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► **To cite this version:**

Cecile Levasseur-Garcia, Léa Volmerange, Marielle Pages. Analysis of Volatile Organic Compounds (VOCs) emitted by Food Preservation Bags: A SIFT-MS Approach. Food Science Summit, 2024, Rome, Italy. ⟨hal-05057754⟩

HAL Id: hal-05057754

<https://ut3-toulouseinp.hal.science/hal-05057754v1>

Submitted on 6 May 2025

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Cecile Levasseur-Garcia, Lea Volmerange, Marielle Pages-Homs



Analysis of Volatile Organic Compounds (VOCs) emitted by Food Preservation Bags: A SIFT-MS Approach



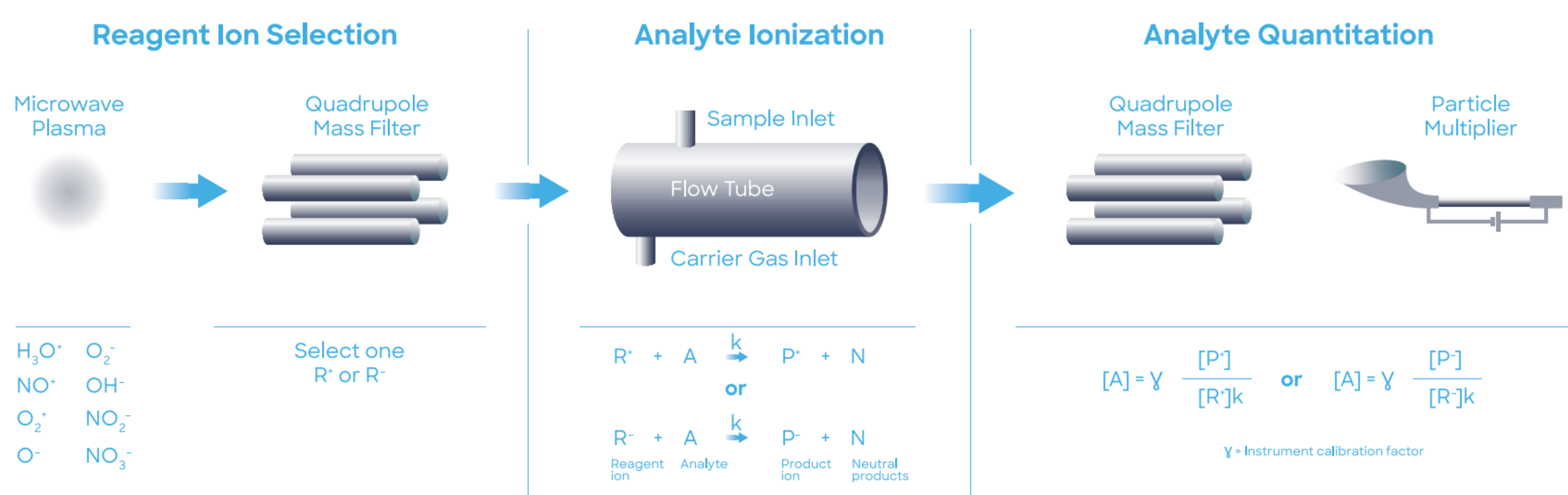
Agri-food Science Department

Plastic freezer bags are widely used to store and preserve food. Our study focuses on the analysis of emissions of Volatile Organic Compounds (VOCs). VOCs are organic compounds that can easily be found in gaseous form. They can therefore have a direct or indirect impact on our environment and our health.

1. Material and Methods

6 commercial zippered food bags were tested in this study. Each zippered bag was stored in an airtight Tupperware and the SIFT-MS spectrum was collected in the headspace of the tupperware after 1, 33, 103 and 132 days.

Schematic representation of the SIFT-MS technique



The eight SIFT-MS reagent ions (H₃O⁺, NO⁺, O₂⁺, O⁺, O₂⁻, OH⁻, NO₂⁻, and NO₃⁻) are all formed by microwave discharge through moist or dry air. The reagent ion of choice is then selected using a quadrupole mass filter.

The selected reagent ion is injected into the flow tube and excess energy is removed through collisions with the carrier gas. The sample is then introduced at a known flow rate and the reactive compounds it contains are ionized by the reagent ion to form well characterized product ions.

Product ions and unreacted reagent ions are sampled into a second quadrupole mass spectrometer. Utilizing Syft's compound library, the software instantaneously calculates each analyte's absolute concentration. The next section provides more information on the unique application of chemical ionization in SIFT-MS.



Nonparametric test Kruskal-Wallis + Fisher Least Significant Difference (LSD) Method

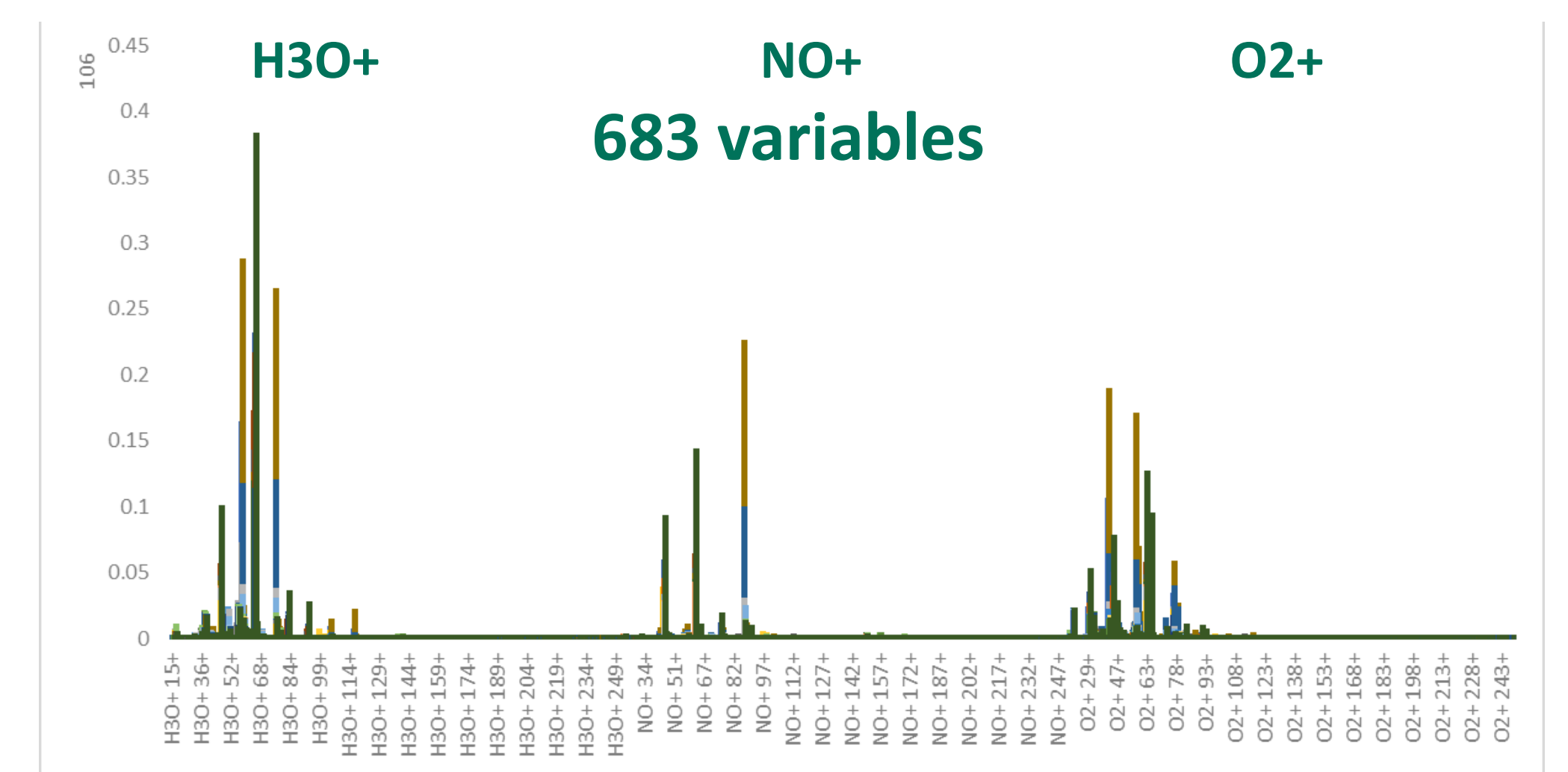
Specific Isotopes for Storage Time					
ziploc	ikea 0.4l	albal zipper	albal ultrazip	ikea 1l	carrefour
H3O+ 143+	H3O+ 149+	H3O+ 120+	H3O+ 102+	H3O+ 146+	NO+ 180+
H3O+ 151+	H3O+ 163+	H3O+ 148+	H3O+ 154+	H3O+ 153+	NO+ 193+
H3O+ 159+	NO+ 90+	H3O+ 166+	H3O+ 166+	H3O+ 158+	NO+ 199+
H3O+ 211+	O2+ 117+	H3O+ 49+	H3O+ 233+	H3O+ 186+	O2+ 132+
H3O+ 223+	O2+ 142+	H3O+ 76+	NO+ 177+	NO+ 137+	O2+ 169+
NO+ 29+	O2+ 147+	NO+ 135+	NO+ 18+	NO+ 33+	O2+ 76+
NO+ 31+	O2+ 177+	NO+ 154+	NO+ 193+	NO+ 39+	
NO+ 42+	O2+ 192+	NO+ 175+	NO+ 210+	O2+ 221+	
NO+ 51+	O2+ 197+	NO+ 52+	NO+ 244+	O2+ 237+	
O2+ 108+	O2+ 204+	O2+ 119+	O2+ 106+		
O2+ 148+	O2+ 208+	O2+ 175+	O2+ 70+		
O2+ 182+	O2+ 223+	O2+ 191+			
O2+ 210+					
O2+ 52+					
O2+ 82+					
	+	+++	+	+	+++
					0

2. Results and discussion

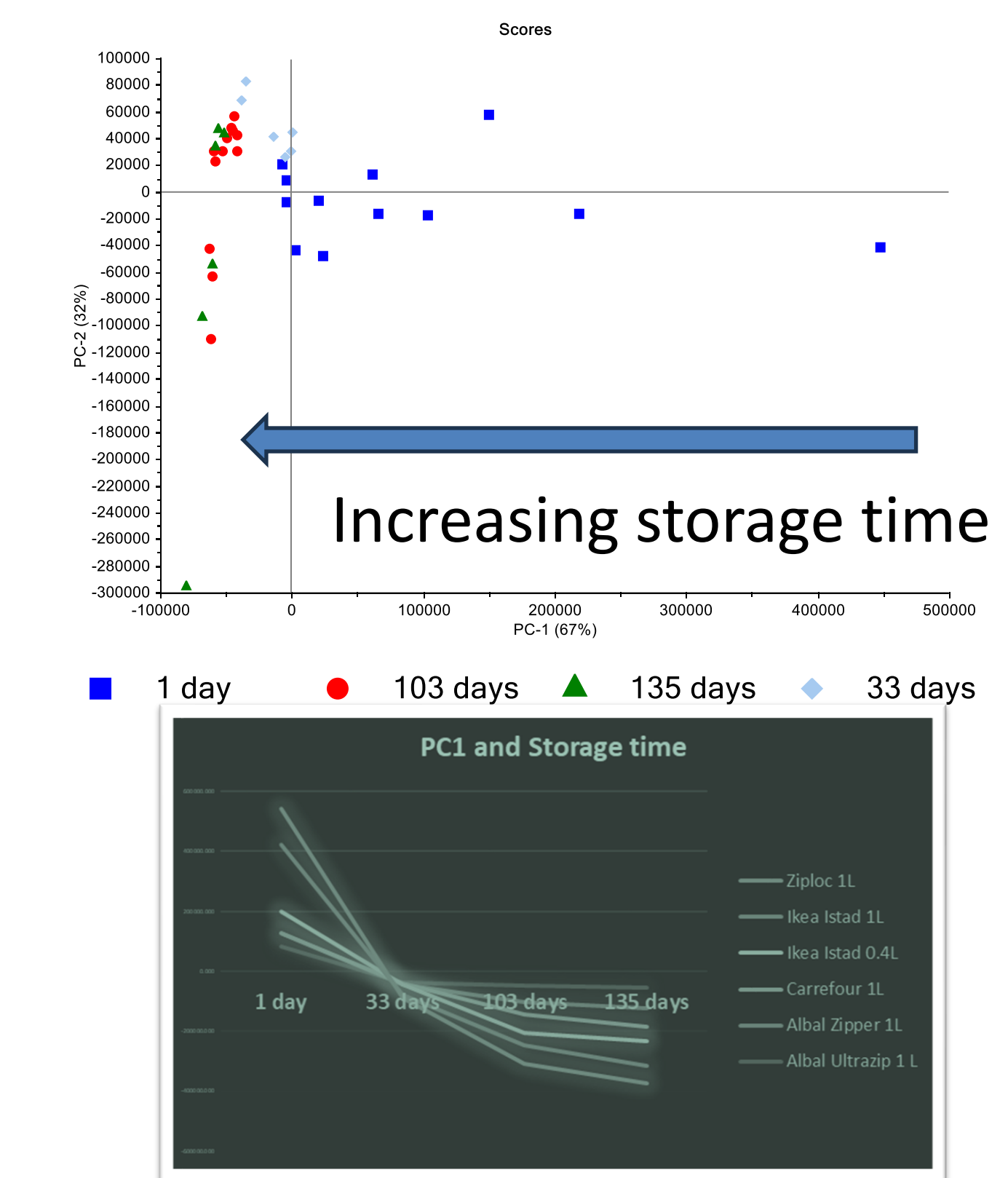
Cluster and precursor ions must be cleaned.

- Albal Zipper 1L
- Albal Ultrazip 1L
- Carrefour 1L
- Ikea Istad 1L
- Ikea Istad 0.4L
- Ziploc 1L

2. Results and discussion



Principal Component Analysis



The 6 freezer bags do not emit the same VOCs after 1 day's storage. This could be due to several factors, including the materials used to manufacture the bags, storage conditions, production processes, and so on. The bag with the lowest VOC emissions is the Carrefour bag. Overall, VOC emissions decrease over time.

Indication of identified VOCs in Syft library : from 0 to 31 analytes



3. Conclusion

Various VOCs have been released from freezer bags at varying levels. VOCs are volatile organic chemical compounds that can originate from a variety of sources, including the bag-making materials themselves or the environments where the bags are stored or used. Some VOCs may have known uses, such as formaldehyde. Once the VOCs have been identified by GC-MS, it will be necessary to check whether they pose a safety or quality problem (for example, whether they are toxic, allergenic, or affect the quality of the food stored in the bags). In any case, this feasibility study shows that the use of SIFT-MS is promising for the analysis of zippered freezer bags.



Sciences du vivant | Agriculture
Agroalimentaire | Marketing | Management

Projet cofinancé par le Fonds Européen de Développement Régional

Cabanes et al. A review on VOCs from recycled plastics. Sustainable materials and technologies 2020, 25, e00179.

Torri et al. Sensory methods and electronic nose as innovative tools for the evaluation of the aroma transfer properties of food plastic bags. Food Res. Int. 2016, 85, 235-243.