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TEST REPORT N°

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2507 - E0241604/E0241611

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TEST REPORT: QUALITATIVE AND QUANTITATIVE ANALYSIS OF MICROPLASTIC

Order: Devis signé D2505647

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TABLE OF CONTENT

1. CONTEXT AND REFERENCE

This study is about identification and quantification of microplastic release from your cutting board.

The obtained results are presented in this report.

In order to carry out this study, the techniques used are:
• **Preparation of samples** in order to extract microplastics from the matrix composing the sample.
• **Filtration**, allowing particles to be isolated on a support allowing analyzes after sample preparation.
• **Qualitative and quantitative analysis of microplastics by µIRTF**, in order to identify the nature, number and size of particles present on the surface of the filter.
• **Direct µIRTF analysis of a raw material**, with the raw material added to a database.

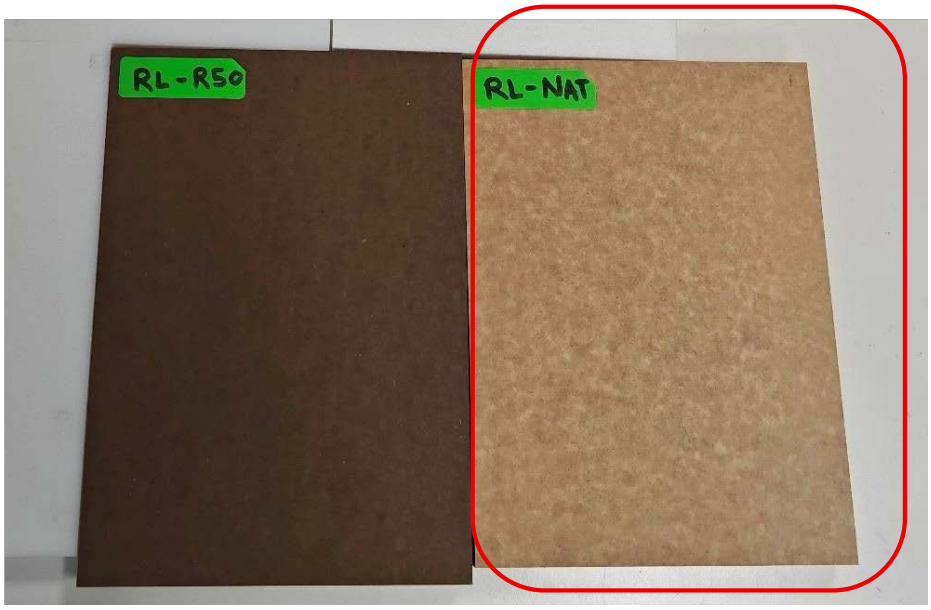
Reference of studied samples are presented in the following table:

Filab Reference	Customer Reference
2507-E0241604	**RL-NAT - Cutting board material**
2507-E0241611	**RL-NAT - Cutting board material**

** in the appendix is available information on the definition and regulation of microplastics to which the reader can refer*

The sample 2507-E0241604 is leached directly, whereas the sample 2507-E0241611 is already scratched before being leached.

2. SAMPLES'PRESENTATION



Photography of samples

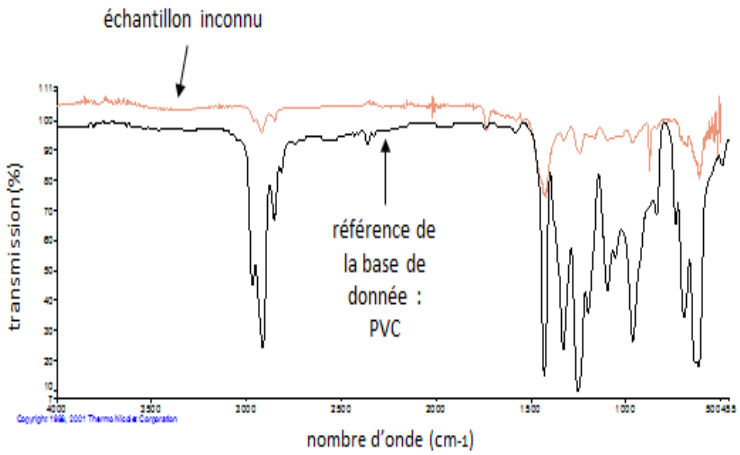
3. ANALYSIS AND RESULTS

3.1 PRESENTATION OF THE µIRTF TECHNIQUE

Infrared spectrometry, Fourier transform (IR-TF), which can be used in reflection or transmission mode, is an analysis method aimed at organic materials with high absorbance. It is therefore particularly suitable for the study of polymers. The material is analyzed by identifying the chemical bonds between the atoms that constitute it.

The sample to be analyzed is illuminated by a light beam containing a combination of multiple frequencies of light. The energy provided by the infrared radiation is absorbed by the molecule and it is this same absorption that is measured. The beam is then modified to contain a combination of different frequencies. The absorption is measured again and the operation is repeated multiple times. Once all the data has been acquired, we can deduce the absorption for each wavelength: This is the IR spectrum of the molecule.

The identification of the material is done in two stages. Characteristic peaks are extracted to search for corresponding links in reference tables. The continuous spectrum is then compared to a spectral database which allows the nature of the material to be determined precisely, via maximum match calculations.

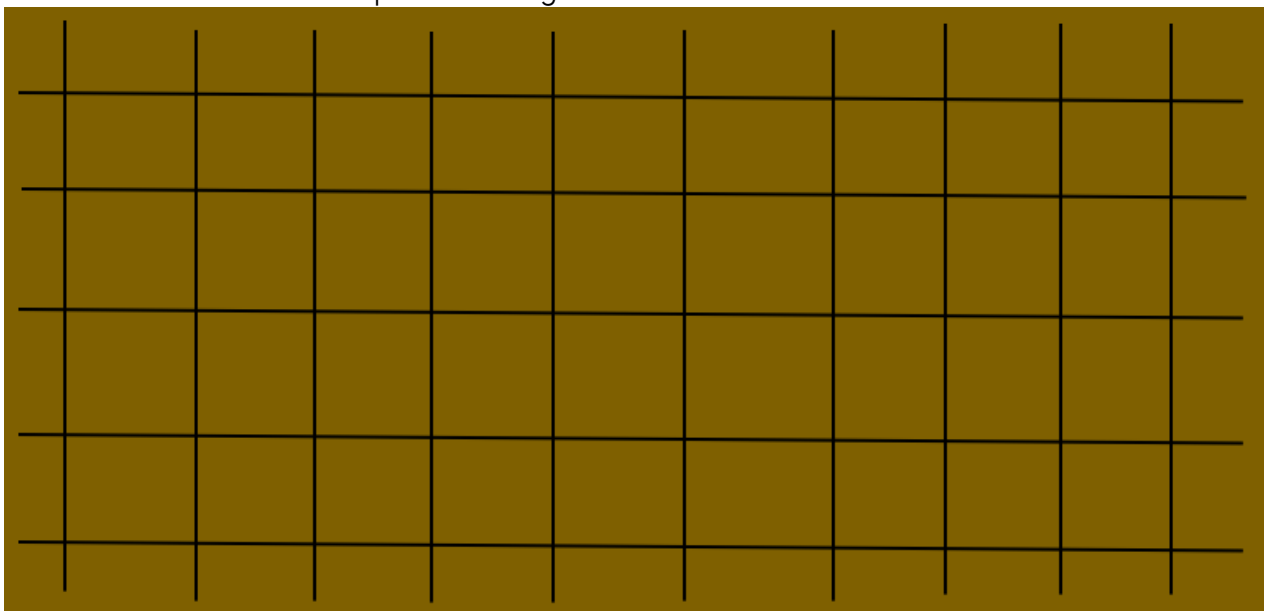


Comparison of the spectrum of the sample and the reference

FTIR spectrometry is not just limited to material identification. It is possible to account for the abnormal degradation of a material, by comparing degraded and new samples for example, or to characterize crosslinking mechanisms.

3.2 SAMPLE PREPARATION

Each sample was prepared by leaching the cutting board during 48 hours in 1 liter of ultra-pure water UPW in a glass Tupperware.
The sample 2507-E0241604 was directly leached meanwhile the sample 2507-E0241611 was first altered with a steel scalpel according to this cut scheme below :



After the leaching, booth samples were filtrated:
- Filtration of 150 mL of the preparation solution of the sample 2507-E0241604 on a silicon membrane with a cutoff threshold of 5 µm.
- Filtration of 50 mL of the preparation solution of the sample 2507-E0241611 on a silicon membrane with a cutoff threshold of 5 µm.
The filtered volume is lower for the sample 2507-E0241611 because the leachate contained more particles.
The filter used is a silicon filter measuring 10 mm x 10 mm.
The filtration kit used makes it possible to obtain a circular filtration zone of 9 mm in diameter.

Note that not all of the preparation solution is filtered. The test sample is adapted so as not to overload the silicon filter measuring 10 mm x 10 mm.

The results are then interpreted by number of particles on the analyzed surface. An estimate of the number of microplastic particles per quantity of sample can then be made by considering the raw sample and its preparation as homogeneous.

3.3 µ-IRTF ANALYSIS METHOD

Step 1: Optical microscopy mosaic of the filter
A mosaic is produced by taking several photos by the device's camera, defining the analysis zone(s).

Step 2: Detection of particles in the area of interest
The software detects particles present on the surface of the filter in gray level. These are then identified in red and a yellow square (mask) defines the analysis area per particle.

Step 3: Determination of the infrared spectra of the targeted particles and production of the blank
Each particle is analyzed by µIRTF in order to obtain the spectrum of the defined analysis zone.
A blank is then produced in order to obtain the "background" spectrum.

Step 4: Search and identification in our microplastic databases
Each particle is identified by comparing the spectrum obtained with our microplastic databases. A correlation factor generally between 30% and 70% is defined depending on the results proposed by the software. This factor is defined by the operator.

Step 5: Extrapolation of the results to the entire filter and the sample
The number of microplastic particles detected on the surface analyzed is extrapolated to the entire filter, assuming a homogeneous distribution of particles on the filter. This number of particles is representative of the number of particles contained in the solution taken for filtration.

A dilution factor is then taken into account in order to extrapolate the number of particles over the entire preparation solution, assuming a homogeneous distribution in the preparation solution. This number corresponds to the number of particles contained in the sample and makes it possible to establish the number of particles per gram or milliliter of sample.

3.4 2507-E0241604 - RL-NAT - CUTTING BOARD MATERIAL

➢ ANALYSIS CONDITIONS

The analysis was realized thanks to a µIRTF iN10 by Thermo Fisher and controlled by OMNIC Picta software.
The applied parameters are mentioned in the following table:

Parameters	
Collect Mode	Transmission
Detector Mode	Cooled
Acquisition time	3 s
Spectral resolution	8 cm^{-1}
Background	At the reference location
Data base	Polymer miracles Microplastic Spectral Librairies Microplastic Filab (Intern data base)
Threshold	70%
Correlation algorithm	OMNIC correlation coefficient

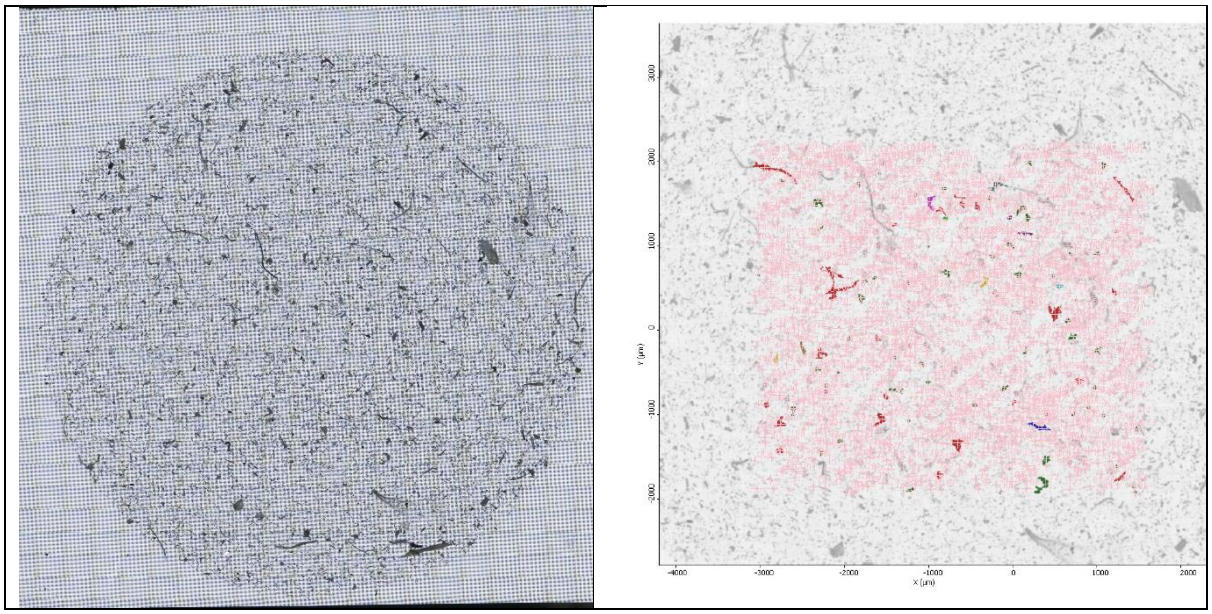
The analyzes were carried out on 1 zone of dimension 37.30 mm^2 for the blank of the sample and on 1 zone of y 18.58 mm^2 for the sample 2507-E0241604.

➢ RESULTS

The microplastic detection and identification released after leaching of the sample 2507-E0241604 are shown below.

- **DETECTION AND IDENTIFICATION OF ANALYZED PARTICLES**

The area of the filter where the detection and identification of particles was carried out is presented below.



Mosaic of the analyzed zone: to the left the detected particles and to the right the analyzed particles

The enumeration and identification results are summarized in the following table:

Results of the number of particles identified in the analysis area	
Number of particles detected per gray level	1051
Number of particles identified *	97

** Unidentified particles are either particles that do not respond in the infrared, optical artefact or particles whose identification does not exceed the correlation factor chosen based on the results.*

- **NATURE OF DETECTED PARTICLES**

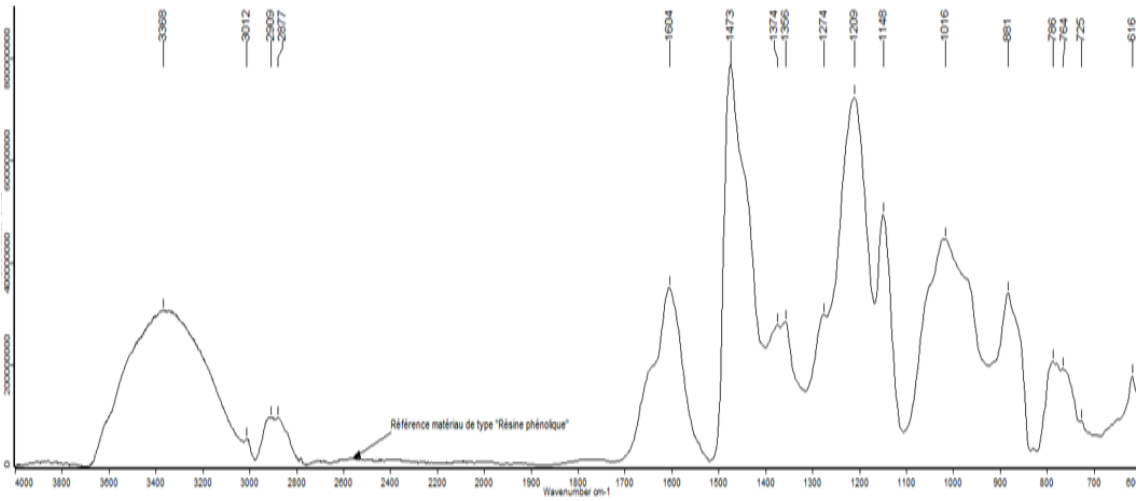
The results for the nature of the identified particles are summarized in the following table:

Identification associated to the spectral database	Number of particles	Nature can be included in the microplastic category *
Polyethylene	1	Yes
Protein Matter	63	No
Poly(acrylonitrile-co-butadiene-co-styrene)	1	Yes
Cotton	2	No
Paper coated	20	Yes
Cellulose	1	No
Poly(vinyl chloride)	1	Yes
Polyamide 6	1	Yes
C5. Pink Fiber Bundle	2	No
C1. Black Fiber	1	No
Cotton 13. Yellow Fiber	2	No
Poly(acrylonitrile-co-butadiene)	1	Yes
Protein matter + Cellulose	1	No
Unidentified	954	No

** Non-polymeric particles and natural polymers are exempt from the microplastic category due to their nature.*

On the surface of the filter analyzed, the number of particles that were identified as microplastics was 25.

It should be noted that the phenolic resin's theoritical spectrum is well defined and cannot be confused with the other references described in the table above which means that no traces of phenolic resin are detected and so released fromn cutting boards.
The theoritical spectrum of phenolic resin is shown below :



Phenolic Resin's spectrum

- **SIZE AND TYPE OF IDENTIFIED PARTICLES CLASSEMENT**

The classification of particles identified according to their size and type is presented in the table and graph below:

Nature and size (µm)	1 - 5	5 - 10	10 - 20	20 - 50	50 - 100	100 - 500	> 500	total
Polyethylene	0	0	0	0	1	0	0	1
Protein Matter	0	0	0	18	32	13	0	63
Poly(acrylonitrile-co-butadiene-co-styrene)	0	0	0	0	1	0	0	1
Cotton	0	0	0	0	0	2	0	2
Paper coated	0	0	0	0	7	12	1	20
Cellulose	0	0	0	0	0	1	0	1
Poly(vinyl chloride)	0	0	0	0	1	0	0	1
Polyamide 6	0	0	0	0	1	0	0	1
C5. Pink Fiber Bundle	0	0	0	0	1	1	0	2
C1. Black Fiber	0	0	0	0	0	1	0	1
Cotton 13. Yellow Fiber	0	0	0	0	0	2	0	2
Poly(acrylonitrile-co-butadiene)	0	0	0	0	1	0	0	1
Protein matter + Cellulose	0	0	0	1	0	0	0	1
Unidentified	0	0	0	610	260	83	1	954

3.5 2507-E0241611 - RL-NAT - CUTTING BOARD MATERIAL

➢ CONDITIONS OF SAMPLE 2507-E0241611 – RL NAT ANALYSIS:

The analysis was realized thanks to a µIRTF iN10 by Thermo Fisher and controlled by OMNIC Picta software.
The applied parameters are mentioned in the following table:

Parameters	
Collect Mode	Transmission
Detector Mode	Cooled
Acquisition time	3 s
Spectral resolution	8 cm^{-1}
Background	At the reference location
Data base	Polymer miracles Microplastic Spectral Librairies Microplastic Filab (Intern data base)
Threshold	70%
Correlation algorithm	OMNIC correlation coefficient

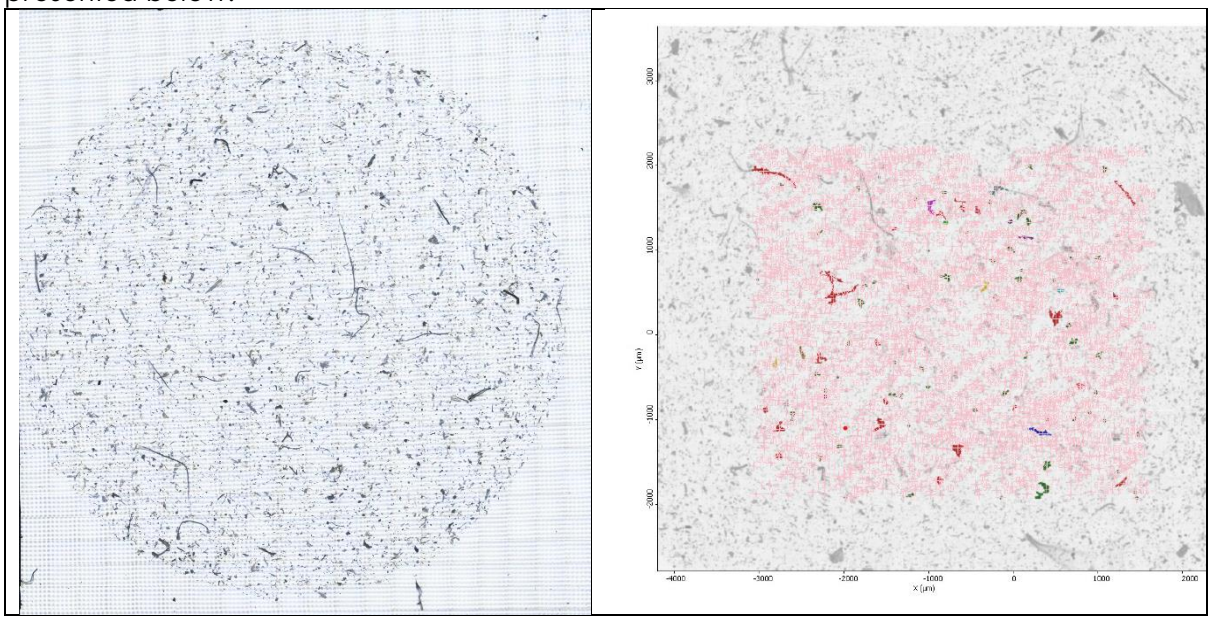
The analyzes were carried out on 1 zone of dimension 37.39 mm^2 for the blank of the sample and on 1 zone of 29.77 mm^2 for the sample 2507-E0241611.

➢ ANALYSIS OF SAMPLE 2507-E0241611 – RL NAT

The microplastic detection and identification released after leaching of the sample 2507-E0241611 are shown below.

- **DETECTION AND IDENTIFICATION OF ANALYZED PARTICLES**

The area of the filter where the detection and identification of particles was carried out is presented below.



Mosaic of the analyzed zone: to the left the detected particles and to the right the analyzed particles

The enumeration and identification results are summarized in the following table:

Results of the number of particles identified in the analysis area	
Number of particles detected per gray level	1036
Number of particles identified *	43

** Unidentified particles are either particles that do not respond in the infrared, optical artefact or particles whose identification does not exceed the correlation factor chosen based on the results.*

- **NATURE OF DETECTED PARTICLES**

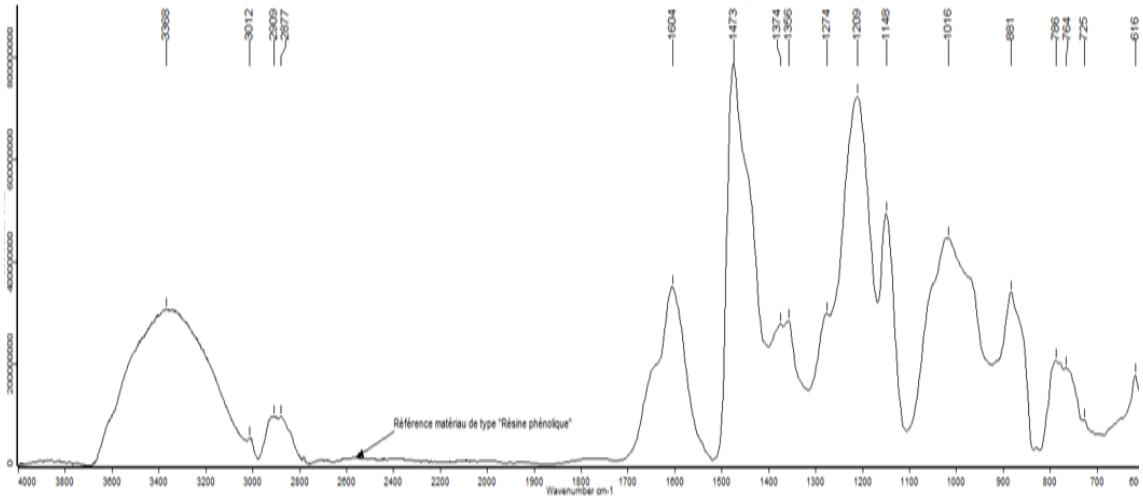
The results for the nature of the identified particles are summarized in the following table:

Identification associated to the spectral database	Number of particles	Nature can be included in the microplastic category *
Unidentified	993	No
Protein Matter	30	No
C4. Green Fiber	1	No
Paper coated	6	Yes
Cotton	2	No
PE 12. White Film	1	Yes
Polyethylene	1	Yes
Stearate Calcium	1	No
C5. Pink Fiber Bundle	1	No

** Non-polymeric particles and natural polymers are exempt from the microplastic category due to their nature.*

On the surface of the filter whose analyzed, the number of particles that were identified as microplastics was 8.

It should be noted that the phenolic resin's theoritical spectrum is well defined and cannot be confused with the other references described in the table above which means that no traces of phenolic resin are detected and so released fromn cutting boards.
The theoritical spectrum of phenolic resin is shown below :



Phenolic Resin's spectrum

- **SIZE AND TYPE OF IDENTIFIED PARTICLES CLASSEMENT**

The classification of particles identified according to their size and type is presented in the table and graph below:

Nature and size (µm)	1 - 5	5 - 10	10 - 20	20 - 50	50 - 100	100 - 500	> 500	total
Unidentified	0	0	0	553	334	101	5	993
Protein Matter	0	0	0	4	19	6	1	30
C4. Green Fiber	0	0	0	0	0	1	0	1
Paper coated	0	0	0	0	5	1	0	6
Cotton	0	0	0	0	0	2	0	2
PE 12. White Film	0	0	0	0	0	1	0	1
Polyethylene	0	0	0	0	0	1	0	1
Stearate Calcium	0	0	0	1	0	0	0	1
C5. Pink Fiber Bundle	0	0	0	0	1	0	0	1
Unidentified	0	0	0	553	334	101	5	993

4. CONCLUSION

Analyses of the sample are described in the following:

Sample	Blank	2507-E0241604 RL NAT Without alterations	Blank 2	2507-E0241611 RL NAT After alterations
Type of identified microplastic	PET ; PVC ; PE ; Poly[(acrylic acid)-co-(butyl acrylate)-co-(methacryl amide)-co-styrene] ;	PE ; PVC ; Paper coated ; polyamide 6 ; Poly(acrylonitrile-co-butadiene-co-styrene) ; Poly(acrylonitrile-co-butadiene)	PE	PE ; Paper coated
Number of particles of microplastic type detected on the analysed area	15	25	3	8

In order to interpret the results, it is necessary to compare the results of the samples with the analytical blanks results: the number of microplastic particles found in the leachates remains in the same order of magnitude as the number of particles found in the analytical blanks, which already suggests low leaching.
Furthermore, the nature of the particles released does not correspond to the compounds that make up the boards. These released microplastic particles may therefore come from external sources accidentally introduced during manufacture, transport, handling or analysis. All this suggests that un-scraped boards release no or very few microplastic particles.

Secondly, it is necessary to compare the results of the sample before and after scraping, focusing on the constituent elements of the boards, here paper and phenolic resin. Only phenolic resin may release microplastics, as the paper is natural and uncoated. The coated paper found is certainly the result of external pollution. No particles from the phenolic resin constituting the cutting board were found after leaching. Scraping the board therefore does not cause any significant release of microplastics.

Technic Visa:
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5. APPENDICES

Appendix 1: Informations on the definition and regulation regarding microplastics

- **Definition:**

According to the European Commission (restriction proposal of microplastics):
« Synthetic polymers microparticles » are defined as solid polymers, that are contained in particles and constitute at least 1 % of these particles, either in the form of continuous coating on the particles, where at least 1 % of these particles' weight fulfill one of these conditions:

- All particles' dimensions are superior or equal to 5 mm
- The particles' length is superior or equal to 15 mm and their length to diameter ratio is superior to 3

The following polymers are excluded from this designation:

- Polymers that are the result of a polymerization process which occurred in nature, that are not chemically modified substance
- Degradables polymers
- Polymers that have a solubility superior to 2 g/L
- Polymers that don't contain Carbon atoms in their chemical structure »

Therefore, microplastics are solid synthetic plastic particles, of a size inferior to 5 mm, insoluble and non-biodegradable. They can have different origins, such as cosmetics, clothing, food packaging, etc.
These are defined regarding three criteria:

- Solubility
- Biodegradability
- Size/nature

Microplastics have been associated with negative impacts on environment and human health, which led to a heightened regulation in this domain. In this report, we will concentrate on the microplastics' size and nature, as these criteria are the most relevant to evaluate their impact on the environment.

- **There exist two types of microplastics, depending on their origins :**

- Primary microplastics:

They are found directly in their initial form in the environment owing to their presence in certain hygienic and cosmetic products, detergents, synthetic clothing, paints, road marking...

- Secondary microplastics:

They come from degradation or fragmentation of plastic objects of greater size under the effect of oxygen, UV, heat, mechanical action or biological activity.

- **Regulation and normative aspect:**

Microplastics have been associated with negative impacts on environment and human health, which led to a heightened regulation in this domain.

- In the **construction industry**, microplastics can be used in sealing products, paints, caulks and adhesives. In France, the NF T 30-608 (2019) norm defines the analytical methods for determination of microplastics in waste waters. Microplastics in surface waters are also regulated by the European directive regarding surface waters (Directive 2000/60/CE).
- In the **cosmetics industry**, microplastics can be used in personal care products such as exfoliants and toothpastes. The EU regulation forbids the use of plastic microbeads in cosmetic products since July, 2018 (regulation (EU) 217/1224).
- In the **food industry**, microplastics can be present in food packaging and additives. The ISO 20225 (2018) norm provides guidelines for the determination of microplastics in drinking water.
- In **plastic medical dispositive**: the European regulation for medical dispositive (Regulation (EU) 2017/745) establishes requirements for materials in contact with the human body, including microplastics.
- Analyze of **plastic materials in water**: several norms are currently being written, namely the ISO 16094:2022 norm regarding water quality.
- The **fishing industry**: microplastics can be swallowed by fishes, which can have an impact on their health and their reproduction. In the EU, regulation regarding sustainable fishing (Regulation (EU) 2019/1241) involves measures aiming to reduce sea pollution, including microplastics.
- The **sanitation sector**: microplastics can be found in sewage sludge and waste waters. In France, the NF T 90-432 (2019) norm defines analytical methods for determination of microplastics in sewage sludge.
- In the **packaging industry**: microplastics can be present in plastic packaging, such as bags, films and bottles. In France, the law regarding wastage and circular economy (Law n°202-105 of February 10, 2020) forbids the use of some single-use plastics, such as thin plastic bags.
- In the **textile industry**: microplastics can be released by synthetic textiles while being washed. In Europe, the European Commission launched a public consultation on pollution from microplastics in 2018, which included a discussion regarding synthetic textiles' impacts.
- The **scientific research sector**: microplastics are a scientific research subject constantly evolving, with new developments and regular discoveries. The future regulations could be influenced by the results of these researches.

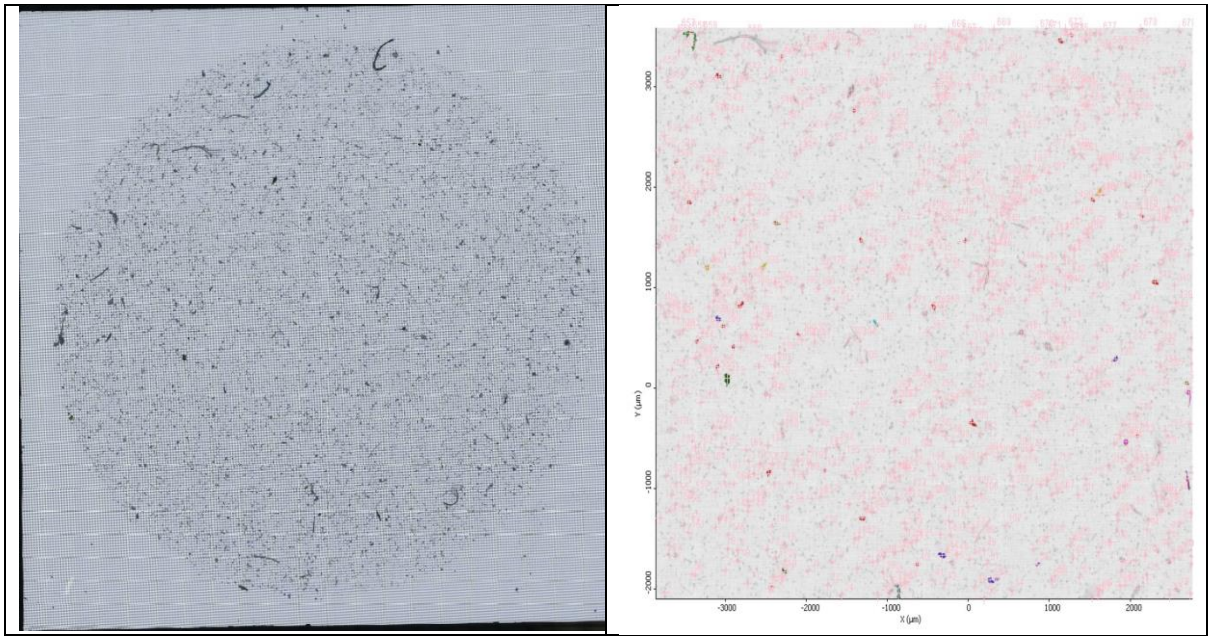
Appendix 2 : Blank analysis

➢ **Blank of sample 2507-E0241604 – RL NAT**

The results of the detection and identification of microplastic in the blank sample that followed the environment of sample 2507-E0241604 during its preparation and filtration are presented below.

- **DETECTION AND IDENTIFICATION OF ANALYZED PARTICLES**

The area of the filter where the detection and identification of particles was carried out is presented below.



Mosaic of the analyzed zone: to the left the detected particles and to the right the analyzed particles

The enumeration and identification results are summarized in the following table:

Results of the number of particles identified in the analysis area	
Number of particles detected per gray level	678
Number of particles identified *	50

** Unidentified particles are either particles that do not respond in the infrared, optical artefact or particles whose identification does not exceed the correlation factor chosen based on the results.*

- **NATURE OF DETECTED PARTICLES**

The results for the nature of the identified particles are summarized in the following table:

Identification associated to the spectral database	Number of particles	Nature can be included in the microplastic category *
Unidentified	628	No
Cotton	1	No
Cellulose	4	No
Protein Matter	29	No
Stearate Calcium	1	No
Polyethylene	2	Yes
PE 2. White Pellet	6	Yes
PE 46. Pink Fragment	3	Yes
Poly[(acrylic acid)-co-(butyl acrylate) -co-(methacryl amide)-co-styrene]	1	Yes
PET	1	Yes
Poly(vinyl chloride)	2	Yes

** Non-polymeric particles and natural polymers are exempt from the microplastic category due to their nature.*

On the surface of the filter whose analyzed, the number of particles that were identified as microplastics was 15.

- **CONCENTRATION CALCULATION**

Considering the quantity of sample engaged in the preparation solution as well as the quantity filtered and analyzed, the number of microplastic particles per sample can be estimated at 26 per liter.

- **SIZE AND TYPE OF IDENTIFIED PARTICLES CLASSEMENT**

The classification of particles identified according to their size and type is presented in the table and graph below:

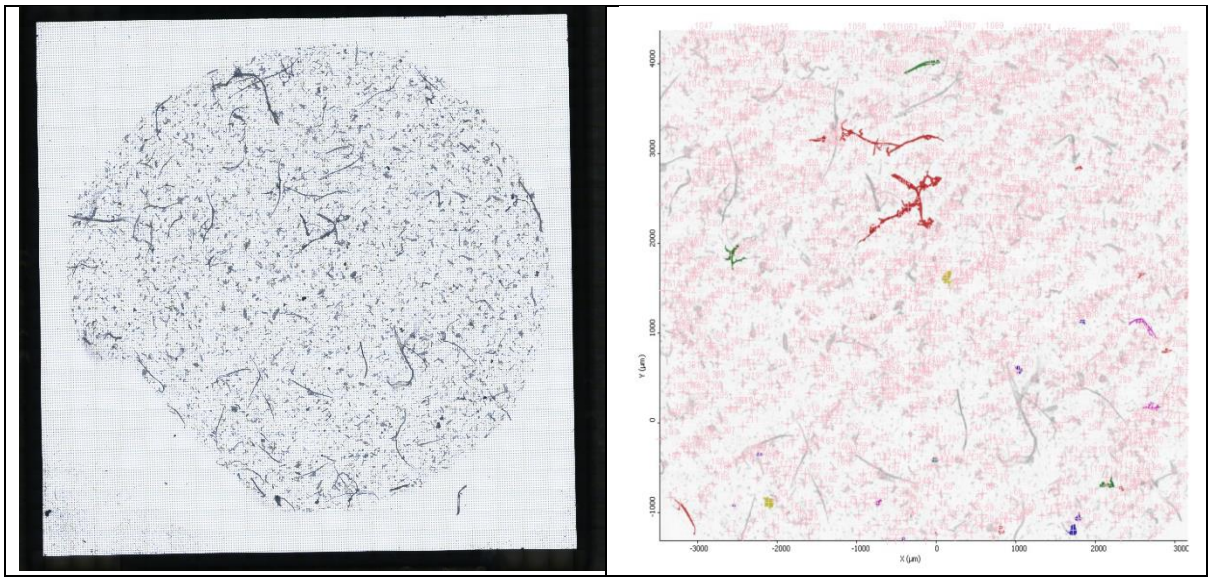
Nature and size (µm)	1 - 5	5 - 10	10 - 20	20 - 50	50 - 100	100 - 500	> 500	total
Unidentified	0	0	0	508	106	13	1	628
Cotton	0	0	0	0	0	1	0	1
Cellulose	0	0	0	0	2	2	0	4
Protein Matter	0	0	0	13	15	1	0	29
Stearate Calcium	0	0	0	1	0	0	0	1
Polyethylene	0	0	0	0	1	1	0	2
PE 2. White Pellet	0	0	0	0	5	1	0	6
PE 46. Pink Fragment	0	0	0	0	2	1	0	3
Poly[(acrylic acid)-co-(butyl acrylate)-co-(methacryl amide)-co-styrene]	0	0	0	1	0	0	0	1
PET	0	0	0	0	1	0	0	1
Poly(vinyl chloride)	0	0	0	0	1	1	0	2

➢ **Blank of sample 2507-E0241611 – RL NAT**

The results of the detection and identification of microplastic in the blank sample that followed the environment of sample 2507-E0241611 during its preparation and filtration are presented below.

- **DETECTION AND IDENTIFICATION OF ANALYZED PARTICLES**

The area of the filter where the detection and identification of particles was carried out is presented below.



Mosaic of the analyzed zone: to the left the detected particles and to the right the analyzed particles

The enumeration and identification results are summarized in the following table:

Results of the number of particles identified in the analysis area	
Number of particles detected per gray level	1082
Number of particles identified *	27

** Unidentified particles are either particles that do not respond in the infrared, optical artefact or particles whose identification does not exceed the correlation factor chosen based on the results.*

- **NATURE OF DETECTED PARTICLES**

The results for the nature of the identified particles are summarized in the following table:

Identification associated to the spectral database	Number of particles	Nature can be included in the microplastic category *
Unidentified	1055	No
Cellulose	10	No
Cotton 13. Yellow Fiber	3	No
Protein Matter	8	No
C4. Green Fiber	3	No
Polyethylene	3	Yes

** Non-polymeric particles and natural polymers are exempt from the microplastic category due to their nature.*

On the surface of the filter analyzed, the number of particles that were identified as microplastics was 3.

- **CONCENTRATION CALCULATION**

Considering the quantity of sample engaged in the preparation solution as well as the quantity filtered and analyzed, the number of microplastic particles per sample can be estimated at 34 per liter.

- **SIZE AND TYPE OF IDENTIFIED PARTICLES CLASSEMENT**

The classification of particles identified according to their size and type is presented in the table and graph below:

Nature and size (µm)	1 - 5	5 - 10	10 - 20	20 - 50	50 - 100	100 - 500	> 500	total
Unidentified	0	0	0	468	370	204	13	1055
Cellulose	0	0	0	0	3	5	2	10
Cotton 13. Yellow Fiber	0	0	0	0	0	3	0	3
Protein Matter	0	0	0	3	3	2	0	8
C4. Green Fiber	0	0	0	0	1	2	0	3
Polyethylene	0	0	0	0	1	2	0	3