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Université de Liège

ML Fauconnier
Ecole des mines d'Alès
05/11/2018

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La faculté de Gembloux Agro-Bio Tech

Quatre masters bioingénieur

- les sciences et technologies de l'environnement
- la gestion des forêts et des espaces naturels
- les sciences agronomiques
- la chimie et les bioindustries

- 1000 étudiants de 40 nationalités dont 40 % de filles

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Unités de recherche

TERRA

11 axes de recherche
7 plateaux techniques
320 doctorants

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Laboratoire de Chimie des Molécules Naturelles

Les métabolites secondaires de plantes: extraction , purification et valorisation dans le secteur agronomique et agro-alimentaire

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Laboratoire de Chimie des Molécules Naturelles

Prof. ML Fauconnier

4 post-docs
20 doctorants
4 techniciens

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Laboratoire de Chimie des Molécules Naturelles

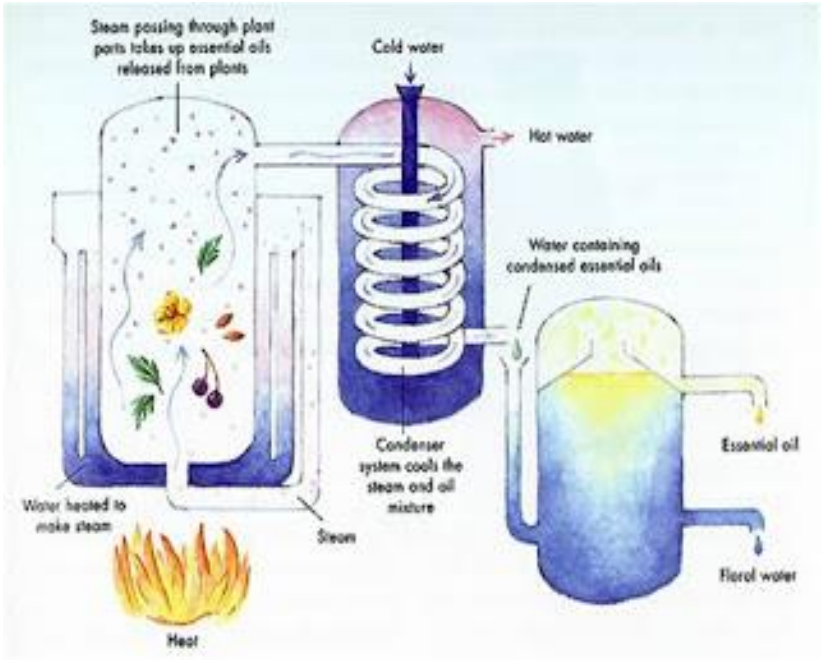
Huiles essentielles

La volatolomique – autres COVs

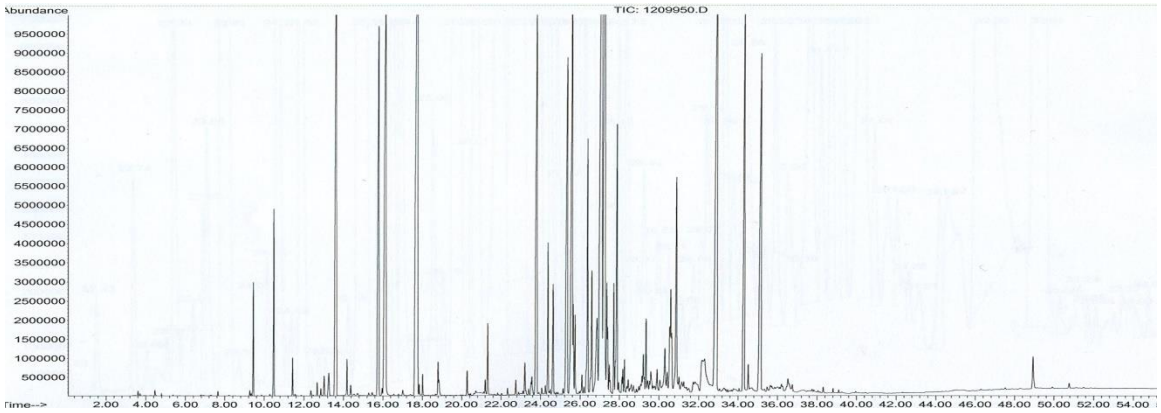
Oxylipines

Autres métabolites secondaires

Huiles essentielles



The process of steam distillation as it is practiced today

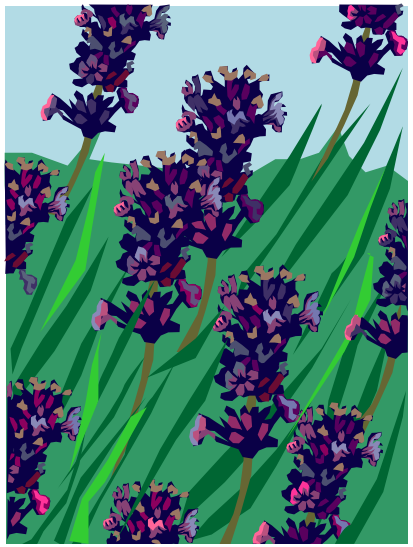


Huiles essentielles

Nombreuses applications mais

➔ grande variabilité

- Chémotypes
- Organe
- Etat physiologique
- Climat, sol
- Pratiques culturales
- Extraction
- Conservation



➔Approvisionnement / disponibilité

➔Prix

Projets huiles essentielles

Oilprotect Project
EOs for Protection of cereals against insects
Tierry Kenne and Saskia Sergeant
Coll. UCL- private companies

Ecoextraction of Apiaceae seed EOs
Iness Bettaieb post-doc
Coll. Center of Biotechnology of Borj Cedria (Tunisia)

Tree Injection Project
EOs for Protection of trees against insects
Pierre-Yves Werrie Ph D student
Coll. UCL- private companies

HERBIOIL project
Eos as herbicides study of the action mechanisms
LBMI + CGO

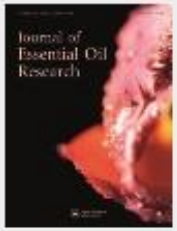
EOs production in Senegal
Two senegale Ph D students
Founded by WBI

EOHUB project
Erasmus + Knowledge alliance
Coll. different countries

EOs slow release for biopesticide develop.
Use of new polymers for encapsulation
Chloé Maes Ph D student
Coll. Reims University

Collaboration with different universities in Morocco, Tunisia, Algeria, …

Projets huiles essentielles



Journal

Journal of Essential Oil Research ›

Volume 30, 2018 - Issue 2

Characterization of essential oils and hydrosols from senegalese *Eucalyptus camaldulensis* Dehnh

El Hadji Barka Ndiaye ✉, Michel Bakar Diop, Momar Talla Gueye, Ibrahima Ndiaye, Serigne Mbacké Diop, Marie-Laure Fauconnier & ...Show all

Pages 131-141 | Received 02 Jan 2017, Accepted 14 Dec 2017, Published online: 04 Jan 2018

Download citation https://doi.org/10.1080/10412905.2017.1420554 Check for updates

Published in: Flavour and Fragrance Journal (2012), vol. 27, pp. 356-366.
Status : Postprint (Author's version)

Variations in the essential oils from ylang-ylang (*Cananga odorata* [Lam.] Hook f. & Thomson forma *genuina*) in the Western Indian Ocean islands

Céline Benini,[a] Mélanie Ringuet,[a] Jean-Paul Wathelet,[b] Georges Lognay,[c] Patrick du Jardin[a] and Marie-Laure Fauconnier[a]

[a] *Plant Biology Unit, Gembloux Agro-Bio Tech, University of Liège, Passage des Déportés, 2 5030 Gembloux, Belgium*

[b] *General and Organic Chemistry Unit, Gembloux Agro-Bio Tech, University of Liège, Passage des Déportés, 2 5030 Gembloux, Belgium*

[c] *Analytical Chemistry Unit, Gembloux Agro-Bio Tech, University of Liège, Passage des Déportés, 2 5030 Gembloux, Belgium*

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Huiles essentielles

La volatolomique – autres COVs

Oxylipines

Autres métabolites secondaires

La volatolomique – autres COVs

Volatolomics is a branch of chemistry that studies volatile organic compounds (VOCs) emitted by a biological system, under specific experimental conditions (*Wikipedia*).

- Les outils pour la volatolomique
  - Echantillonnage des COVs
  - Séparation COVs
  - Identification des COVs
  - Quantification des COVs

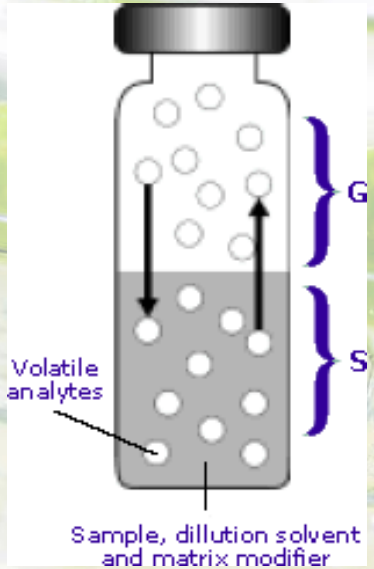
La volatolomique – autres COVs

Echantillonnage

- *Static « Headspace »*
- *Dynamic « Headspace »*
- *Stir Bar Sorptive Extraction*
- *Solid Phase MicroExtraction*
- *Extraction liquide-liquide*
- *Extraction Likens-Nickerson*
- *Extraction Soxhlet*
- *SAFE (Solvent Assisted Flavor Extraction)*

Technique d'échantillonnage

Static « Headspace »



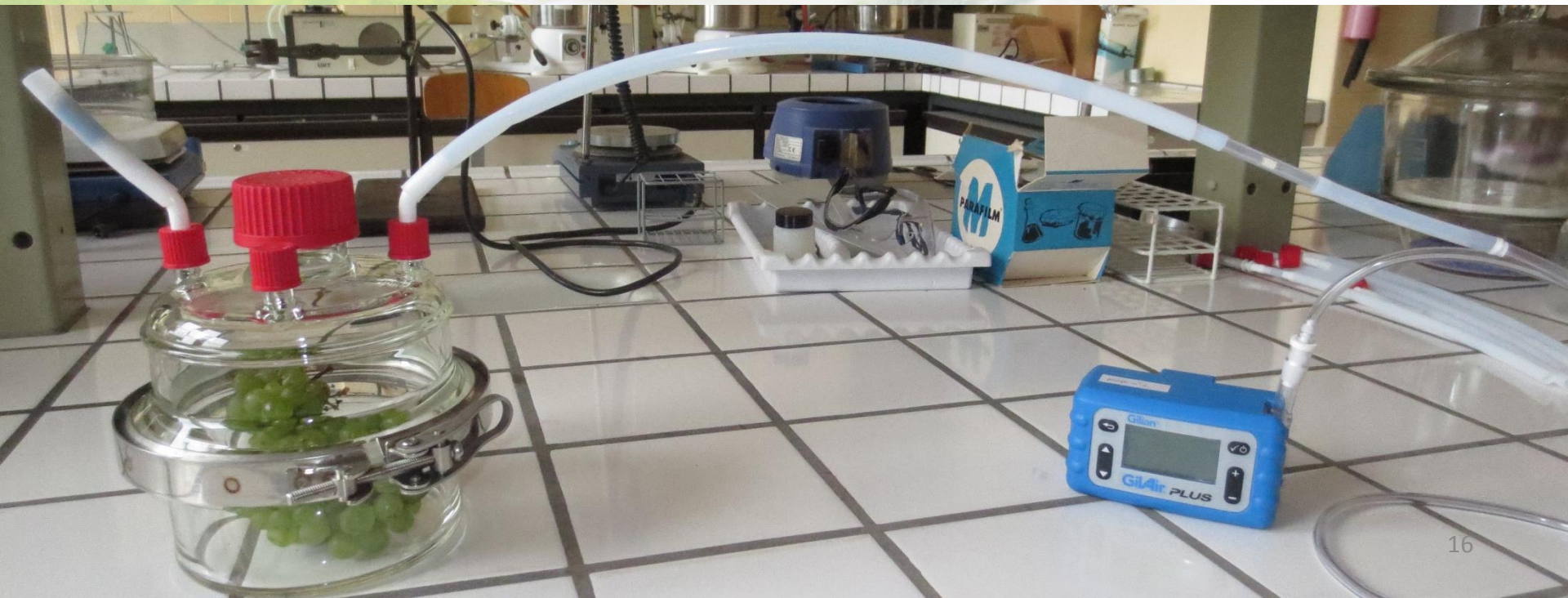
Ref: http://www.labhut.com

Equilibre thermodynamique des COVs entre la phase gazeuse et l'échantillon

- Température
- Matrice
- Addition de sels
- Agitation

Technique « *Headspace* »

Dynamic « Headspace »



Technique d'échantillonnage

Dynamic « Headspace »

Le choix de l'adsorbant est très important

- Nature de l'analyte
- Environement (interferences)
- Methode de désorption
  - Solvant
  - Thermodésorption

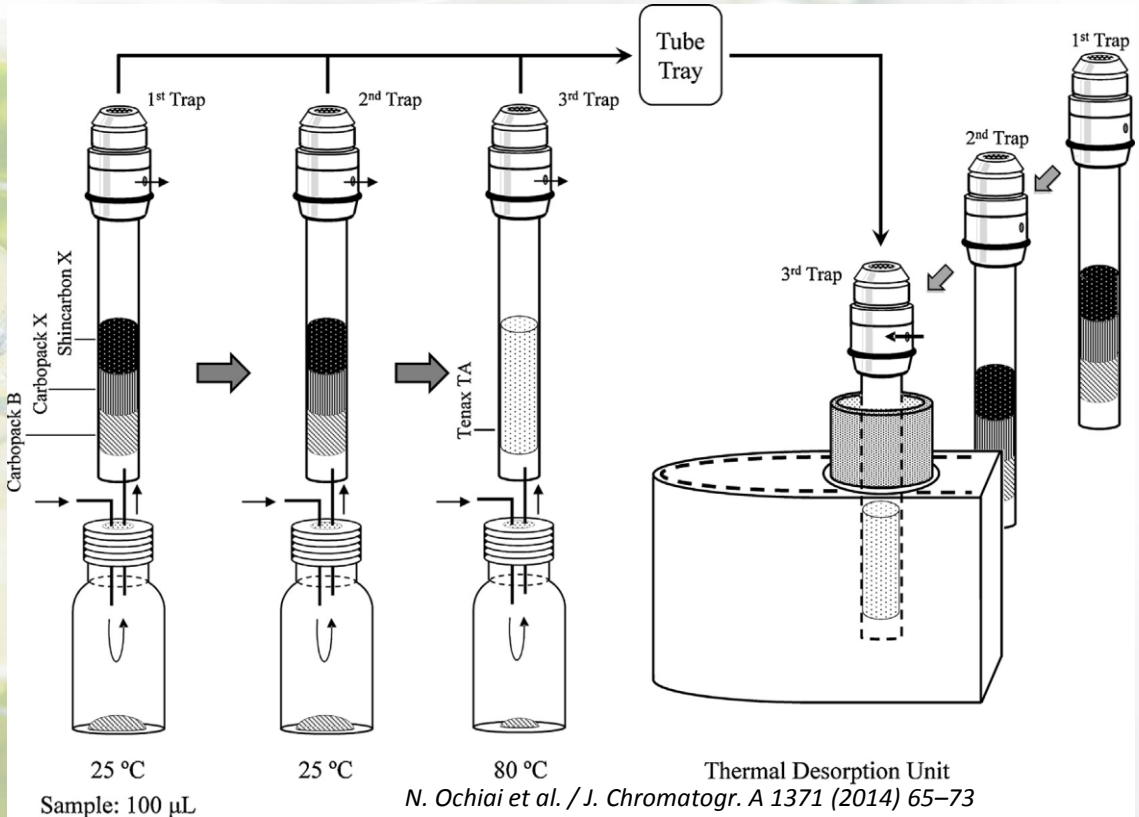
Source: Markes

Technique d'échantillonnage

Dynamic « Headspace »

Multi-Volatile Method

Echantillonnage par Dynamic headspace séquentielle

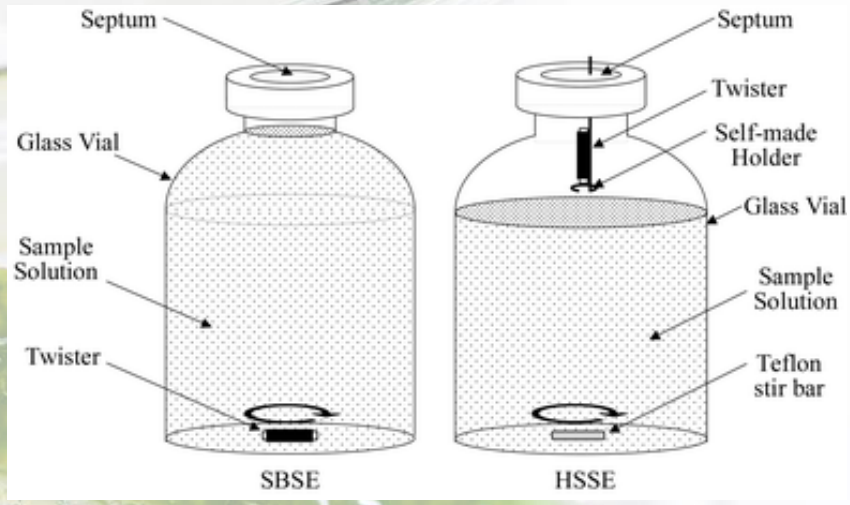


N. Ochiai et al. / J. Chromatogr. A 1371 (2014) 65–73

Technique d'échantillonnage

Stir Bar Sorptive Extraction

Headspace Sorptive Extraction



Ochiai et al., Analyst, 2001, 126, 1652–1657

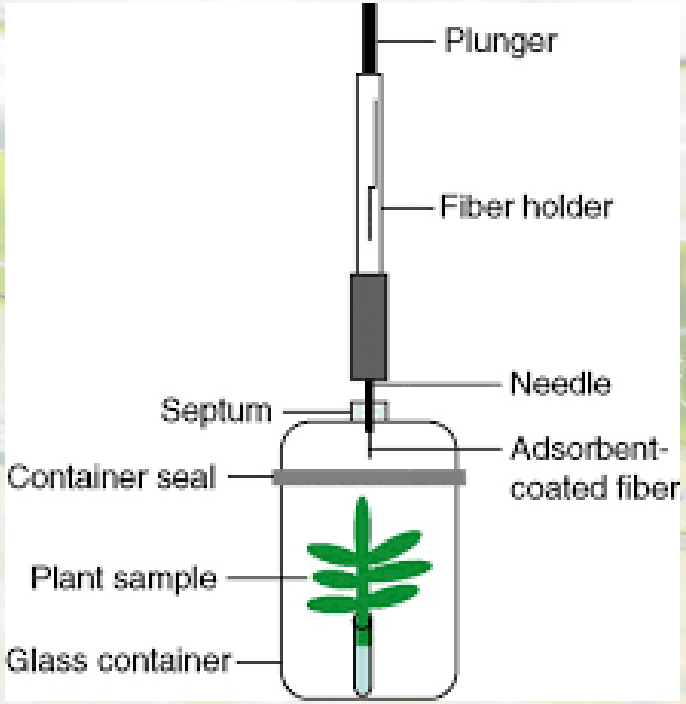
Coéfficient de partition

Conditions d'agitation

Temps d'équilibre

Technique d’échantillonnage

Solid Phase MicroExtraction



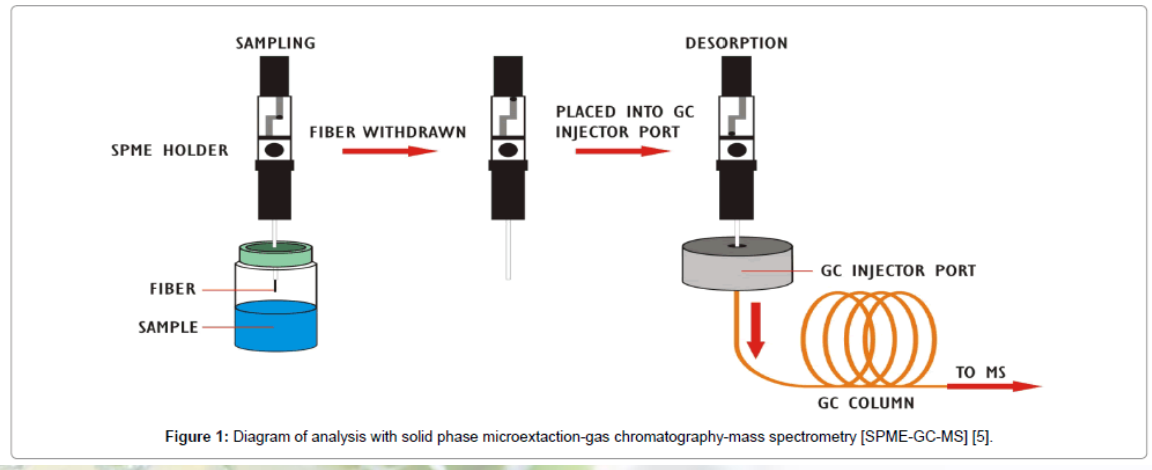
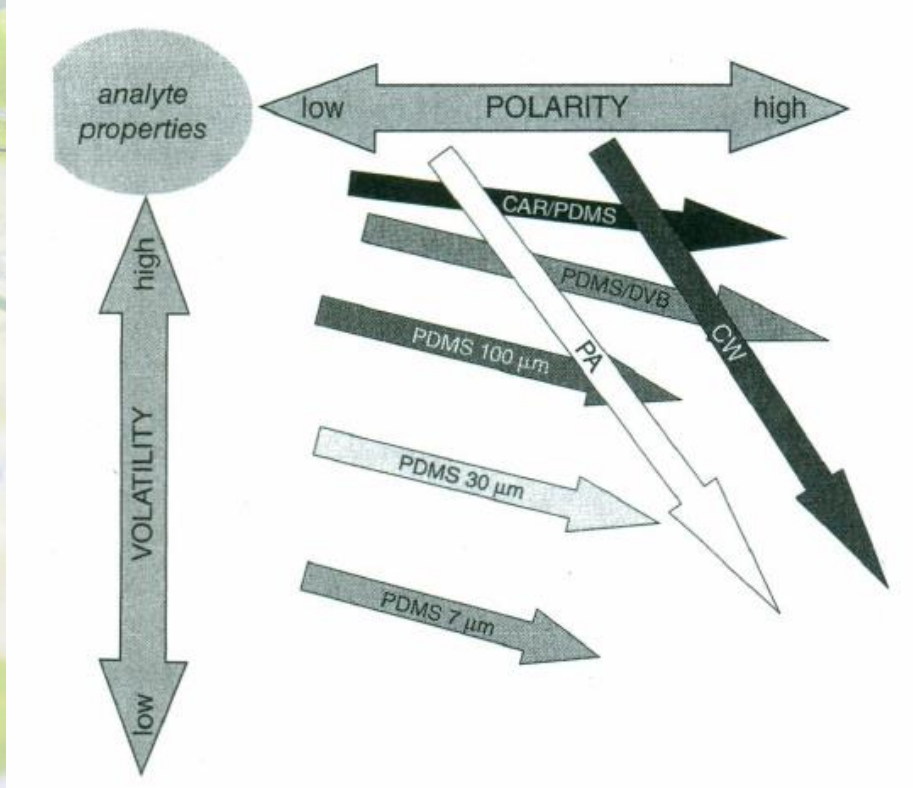


Figure 1: Diagram of analysis with solid phase microextaction-gas chromatography-mass spectrometry [SPME-GC-MS] [5].

Technique d'échantillonnage

Solid Phase MicroExtraction

Fiber choice



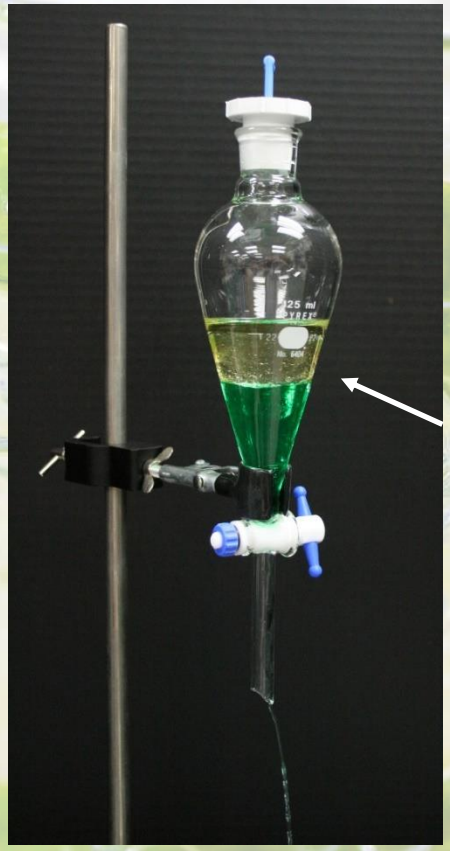
Fiber Selection - Types of SPME Fibers

7µm Polydimethylsiloxane (PDMS)	Absorbent	Nonpolar
30µm PDMS	Absorbent	Nonpolar
100µm PDMS	Absorbent	Nonpolar
85µm Polyacrylate (PA)	Absorbent	Polar
65µm PDMS-DVB, StableFlex™	Adsorbent	Bipolar
65µm CW-DVB, StableFlex	Adsorbent	Polar
85µm Carboxen-PDMS, StableFlex	Adsorbent	Bipolar
55µm/30µm DVB/Carboxen™-PDMS, StableFlex	Adsorbent	Bipolar

SUPELCO

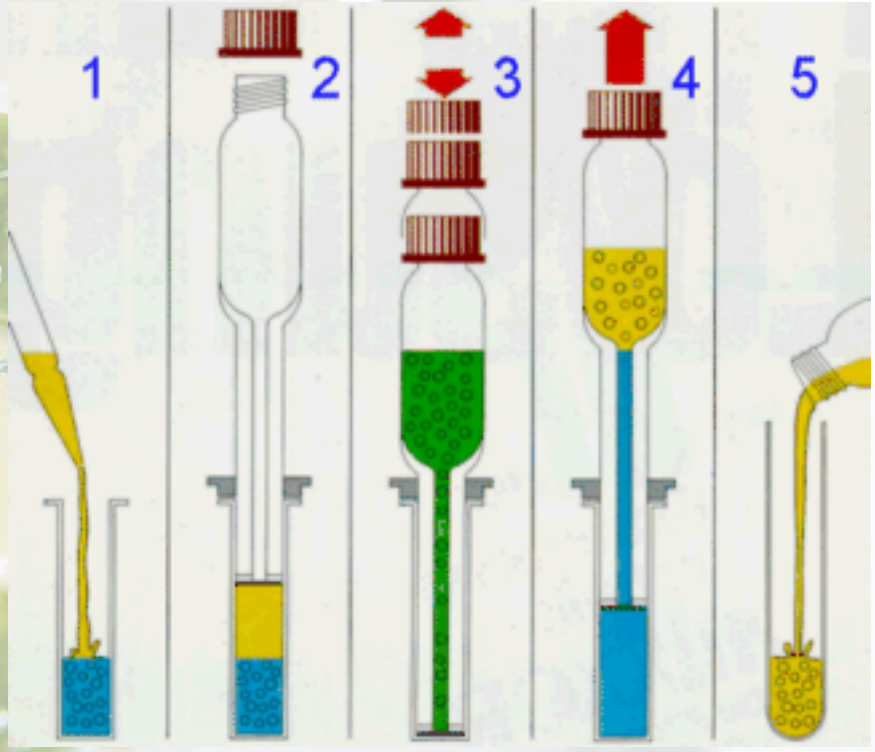
Technique d’échantillonnage

Extraction liquide-liquide



Micro-extraction liquid-liquid system

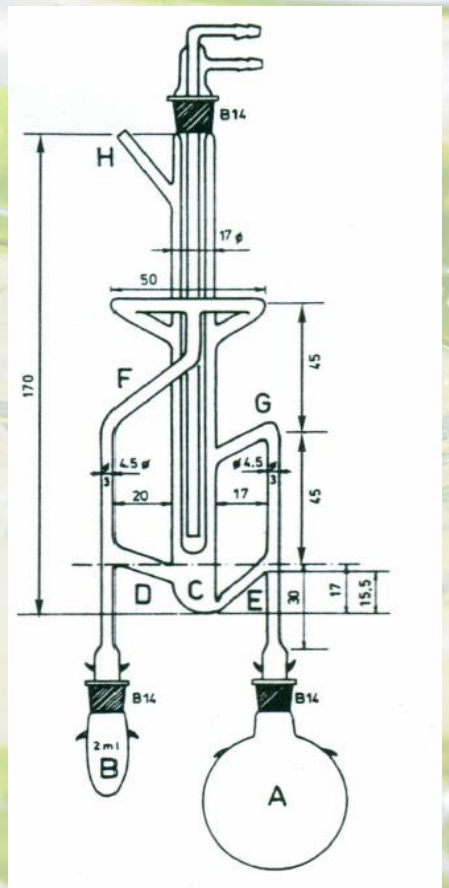
MIXXOR (NBS Systems)

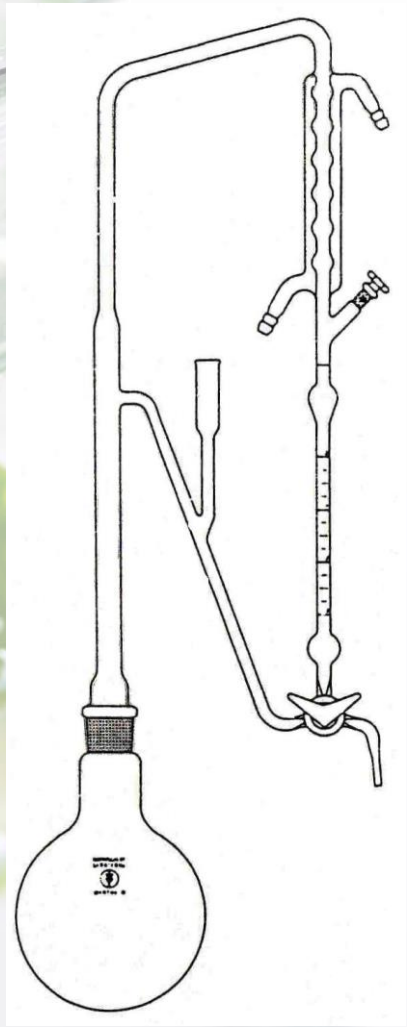


Technique d’échantillonnage

Extraction Likens-Nickerson

Hydrodistillation and iquid-liquid extraction



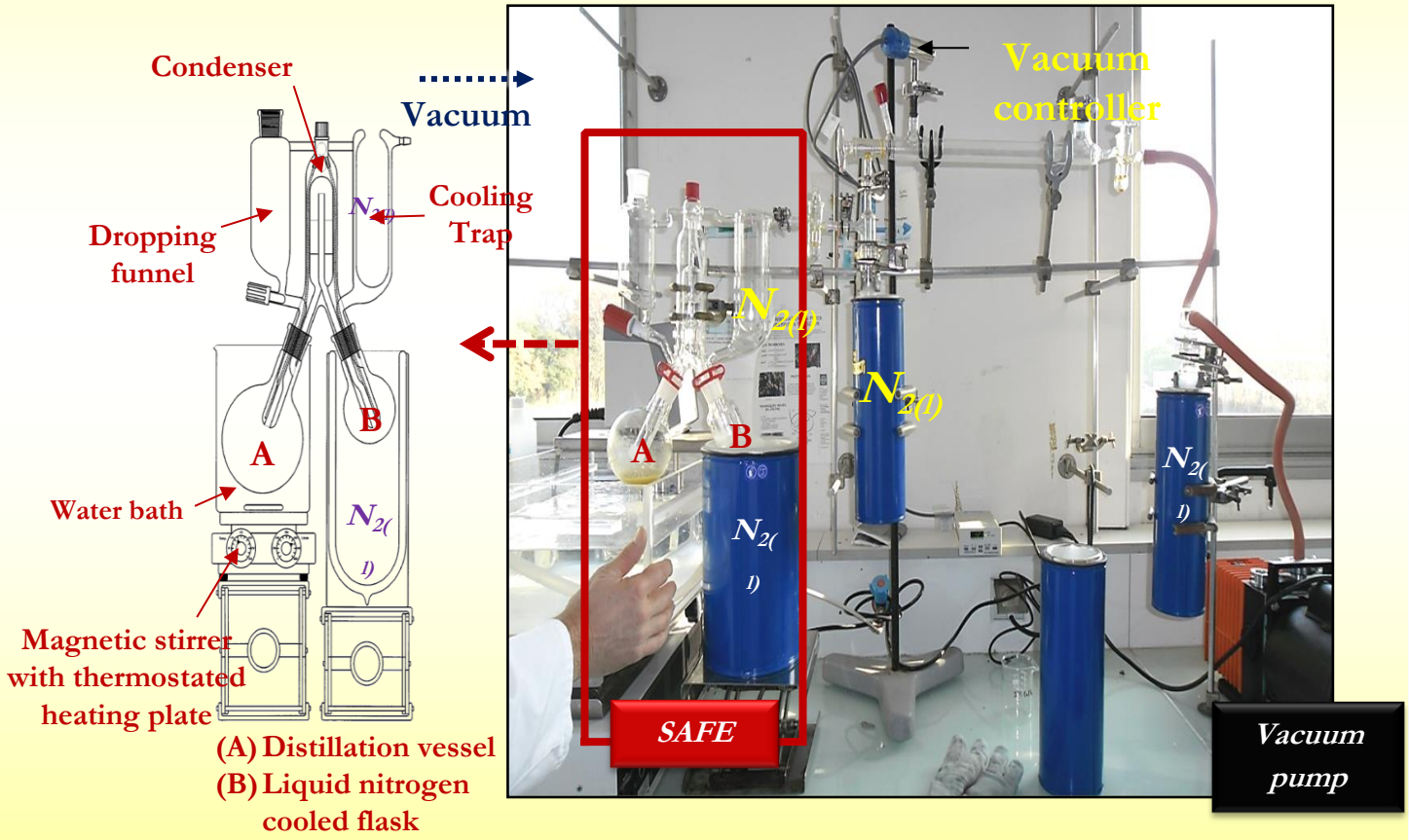


Clevenger

Technique d'échantillonnage

SAFE (*solvent assisted flavour evaporation*)

- The distillation unit SAFE, Engel et al. (1999)

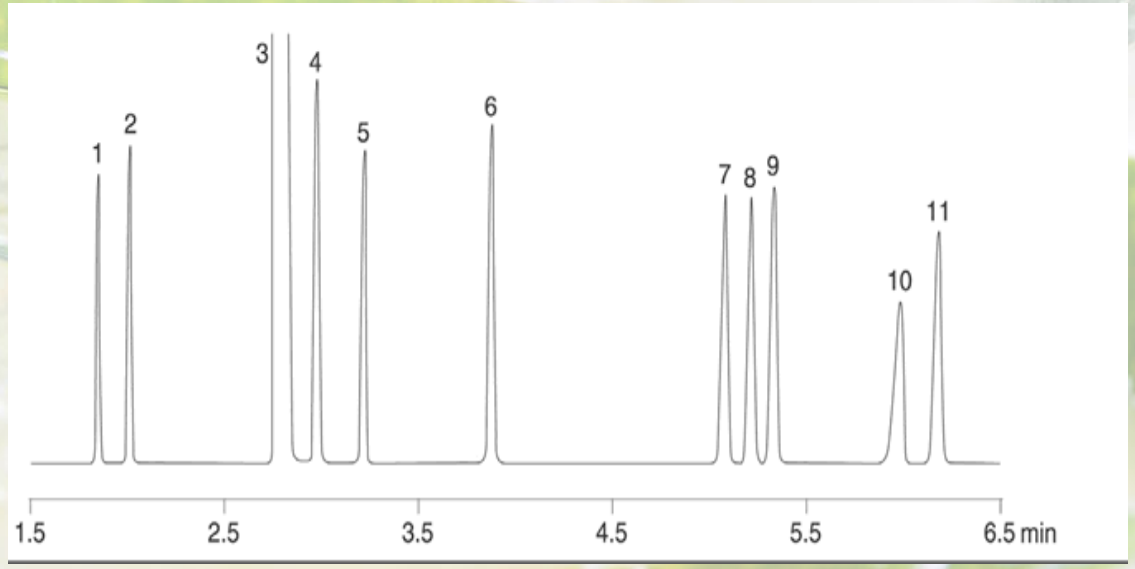


Engel et al. (**1999**). Solvent assisted flavour evaporation - a new and versatile technique for the careful and direct isolation of aroma compounds from complex food matrices, *European Food Research and Technology*

Séparation des COVs

Chromatographie en phase gazeuse

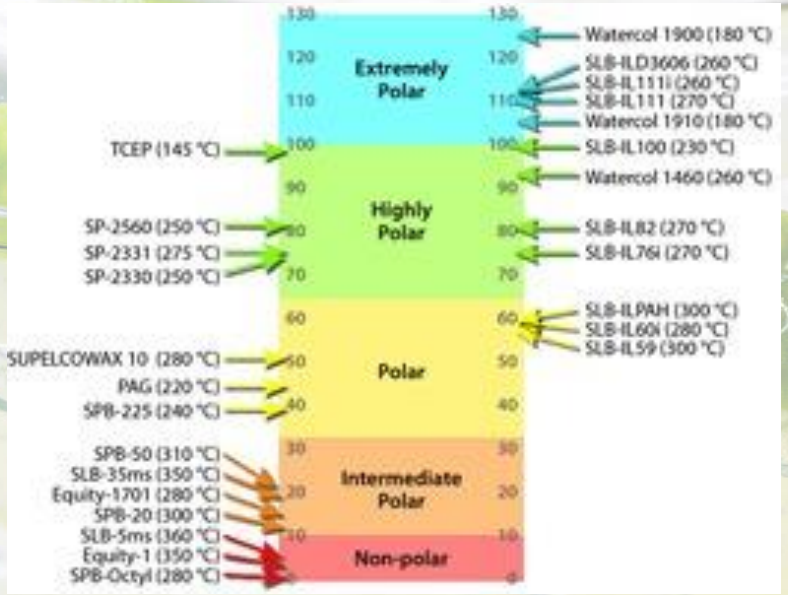
Chromatogramme

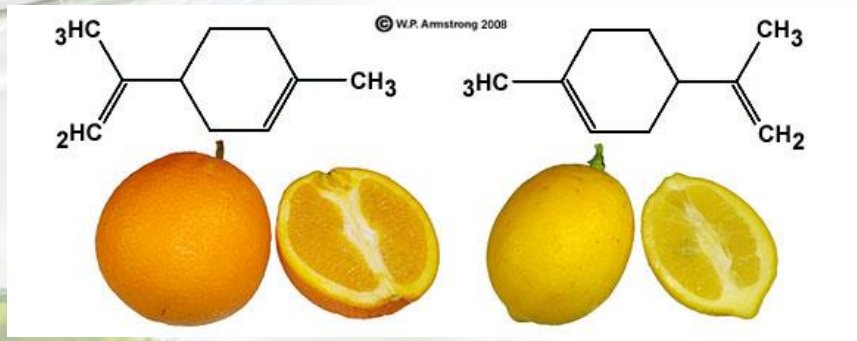


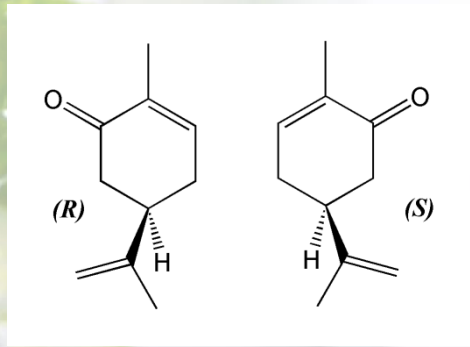
- Mode d'injection
- Choix de la colonne (phase, longueur, …)
- Température (programme)

Séparation des COVs

Chromatographie en phase gazeuse

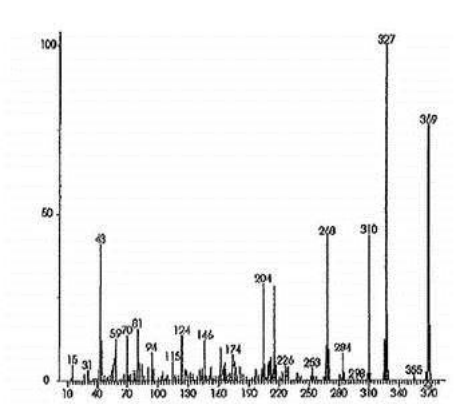


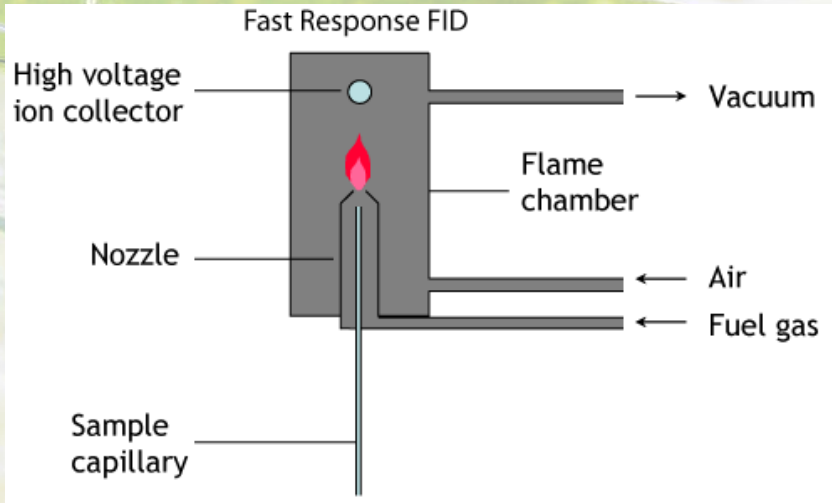




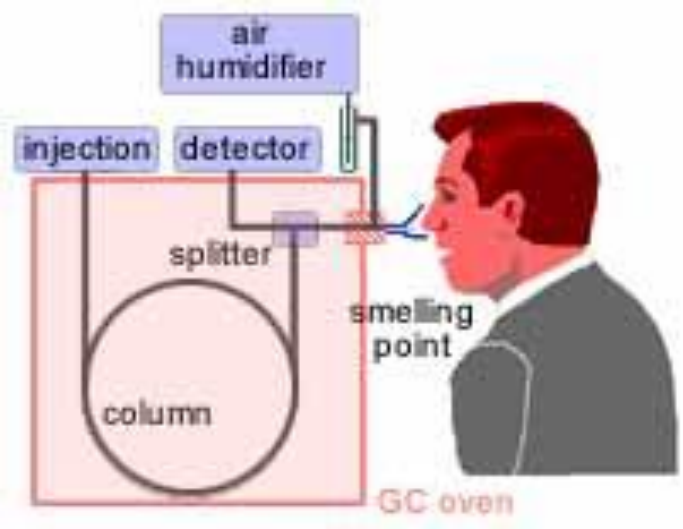
Choix de la colonne

Identification des COVs



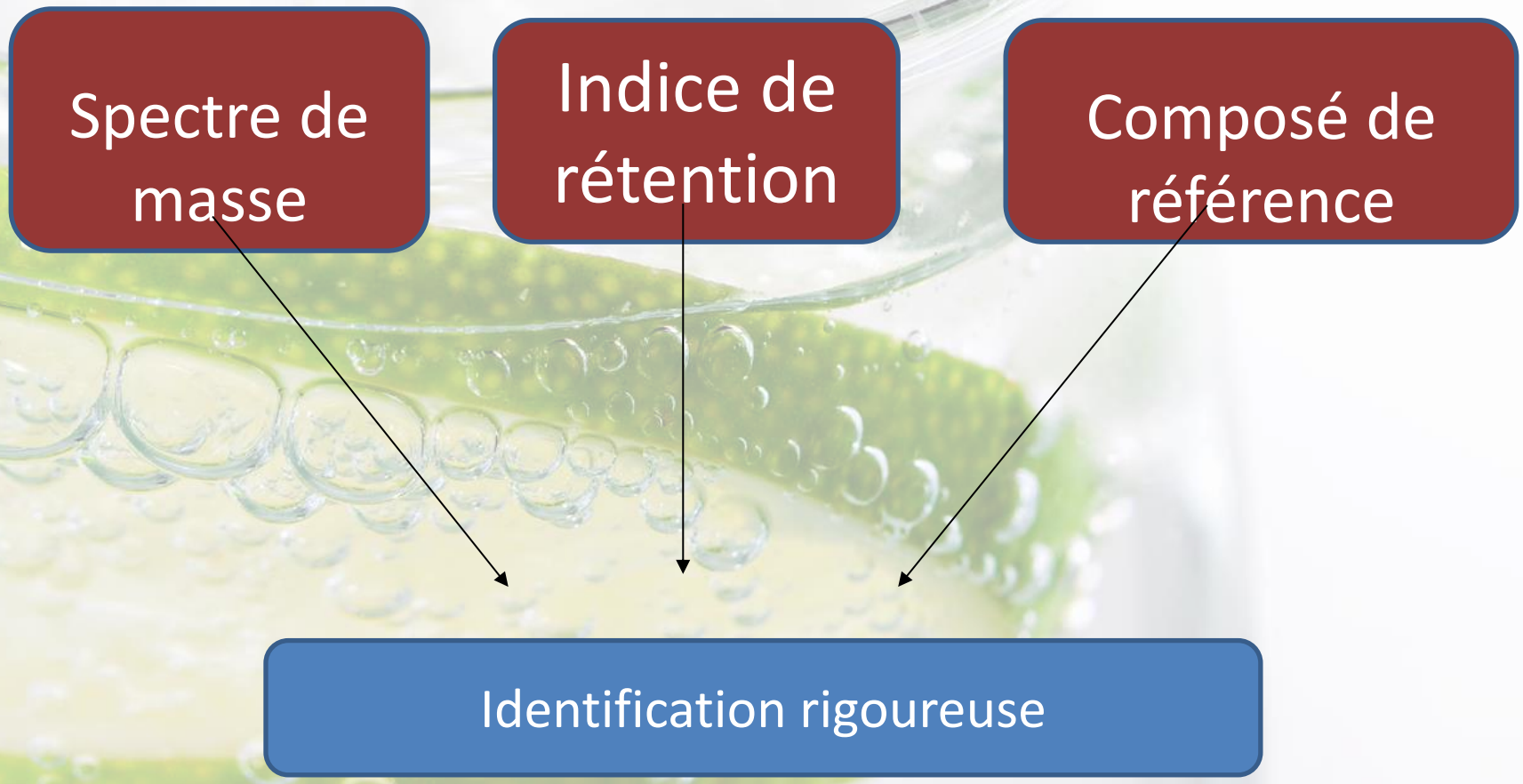


FID

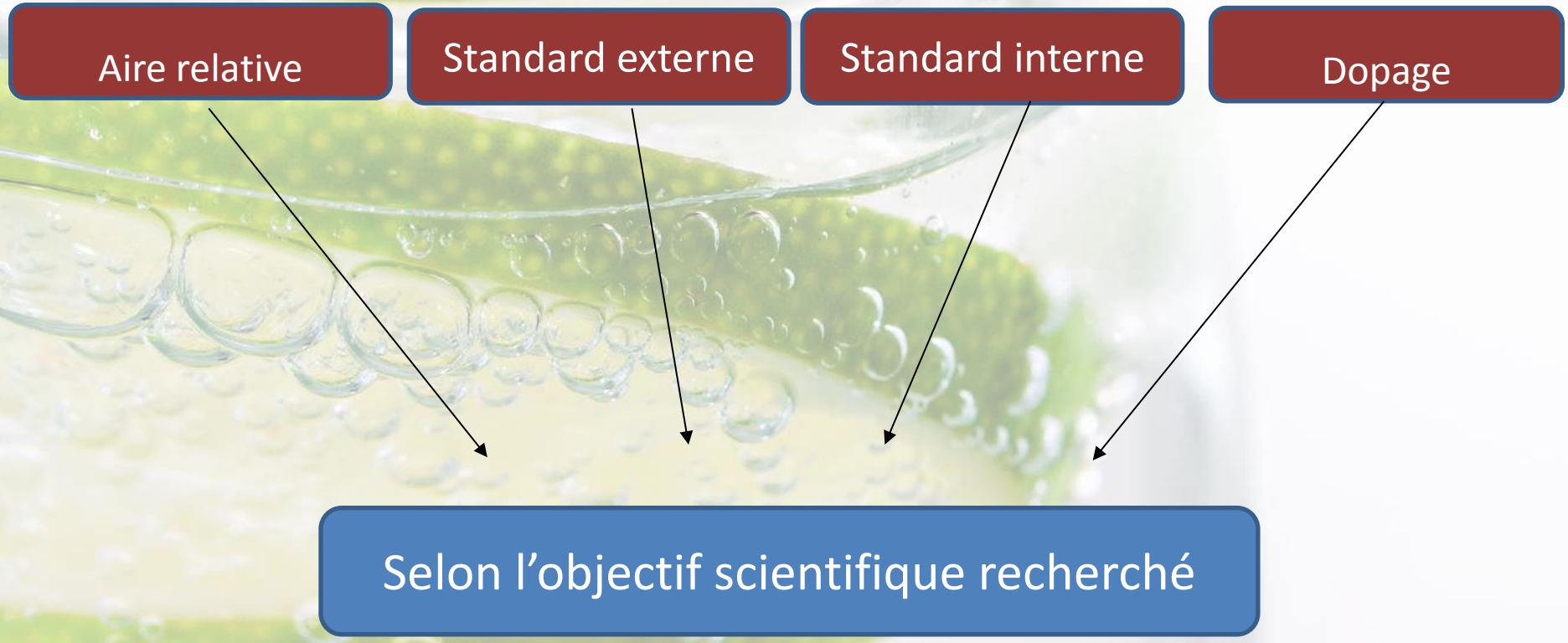


Olfactomètre

Identification des COVs



Quantification des COVs



La volatolomique – autres COVs

VOCs as markers for mycotoxin contamination (Agrosensor project)
Develop. of molecular inprinted polymer sensors
Laurie Josselin PhD student- Guo Xiaodong PhD student CAAS
Coll. Umons-Materia Nova- U Gent- private companies

VOCS as marker of abiotic plant stress (Solindic project)
Bastien Durenne Ph D student
Coll. CRAW

Vocaction project
VOCs as antifungal angents in plant protection
Caroline Declercq post-doc
Founded by FNRS leader: phytopathology lab

VOCs and food process
- Marinated pork Han Dong PhD student CAAS
- Peanut oil LT Hu Hui PhD student CAAS
- Fruits/vegetables Wu Xinye PhD student CAAS

Flavor profiling , aroma formulation
collaboration with different companies (Firmenich, Orval, …)
VOCS in traditional fermented products
VOCs in biological communications
Plant-plant, Plant-insect , plant-fungi
Different coll. inside and outside ULg

Applications : écologie chimique

Plant Physiology and Biochemistry
Volume 104, July 2016, Pages 134-145
Research article

Barley (*Hordeum distichon* L.) roots synthesise volatile aldehydes with a strong age-dependent pattern and release (*E*) -non-2-enal and (*E*,*Z*)-nona-2,6-dienal after mechanical injury

Benjamin M. Delory [a, 1], Pierre Delaplace [a], Patrick du Jardin [a], Marie-Laure Fauconnier [b, c]

Show more

https://doi.org/10.1016/j.plaphy.2016.03.028

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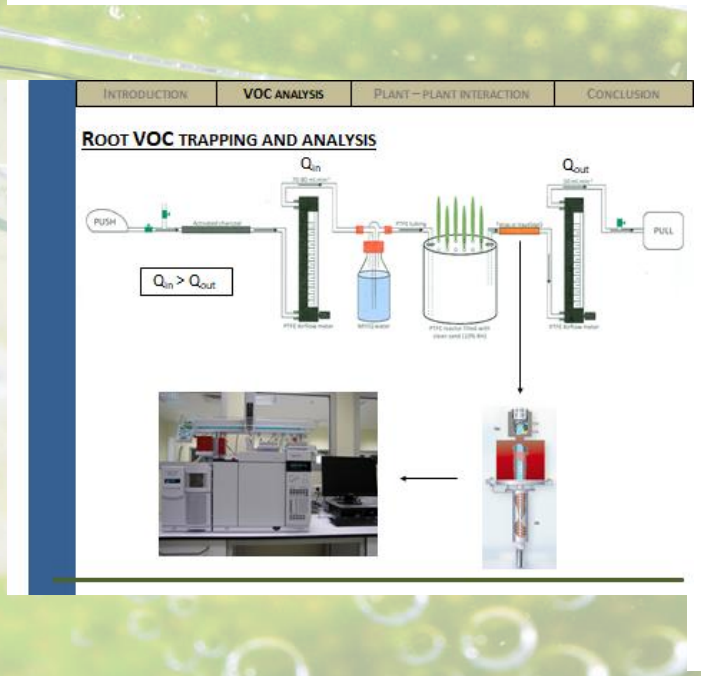
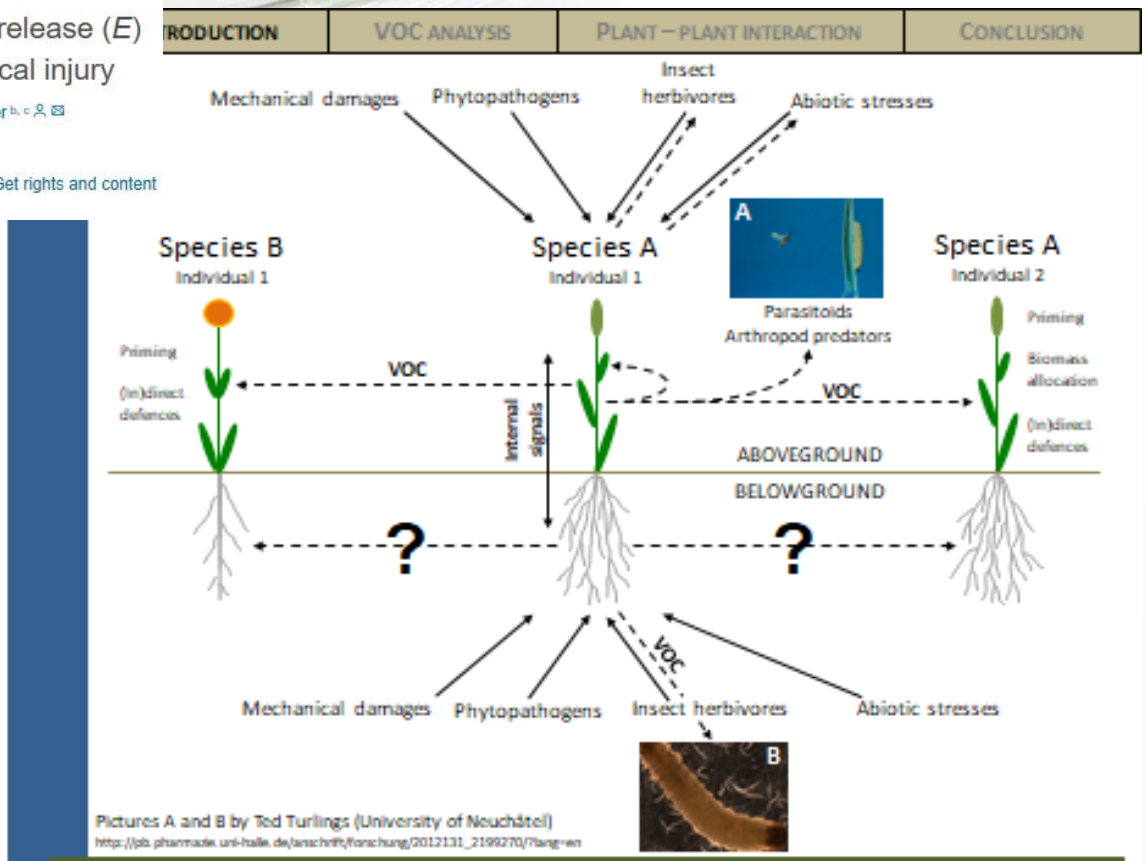




Applications : écologie chimique

Journal of Experimental Botany Advance Access published February 16, 2009

Journal of Experimental Botany, Page 1 of 10
doi:10.1093/jxb/erp015
This paper is available online free of all access charges (see http://jxb.oxfordjournals.org/open_access.html for further details)

Journal of Experimental Botany
www.jxb.oxfordjournals.org

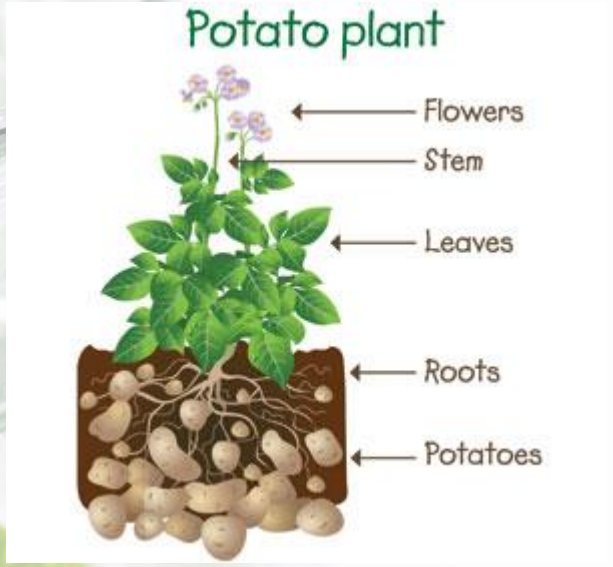
RESEARCH PAPER

Attacks by a piercing-sucking insect (*Myzus persicae* Sultzer) or a chewing insect (*Leptinotarsa decemlineata* Say) on potato plants (*Solanum tuberosum* L.) induce differential changes in volatile compound release and oxylipin synthesis

Virginie Gosset[1], Nicolas Harmel[2], Cornelia Göbel[3], Frédéric Francis[2], Eric Haubruge[2], Jean-Paul Wathelet[4], Patrick du Jardin[1], Ivo Feussner[3] and Marie-Laure Fauconnier[1,*]

[1] Plant Biology Unit, Gembloux Agricultural University, Passage des déportés 2, B-5030 Gembloux, Belgium
[2] Functional and Evolutionary Entomology Unit, Gembloux Agricultural University, Passage des déportés 2, B-5030 Gembloux, Belgium
[3] Department of Plant Biochemistry, Albrecht-von-Haller Institute of Plant Sciences, Georg-August-University Göttingen, Justus-von-Liebig-Weg 11, D-37077 Göttingen, Germany
[4] General and Organic Chemistry Unit, Gembloux Agricultural University, Passage des déportés 2, B-5030 Gembloux, Belgium

Received 29 October 2008; Revised 12 December 2008; Accepted 22 December 2008



Applications : écologie chimique

Chemoecology
December 2014, Volume 24, Issue 6, pp 243–251 | Cite as

Identification of 1-methyloctyl butanoate as the major sex pheromone component from females of the saddle gall midge, *Haplodiplosis marginata* (Diptera: Cecidomyiidae)

Authors Authors and affiliations

Florence Censier, Christophe Y. Fischer, Sandrine Chavalle, Stephanie Heuskin, Marie-Laure Fauconnier, Bernard Bodson, Michel De Proft, Georges C. Lognay, Pascal Laurent

J Chem Ecol (2013) 39:1129–1139
DOI 10.1007/s10886-013-0302-3

Characterization of Volatile Organic Compounds Emitted by Barley (*Hordeum vulgare* L.) Roots and Their Attractiveness to Wireworms

Aurélie Gfeller · Morgan Laloux · Fanny Barsics · Djamel Edine Kati · Eric Haubruge · Patrick du Jardin · François J. Verheggen · Georges Lognay · Jean-Paul Wathelet · Marie-Laure Fauconnier

Applications : écologie chimique

Phytochemical Analysis

RESEARCH ARTICLE | Open Access

A laboratory high-throughput glass chamber using dynamic headspace TD-GC/MS method for the analysis of whole *Brassica napus* L. plantlet volatiles under cadmium-related abiotic stress

Bastien Durenne, Alodie Blondel, Philippe Druart, Marie-Laure Fauconnier

First published: 20 February 2018 | https://doi.org/10.1002/pca.2750

High throughput technique

Sterile conditions

Applications : écologie chimique

SCIENTIFIC REPORTS

OPEN

First Characterisation of Volatile Organic Compounds Emitted by Banana Plants

Received: 25 August 2016
Accepted: 17 March 2017
Published: 16 May 2017

Chadi Berhal[1,*], Caroline De Clerck[1,*], Marie-Laure Fauconnier[2], Carolina Levicek[1], Antoine Boullis[3], Amine Kaddes[1], Haïssam M. Jijakli[1], François Verheggen[3] & Sébastien Massart[1]

Applications: environnement

ELSEVIER

Atmospheric Environment

Volume 176, March 2018, Pages 71-81

Biogenic volatile organic compound emissions from senescent maize leaves and a comparison with other leaf developmental stages

A. Mozaffar [a, b], N. Schoon [b], A. Bachy [a], A. Digrado [c], B. Heinesch [a], M. Aubinet [a], M.-L. Fauconnier [a], P. Delaplace [c], P. du Jardin [c], C. Amelynck [b, d]

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https://doi.org/10.1016/j.atmosenv.2017.12.020

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Echantillonnage en champs
Etudes en serre

Applications:caractérisation de produits alimentaires

OCL
© F. Mansouri *et al.*, published by EDP Sciences, 2017
DOI: 10.1051/ocl/2017012

OCL Oilseeds & fats Crops and Lipids

Available online at:
www.ocl-journal.org

RESEARCH ARTICLE OPEN ACCESS

Flavor profiles of monovarietal virgin olive oils produced in the Oriental region of Morocco

Farid Mansouri[1,*], Abdessamad Ben Moumen[1], Gaetan Richard[2], Marie-Laure Fauconnier[2], Marianne Sindic[3], Hana Serghini Caid[1] and Ahmed Elamrani[1]

[1] Laboratory of Plants & Microorganisms Biology, Faculté des Sciences Oujda – Université Mohammed Premier, BP-717, 60000 Oujda, Morocco
[2] General and Organic Chemistry Unit, Gembloux Agro-BioTech – Université de Liège, Passage des Deportes 2, 5030 Gembloux, Belgium
[3] Laboratory Food Quality and Safety, Analysis Quality and Risk Unit, Gembloux Agro-BioTech – Université de Liège, Passage des Deportes 2, 5030 Gembloux, Belgium

- **Traditional food characterization**
- **Differentiated quality (AOC, IGP, …)**

Advance Journal of Food Science and Technology 14(1): 15-22, 2018
DOI:10.19026/ajfst.14.5421
ISSN: 2042-4868; e-ISSN: 2042-4876

Submitted: August 26, 2017 Accepted: October 6, 2017 Published: January 25, 2018

Research Article

Aromatic Composition of "Sodabi", a Traditional Liquor of Fermented Oil Palm Wine

[1]Péléi Tagba, [2]Elolo Osseyi, [3]Marie-Laure Fauconnier and [1]Courdjo Lamboni
[1]Département de Biochimie/Nutrition, Faculté des Sciences, (FDS), Université de Lomé, Togo
[2]Département des Sciences des Aliments et Technologie Agroalimentaire, Ecole Supérieure des Techniques Biologiques et Alimentaires, (ESTBA-UL), Université de Lomé, Togo
[3]Centre de recherche, Gembloux Agro-Bio Tech/Unité de Chimie Générale et Organique, Université Liège -Gembloux, Belgique

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Agro-Bio Tech

Laboratoire de Chimie des Molécules Naturelles

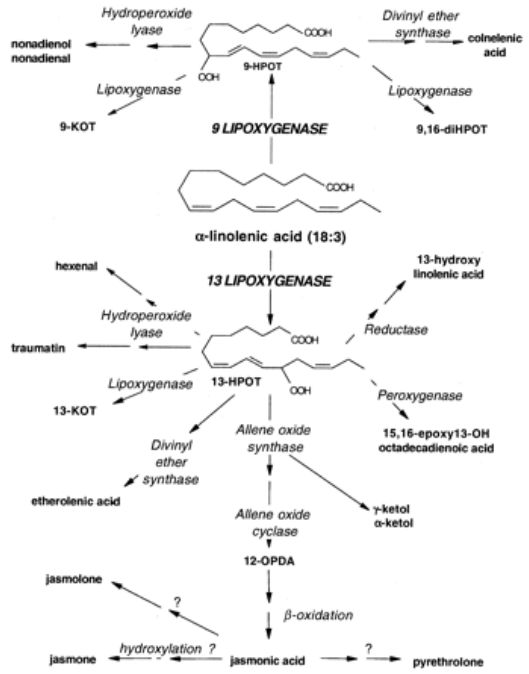
Huiles essentielles

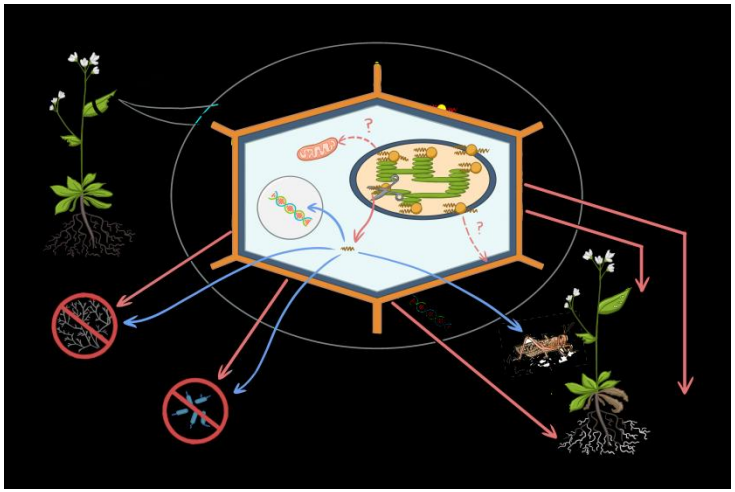
La volatolomique – autres COVs

Oxylipines

Autres métabolites secondaires

3. Oxylipines





Fatty acid hydroperoxides new elicitor/biopesticide

Strucure –function relationship

Estelle Deboever PhD student

Co-promotion LBMI

Esterified oxylipins : roles in plants (arabidopside project)

- Total synthesis (41 steps !)

Firmin Obonou Akong post-doc

Coll. UNamur

- Extraction, dev. Analytical methods, localization, structure-function relationship

Manon Genva PhD student

Co-promotion LBMI

3. Oxylipines

Phytochem Rev
https://doi.org/10.1007/s11101-018-9595-8

New insights into the biosynthesis of esterified oxylipins and their involvement in plant defense and developmental mechanisms

Manon Genva · Firmin Obounou Akong · Mats X. Andersson · Magali Deleu · Laurence Lins · Marie-Laure Fauconnier

LIÈGE université
Gembloux
Agro-Bio Tech

Laboratoire de Chimie des Molécules Naturelles

Huiles essentielles
La volatolomique – autres COVs
Oxylipines

Autres métabolites secondaires

Autres métabolites secondaires

Secondary metabolites from african plants for cosmetic/medicinal applications

- Matthew Saive : valorization of Mahoran flora Ph D student
- Fatimata Nea : valorization of endemic plants from Ivory Cost, PhD student
- Evelyne Tanoh : valorization of endemic plants from Ivory Cost, PhD student
- Liu Jiang : valorization of secondary metabolites from sweet potatoes, Ph D student CAAS

Fabaceae root exudates to improve soil pollution bioremedation

Marie Davin PhD student
Co-promotion with soil dep

Allelopathy: structure-function relationship

Simon Lebeque PhD Student
Leader LBMI

Serious games to improve chemistry learning process at university

Nathalie le Maire Ph D student
Coll. Ifres ULg

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Merci pour votre attention