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MEASUREMENT OF ODOROUS COMPOUNDS WITH A DEVICE BASED ON SPRI TECHNOLOGY

MEDIDA DE COMPUESTOS OLOROSOS CON UN DISPOSITIVO BASADO EN LA TECNOLOGÍA SPRI

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A NEW INSTRUMENTAL APPROACH FOR ODOROUS COMPOUND MEASUREMENT

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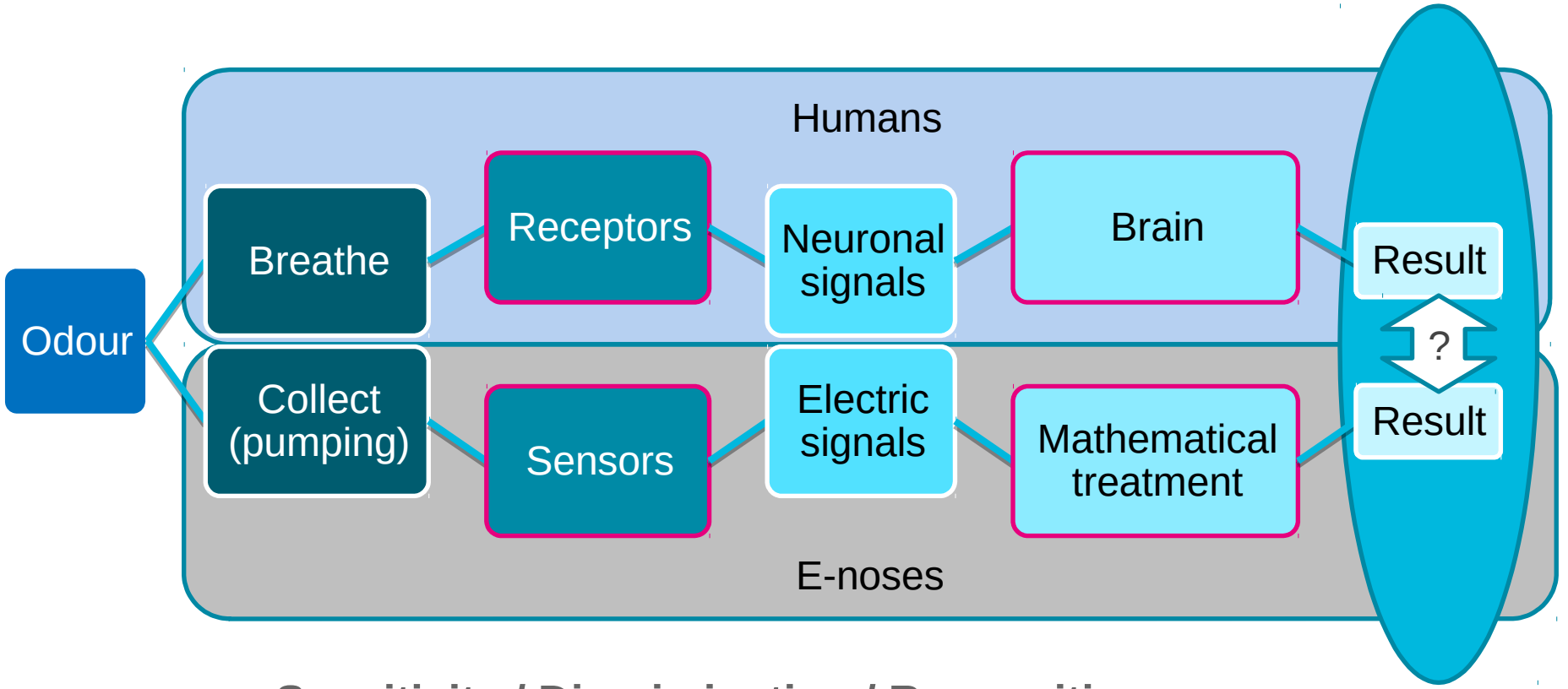
INSTRUMENTAL MEASUREMENT VS OLFACTOMETRY: KEY DIFFERENCES



Sensitivity / Discrimination / Recognition
linked to number of Receptors/Sensors

Discrimination / Recognition
linked to data treatment

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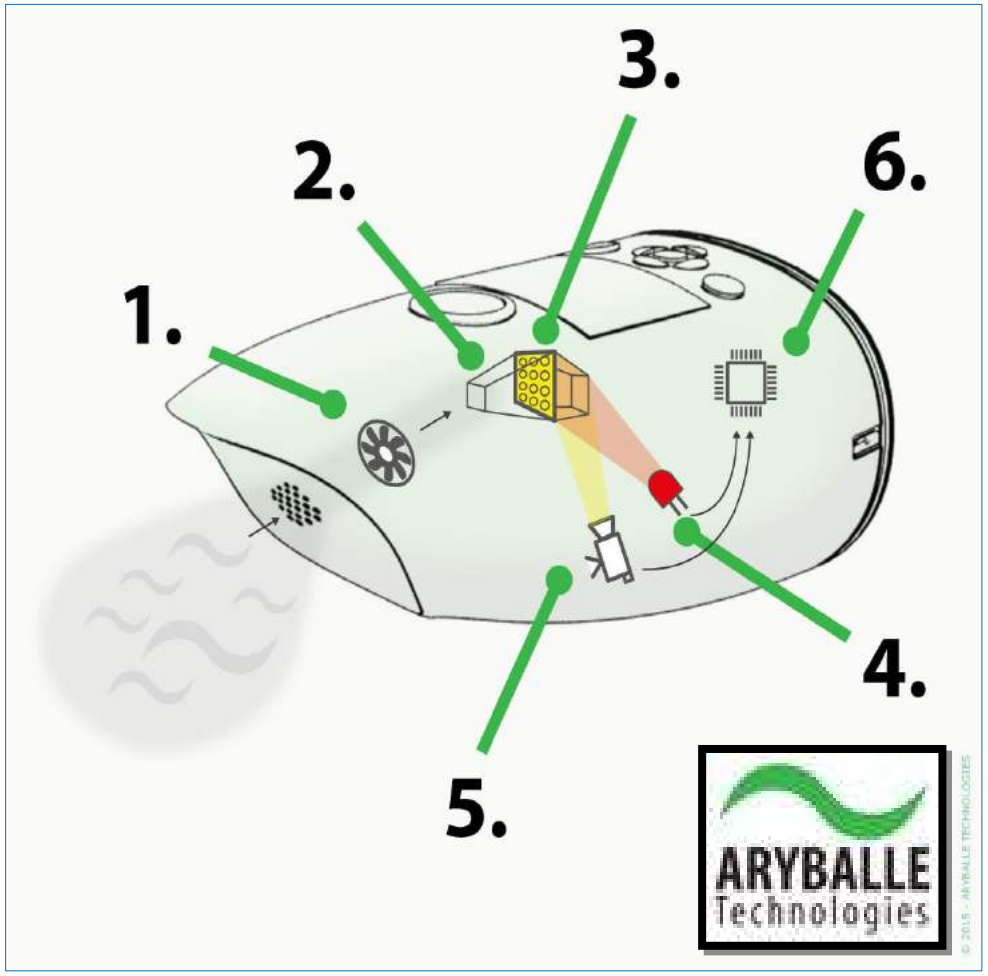
NEOSE INSTRUMENT: PRINCIPLE OF THIS NEW APPROACH



1- Pumping of air and odorous molecules;

2- Transport of compounds to the chamber;

3- Interaction of compounds with chemical sensors arrayed on a prism;

4- Lighting the prism with LED lamp (Surface Plasmon Resonance Imaging :SPRi);

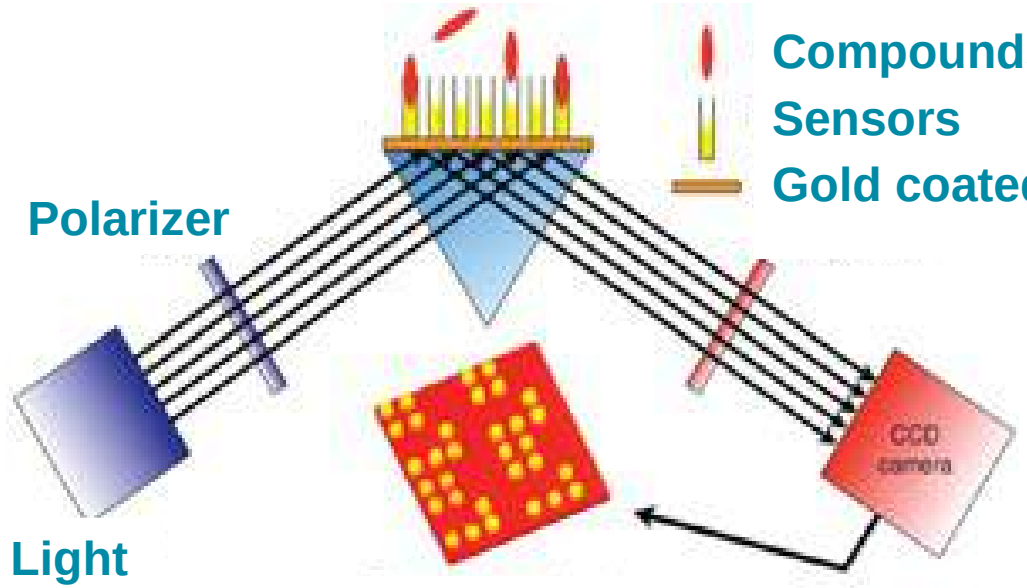
5- Recording optical signal transduction with a camera;

6- Storage (database) and analysis of results

Developed by Aryballe Technologies – Grenoble/France

Global development of the device: core hardware, handle the software, database development, full manufacturing

SPR IMAGING (SPRI): HOW TO VISUALIZE ODOUR ?



Compounds - (VOCs; odorants)
Sensors
Gold coated biochip Filter

Outputs

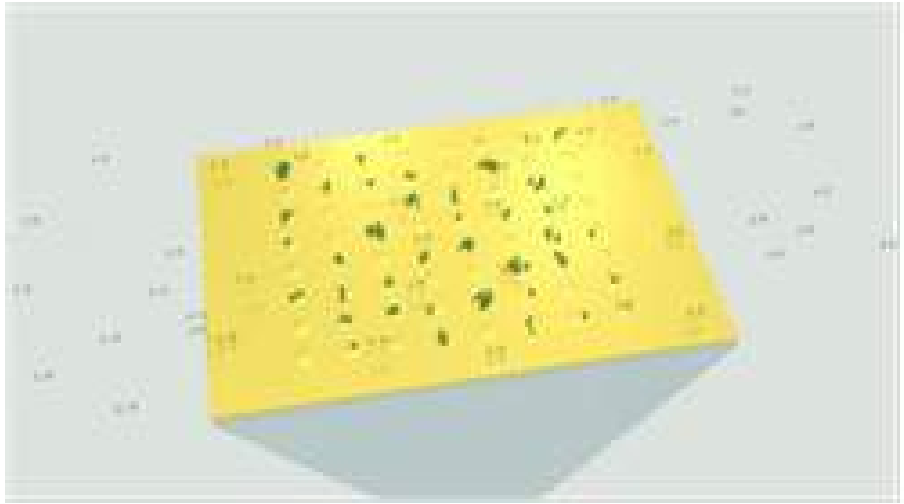
1. Binding – (Yes or No)
2. Specificity
3. Affinity
4. Kinetics
5. Concentration

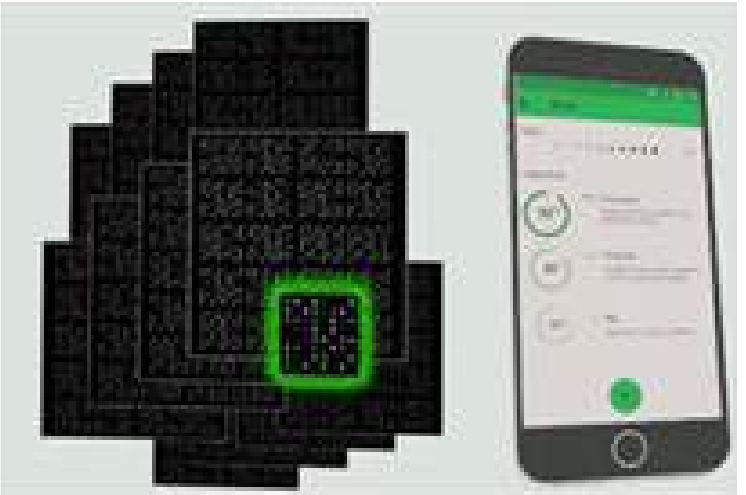
SPR IMAGING (SPRI): 3 KEY ACTIONS

- **Sensors:** Binding of VOCs (or odorous compounds) on the chemical ligands arrayed on SPR prism covered by a gold layer

- **Signals**: interrogating the surface by SPRi;

- **Data Treatment:** image analysis and data transfer





RESULTS EFFICIENCY IN TERMS OF DISTINCTION

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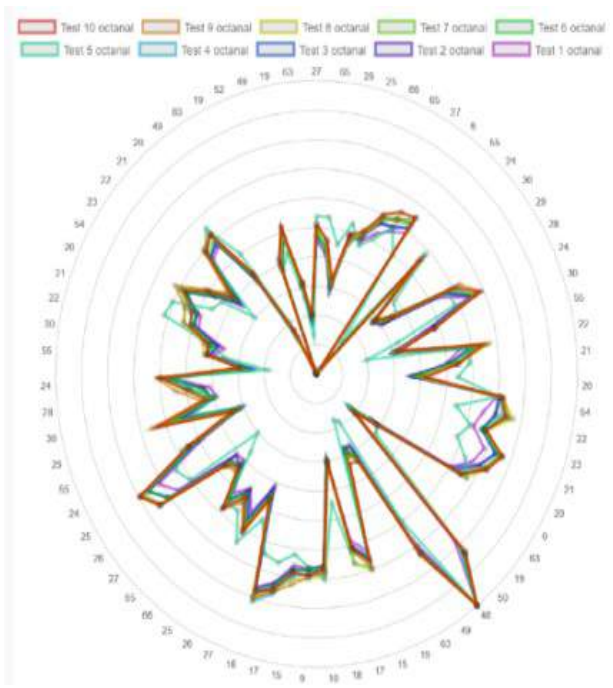
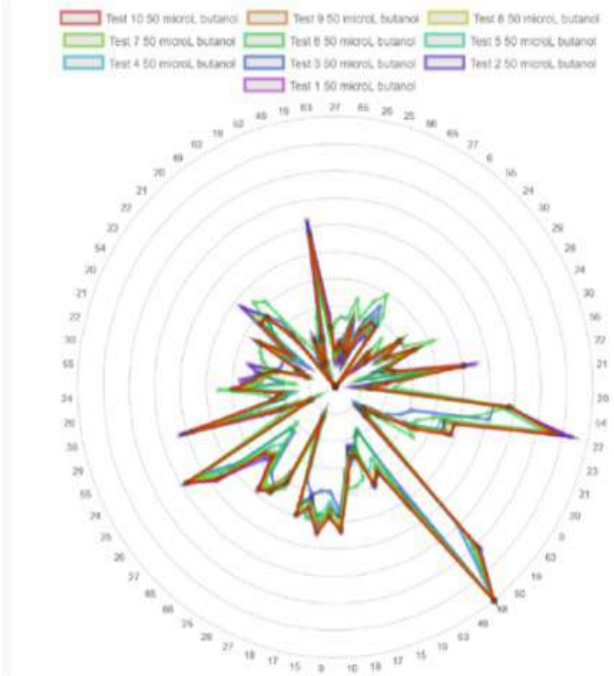
RESULTS (INTENSITY ON PLOTS TO DISTINGHISH COMPOUNDS)

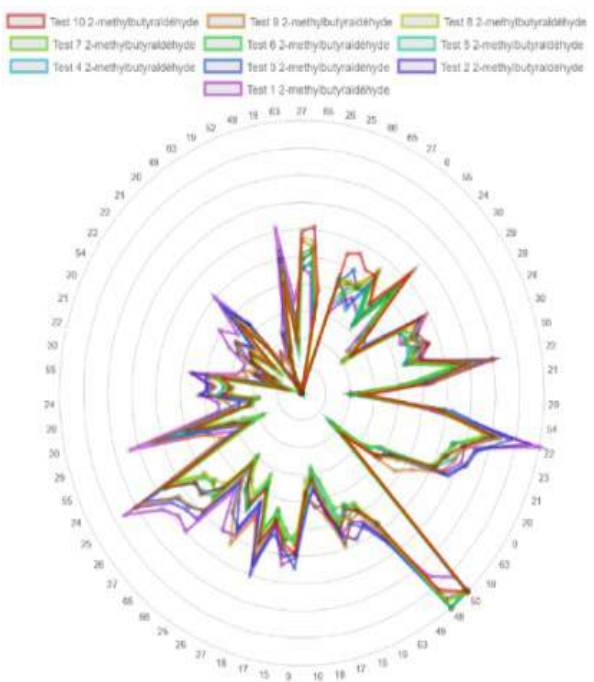
Octanal



n-Butanol

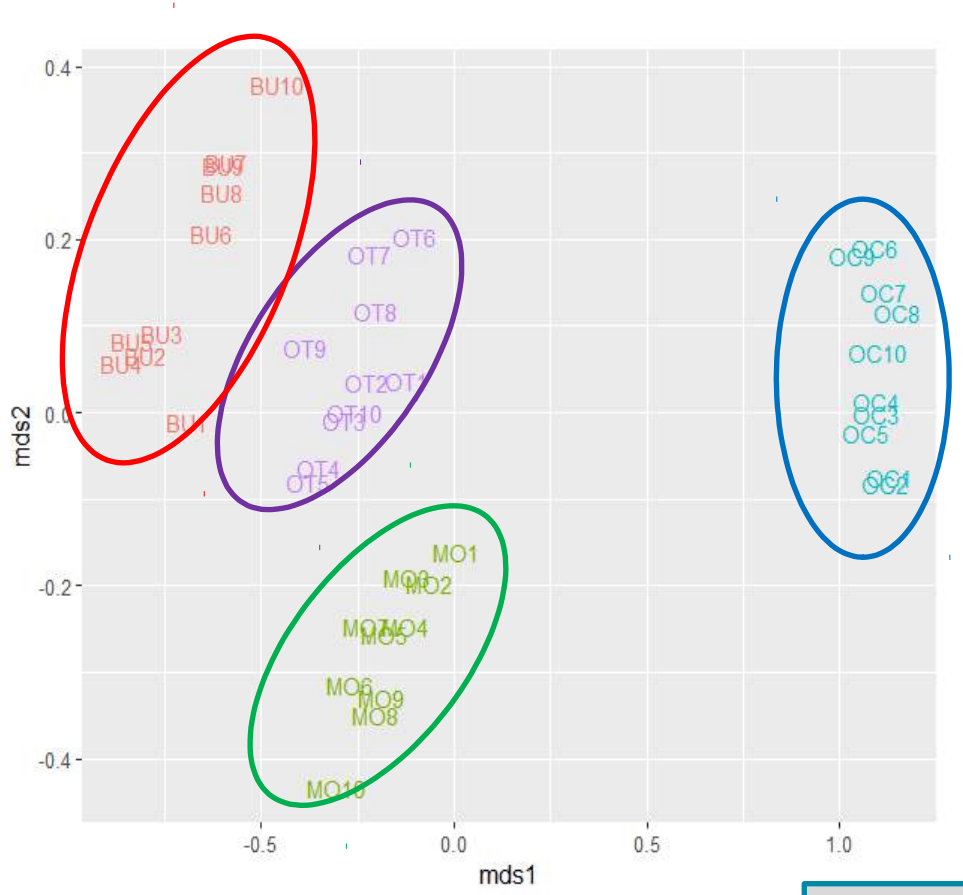


3- Methylbutyraldehyde



Radar plot (fingerprint) that clearly distinguish compounds
Fingerprints obtained with approx. 70 sensors

PCA RESULTS (3 ALCOHOLS / 10 REPETITIONS)

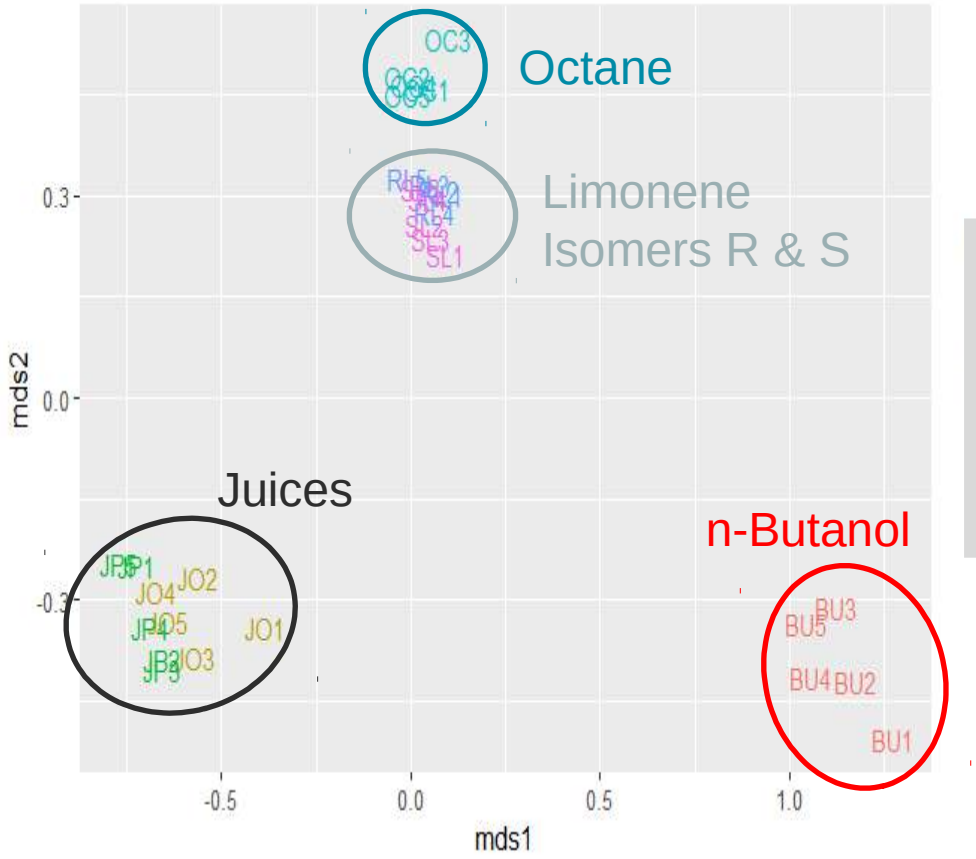


n-Butanol (C-4)
3,7-dimethyl-3-octanol (C-10)
Octane (C-8)
1-octen-3-ol (C-8)

Alcohols are distinguished

C-8 and C-10 Compounds are separated by their chemical functions

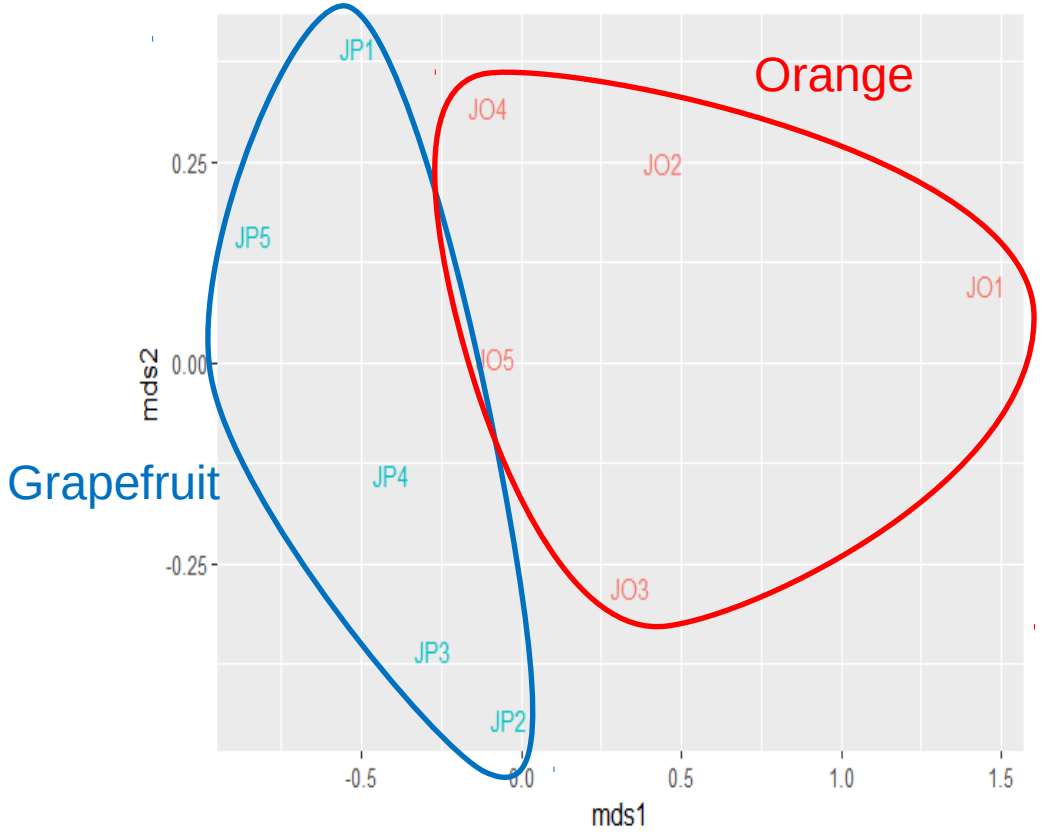
PCA RESULTS (PURE COMPOUNDS AND JUICES)



Comparison of Pure Compounds and fruit juices (Orange and Grapefruit)

Juices are clearly distinguished to pure compounds

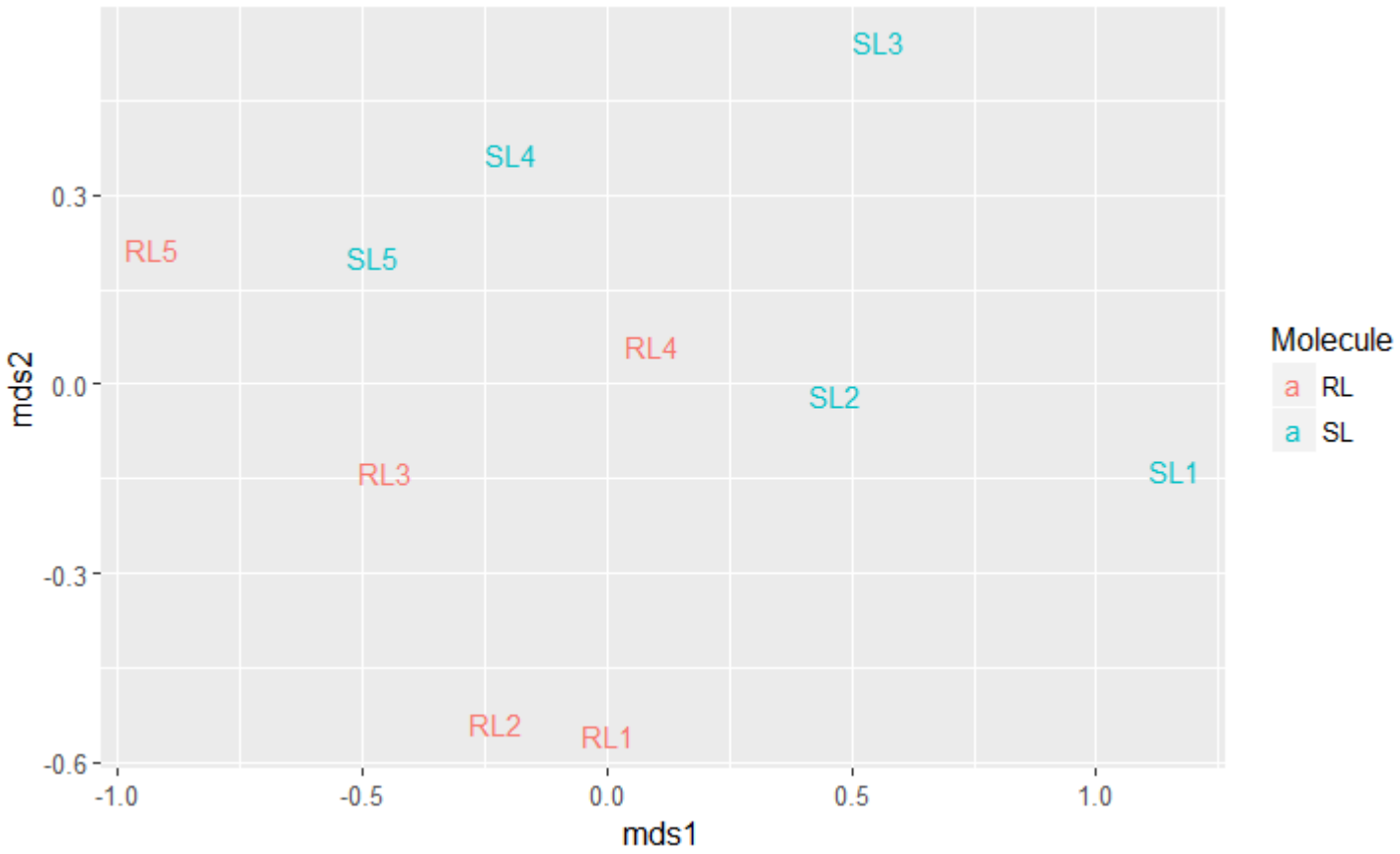
PCA RESULTS (FRUIT JUICES)

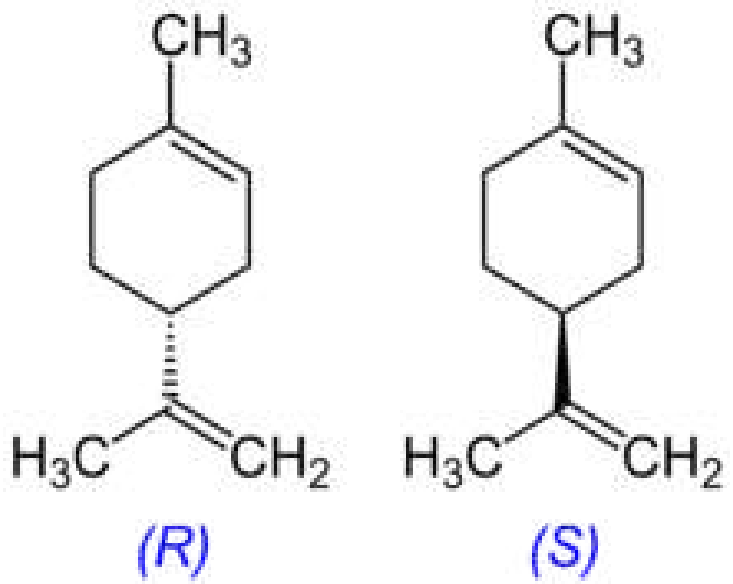


Comparison fruit juices
- Orange juice (JO)
- Grapefruit juice (JR)

Distinction of close fruit juices

PCA RESULTS: ENANTIOMERS





Classical sensors cannot separate isomers and particularly enantiomers

These enantiomers present different odours

R -> orange-like

S-> turpentine-like, lemon note

Main point: good way to distinguish isomers

RESULTS
IN TERMS OF PROPORTION INTO A MIXTURE AND SENSITIVITY

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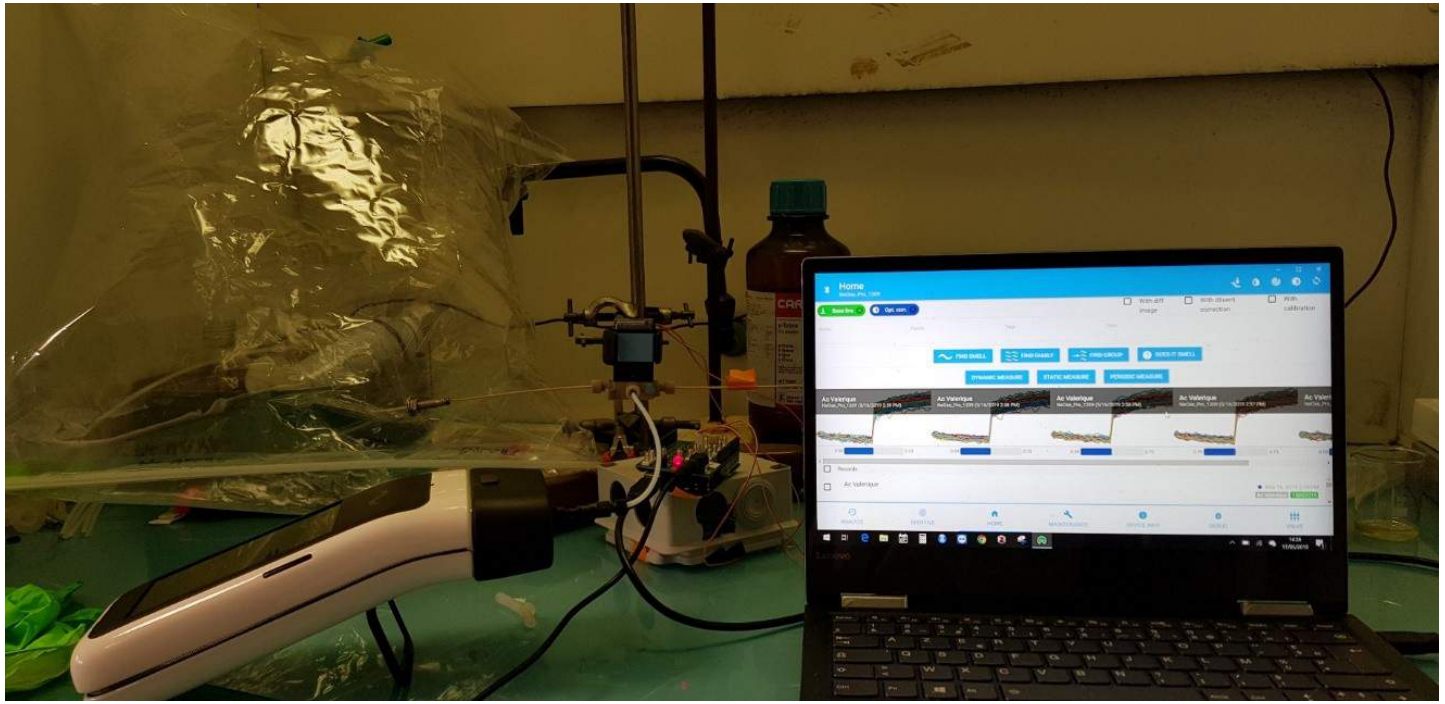
EQUIPMENT AND PROTOCOL

Sample and Air of reference (Zero) in Nalophan bags
Connection to the measurement device (Neose) with a valve
Quantitation by FID measurement



PROPORTION AND IDENTIFICATION

Size of compound is an important (major) criteria to orientate discrimination for mixtures. The biggest compound has an important impact on the fingerprint

Mixture	Identified compound (5 tests)		Main criteria
50/50 Ethanol/Butanol	Butanol 4/5	Ethanol 1/5	Size
50/50 Butanol/Octane	Butanol 3/5	Octane 2/5	Chemical function *
50/50 Ethanol/Octane	Octane 5/5		Size
75/25 Octane/Butanol	Octane 5/5		Size
75/25 Butanol/Octane	Octane 5/5		Size
75/25 Octane/Ethanol	Octane 5/5		Size
75/25 Ethanol/Octane	Octane 5/5		Size
75/25 Ethanol/Butanol	Ethanol 4/5	Butanol 1/5	Quantity
75/25 Butanol/Ethanol	Butanol 3/5	Ethanol 2/5	Quantity
33/33/33 Butanol/Ethanol/Oct.	Octane 5/5		Size

* *No real explication for this result*

SENSITIVITY WITHOUT OPTIMIZATION

Sensitivity clearly linked with molecular size
Small molecules must be highly concentrated to be detected

Alcohols	Methanol	Ethanol	Octanol	Linalol
Detection limit	>400 mg/m^3	>400 mg/m^3	11 mg/m^3	**6,5 mg/m^3**

Alcanes	Pentane	Hexane	Heptane	Octane	Nonane
Detec. limit	>400 mg/m^3	284 mg/m^3	24 mg/m^3	12 mg/m^3	**11 mg/m^3**

Carboxylic acids	Propionic acid	Butyric acid	Valeric acid
Detection limit	23 mg/m^3	156 mg/m^3	**1,6 mg/m^3**

Ketones	Methyl IsoButyl Ketone	2-Heptanone	Di-IsoButyl Ketone
Detection limit	>400 mg/m^3	40 mg/m^3	**10 mg/m^3**

CONCLUSIONS & PERSPECTIVES

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CONCLUSION ABOUT THIS NEW APPROACH

1

- Selectivity
  - Number of sensors
  - => High potentialities for identification
  - => Target: human nose model

2

- Quantitation
  - Based on optical measurement of Interaction
  - Actual limitations in terms of sensitivity and for external use (interferences with temperature or humidity variations)

3

- Portability
- (or device at a fixed place)
- Quick response
  - Recovery time as fast as possible

IMPROVEMENTS AND PERSPECTIVES

- Number of biosensors, sensitivity stability
- Data treatment and odour database
- Better perception of « odour » by odorant measurement
- Decrease the cost with adaptation for specific use

THANK YOU

MUCHAS GRACIAS

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