoxy-1-methylethoxy)- ⁺	29911-28-2	250	4704	103
formaldehyde ⁺	50-00-0	100	140	a)
acetaldehyde ⁺	75-07-0	1200	a)	a)
acetone ⁺	67-64-1	1200	a)	a)
TVOC ⁺	---	---	5536	89.2
TSVOC ⁺	---	---	a)	a)

Parameter to be assessed	Condition to be fulfilled	Results
3 days		
VOCs Carcinogenic 1A and 1B** ($\mu\text{g}/\text{m}^3$)	< 10	n.d.
TVOC ⁺ ($\mu\text{g}/\text{m}^3$)	< 10000	554
28 days		
TVOC ⁺ ($\mu\text{g}/\text{m}^3$)	< 1000	8.92
TSVOC ⁺ ($\mu\text{g}/\text{m}^3$)	<100	< 5,0
VOCs Carcinogenic 1A and 1B** ($\mu\text{g}/\text{m}^3$)	< 1	n.d.
$R = \sum (C_i/LC_{li})$	< 1	0.04
$\sum C_n$ ($\mu\text{g}/\text{m}^3$)	< 100	< 5,0
EVALUATION		Positive

a) Compound with concentration less than $5 \mu\text{g}/\text{m}^3$. Only substances with concentrations equal to or greater than $5 \mu\text{g}/\text{m}^3$ should be quantified.

LCI – Lowest concentration of interest (AgBB 2021⁴); R - Index summarising the estimated health risk of a material emission (only listed substances whose concentrations in the test chamber air exceed $5 \text{ mg}/\text{m}^3$ are evaluated based on LCI): $R = \sum (C_i/LC_{li})$, were: C_i – concentration of an individual compound for which a LCI value is know; $C_i = FE / q_e$; $\sum (C_n)$ - Sum of the concentrations of the compounds, after 28 days of exposure, non-identified or for which a LCI value is not known; $C_n = FE / q_e$;

+ Out of the scope of accreditation.

*Classification according to Regulation (EC) No. 1272/2008 Annex VI Table 3.1;

6. GENERAL CONCLUSIONS

By customer request, the results obtained are compared with the criteria established AgBB⁴. 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 show that, under the criteria set by AgBB the material “Esmalte Waterplus” has a positive evaluation.

7. 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- NP EN ISO/IEC 17025:2018 – Requisitos gerais de competência para laboratórios de ensaio e calibração.
- 3- ISO 16000-3 (2011). Determination of formaldehyde and other carbonyl compounds - Active sampling method.
- 4- AgBB - Evaluation procedure for VOC emissions from building products (2021).

Porto, 19 December 2023

(Head of Laboratory)

Report of the Sampling Procedure

Testing laboratory / certification body:		Sampler (name , company, telephone):	
Name of the manufacturer at the place of sampling (address/stamp):	INDUSTRIAS JUNO S.A BARRIO SACONI 10 48950 ERANDIO BIZKAIA ESPAÑA	Manufacturer (if deviating from company's name at the place of sampling):	
Name of the product:	ESMALTE WATERPLUS	Type of product (e.g. paint, laminate, textile flooring, PVC-flooring).	PAINT
Model/program/series:		Batch nº:	230831278
Article Nº:		Date of batch production:	5/9/23
Sample is taken from:	☒ Production ☐ Store ☐ Retain samples ☐ Miscellaneous	How had the product been stored prior to sampling?	☐ Open ☒ Wrapped up
	Place of storage:		Packing material: metal can

Sample Description/ Application <i>mention where applicable:</i> Density % Solids by weight Spread rate Application type (e.g. walls, floor, doors, sealants)	1.27 g/lit 42% 10 m2/lit doors
--	---

Specifics (Possible negative influences by emission at the place of taking the sample, petrol emissions, solvent emissions from production, uncertainties, questions, etc.):	
---	--

Cut edges (identification of cut edges when present and identification of new surfaces and surface to be exposed in the emission test):	
---	--

Confirmation The signer herewith confirms the correctness of the data given above. The sample was selected, drawn and packed personally in accordance with the instructions for the taking of samples.	
Date 10/10/23	Signature (stamp)

Please attach the Technical Data Sheet of the product.

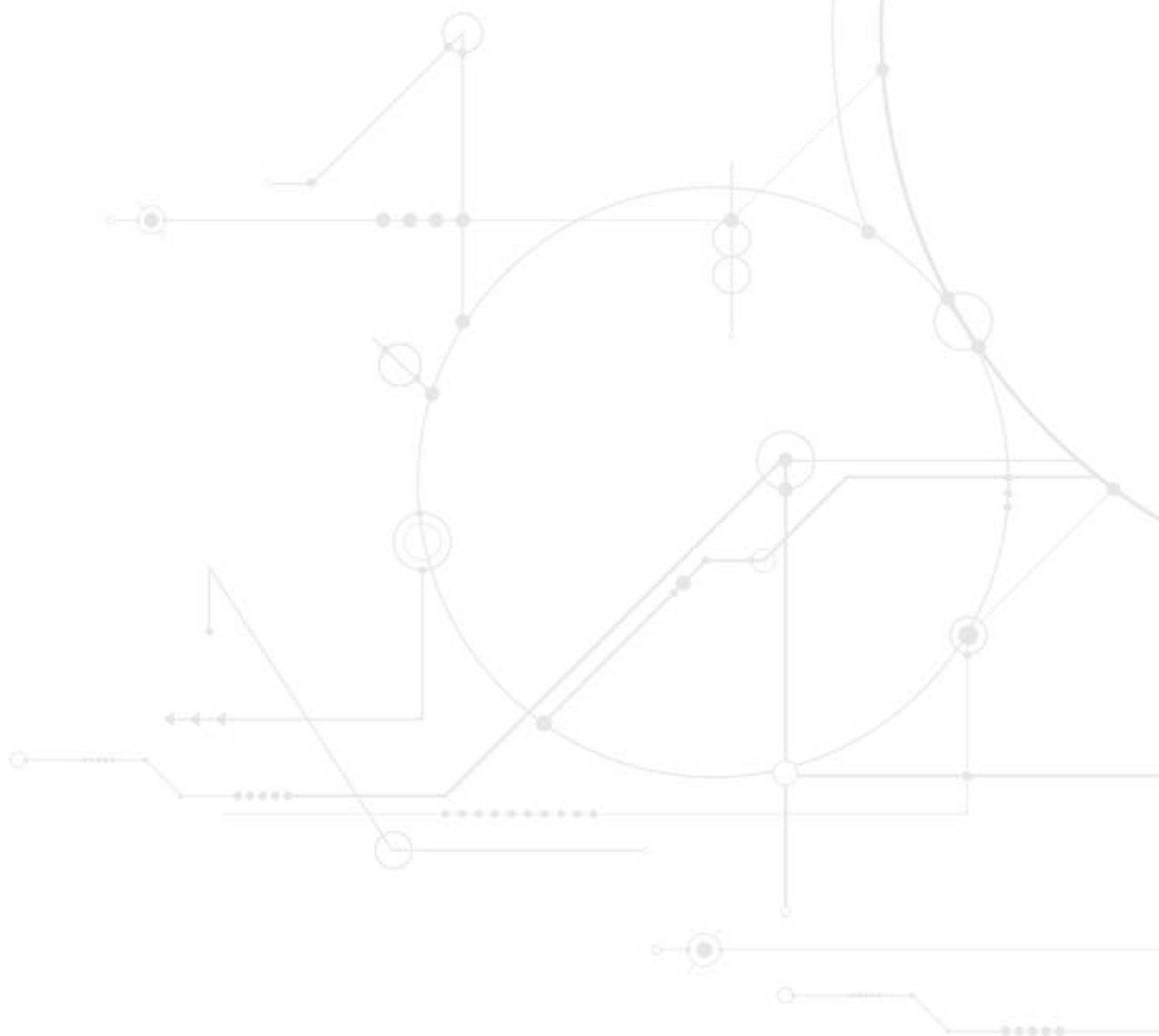
INDUSTRIAS JUNO, S.A.
Barrio Saconi, 10
48950 ERANDIO (BIZKAIA)
Tel. 94.467.00.62 - Fax: 94.467.00.63

Annex B: Photo of the sample of the material under study



Annex C – Bibliography that supported the elaboration of the internal procedures IT403 and IT401:

- ISO 16000-6 (2021): 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 or MS-FID.
- ISO 16000-9 (2006): Determination of the emission of volatile organic compounds from building products and furnishing - Emission test chamber method.
- 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.
- EN 16516:2017. Construction products: Assessment of release of dangerous substances - Determination of emissions into indoor air



**MAIS DE 35 ANOS
A CONVERTER
CONHECIMENTO
EM VALOR**

**INEGI - Instituto de Ciência e Inovação
em Engenharia Mecânica e Engenharia Industrial**

Campus da FEUP | Rua Dr. Roberto Frias, 400 | 4200-465 Porto | PORTUGAL
T. +351 22 957 87 10 | F. +351 22 953 73 52 | inegi@inegi.up.pt

www.inegi.up.pt

