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Relationship Between Sensory Profiles and Odour-Active Compounds Detected by Gas-Chromatography Olfactometry: Novel Attempt to Explain Cheese Aroma

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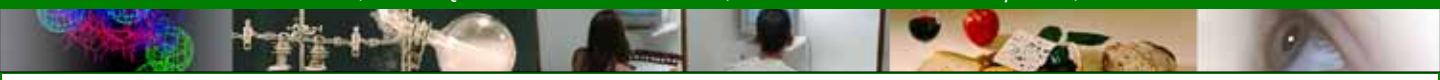
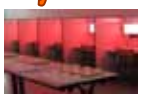


- Cheese flavour has been widely studied by different strategies aiming to better understand the global aroma and to identify the key-aroma compounds. The strategies often rely on either gas-chromatography olfactometry (GC-O) or correlation studies between quantitative measurements and sensory analysis of cheese. However, these correlation studies do neither take into account detection threshold nor different psycho-physical models, like Stewens Law, that relates concentration and sensory perception
- The purpose of this study was to explain sensory characteristics of cheese by GC-O data while accounting as much as possible for perceptual aspects

Materials & Methods

Sensory Analysis

Evaluation of 13 odour attributes by 13 trained judges



Strong Cheese - Buttery - Smoked - The Laughing Cow® - Melted Cheese - Sour - Raw Milk - Cream - Nutty - Musty - Animal - Sweaty – Dairy

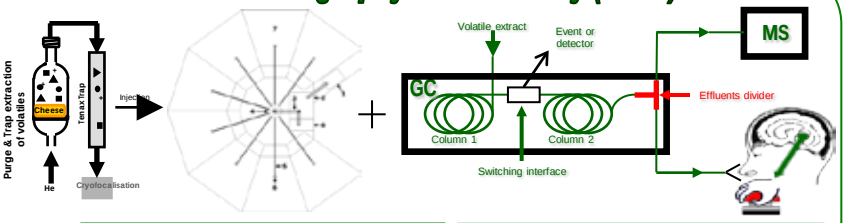
Evaluation on a 10 cm scale

0 — 10

- Presentation of attribute standards

7 semi-hard cheeses

Gas-Chromatography Olfactometry (GC-O)



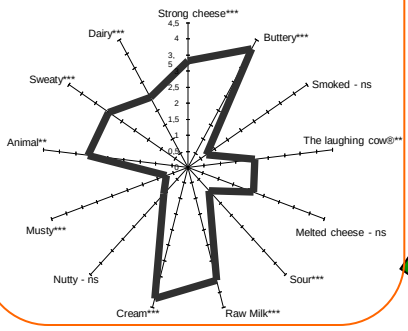
Detection of odour-active compounds:
Gas-Chromatography-Mass Spectrometry- 8 way-Olfactometry (GC-MS/8way O)
Evaluation by time-intensity methodology

Identification of odour-active compounds:
Two-dimensional Gas-Chromatography-Mass Spectrometry-Olfactometry (GC-GC-O/MS)

Results

Sensory profile:

Mean attribute values for one cheese

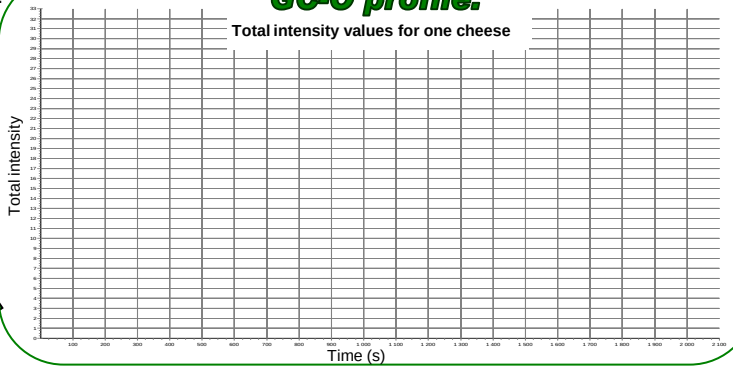


Sensory profiles for the cheeses:
Nine attributes were significantly different. They explain the major differences between the cheeses

GC-O profiles for the cheeses:
19 odour compounds were common for the cheeses and 12 were detected in only one or few cheeses

GC-O profile:

Total intensity values for one cheese



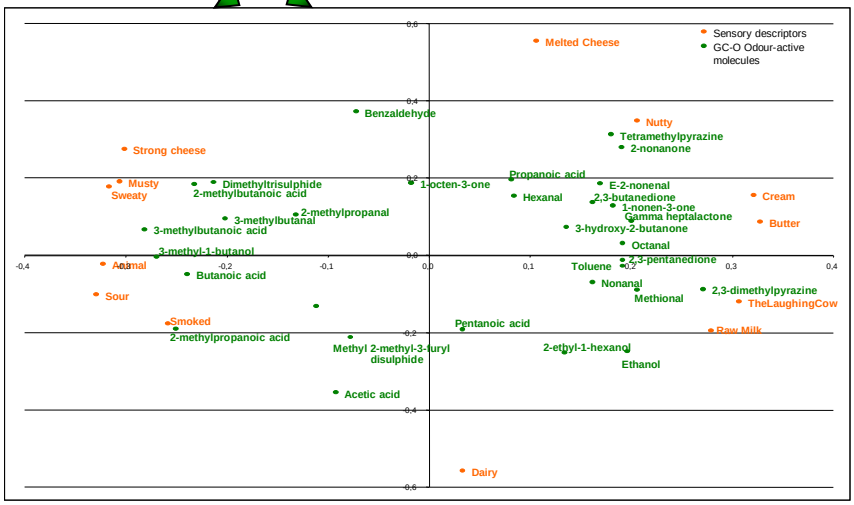
Correlations

We found good correlation between the two datasets:
- 53% of the GC-O data explain 87% of the sensory data on the basis of the two first dimensions

"Soft"- attributes (Butter, Cream, Laughing cow, Raw milk)
à Molecules having butter, milky, and herbal characteristics

"Aggressive"- attributes (Strong cheese, Musty, Animal, Sweaty and Rancid)
à Molecules having cheesy, sulphury, rancid and chocolate characteristics

We found both expected correlation (eg. 2,3-butanedione and the butter-creamy attribute) and new information for molecules with very low detection threshold (eg. methional and methyl 2-methyl-3-furyl disulphide).



By taking into account the perceived intensity of odorants instead of the concentration we can investigate the role of these low detection threshold molecules and other important molecules.

A small enhancement of the concentration might induce a great difference in odour perception by humans in case of one specific molecule and contrarily not be noticeable for the human nose for another molecule

PLS2 bi-plot of sensory descriptors and odour-active molecules, axis 1 and 2. R^2X=67%,20% , R^2Y=40%,13%

Conclusion

- This study provides new opportunities to relate sensory attributes of cheese to odorant molecules while accounting for the perceived intensity of odour-active compounds. This information could be very helpful for the understanding of cheese aroma following a strategy of recombining the aroma substances with the help of instrumental and sensory data.
- However, perceptual interactions such as masking and synergy within odorant mixtures cannot be considered by GC-O. These aspects will be further investigated by mixture studies in order to validate the correlations between the odour-active compounds and the sensory characteristics.