# Characterization of key aroma compounds in vegetable proteins foods

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## Background and Objectives

For several years, vegetable proteins have been the subject of particular attention. Considered by many people as the food of tomorrow, they are more and more popular within consumers. The project GenVie aimed to develop new foods based on vegetable proteins in order to obtain a good digestibility and acceptability by the consumer.

To better characterize the taste of these products, we set up experiments to identify the flavour compounds in two samples produced at different thermal processes.

The combination of a gas chromatography–mass spectrometry (GC-MS) and a gas chromatography–olfactometry (GC-O) approaches showed a link between the aroma composition and the odour of identified compounds.

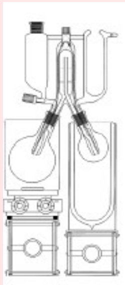
## Materials and Methods

Two vegetable protein samples
Standard composition : Cereal + peas

High (GV1) and low (GV3) thermal processing

Solvent Assisted Flavour Evaporation

(SAFE)



- 50 g of vegetable proteins + 60 ml purified water + 300 µl butan-1-ol standard reference (124 ng/µl in water).
- Distillates were extracted with purified $CH_2Cl_2$ and concentrated to about 300 µl.

**GC-MS Analysis**

- 1µl extract injected on DB-Wax column (30 m x 0.32 mm x 0.5 µm)
Carrier gas (He) linear velocity of 44 cm/s
Oven : 40°C to 240°C (4°C/min)
- Compounds identification
Mass spectra (INRAMASS, Wiley, NIST data base)
Linear retention indices (LRI)

**GC-O Analysis**

- Same GC conditions as GC-MS analyses
- The effluent was split 1:1 between the FID and the sniffing port
- 10 judges
- Detection frequency method

## Results

### GC-MS Analysis

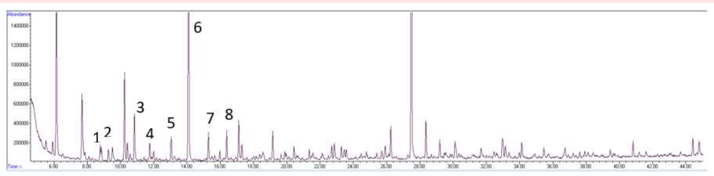



Figure 1 : Chromatogramm of a vegetable protein extract

Table 1 : Example of compounds identification

| | Compounds Identification | Time (min) | Retention Index | | Standard equivalent concentration (µg/kg) | |
|---|---|---|---|---|---|---|
| | | | $RI_{Litt}$ | $RI_{Exp}$ | GV1 | GV3 |
| 1 | Heptan-2-one | 8,784 | 1184 | 1180 | 230 | 133 |
| 2 | Heptanal | 8,853 | 1185 | 1183 | 155 | 135 |
| 3 | Pentan-1-ol | 10,836 | 1251 | 1249 | 147 | 520 |
| 4 | Octan-2-one | 11,892 | 1287 | 1283 | 49 | 22 |
| 5 | 2,6-Dimethylpyrazine | 13,253 | 1328 | 1326 | 165 | 80 |
| 6 | Hexan-1-ol | 14,088 | 1352 | 1352 | 244 | 2673 |
| 7 | 2-ethyl-6-methylpyrazine | 15,060 | 1385 | 1383 | 32 | 12 |
| 8 | Nonanal | 15,293 | 1392 | 1390 | 332 | 295 |

- 71 volatile compounds were identified and semi-quantified with the internal standard (butan-1-ol)
- They represent 4 main chemicals classes

Different amount between the high and low temperature process were observed according to the chemical classes table 2 below

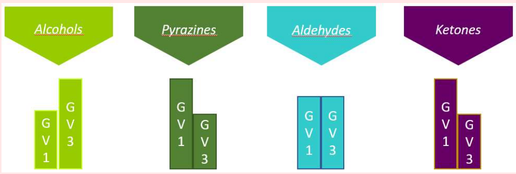



Figure 2 : High GV1> Low GV3

### GC-O Analysis

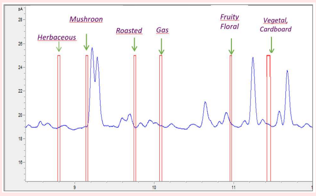



Figure 3 : Part of Chromatogramm of a vegetable protein extract

Table 2 : Example of identification of discriminant odour

| $RI_{GC-O}$ | Compounds Identification | Odour Descriptors |
|---|---|---|
| 1080 | Hexanal | Herbaceous |
| 1300 | Oct-1-en-3-one | Mushroom |
| 1326 | 2,5-Dimethylpyrazine | Roasted, Peanuts |
| 1390 | 2-ethyl-6-methylpyrazine | Cheese, Cabbage,Gas |
| 1397 | Nonanal | Fruity, Citrus, Floral |
| 1410 | Oct-3-en-2-one | Spicy, Vegetal, Burns |
| 1450 | Oct-1-en-3-ol | Vegetal, Earth, Cardboard |
| 1498 | 2ethylhexan-1-ol | Vegetal, Floral |

- 172 olfactives areas were detected (average GV1 & GV3)
- 70 olfactives areas were selected 4 or more times (/10) in at least one sample

48 olfactives areas were attributed to a chemical compound

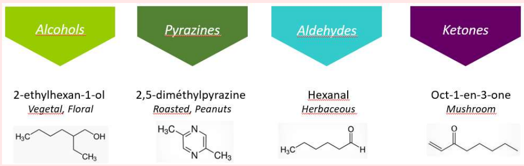



Figure 4 : Correspondence identification description odour and chemical compounds

## Conclusion

The results of this study are a first step in the knowledge of volatile compounds in vegetable proteins foods. GC-MS and GC-O data showed a large spectrum of identified compounds (pyrazines, alcohols, ketones, aldehydes) and associated descriptors (roasted, vegetal, fruity…) contributing to the richness and complexity of the flavour of samples. The profiles of the two samples are the same, on the other hand the quantities of compounds are different between the two thermal treatments. The amounts of pyrazines and ketones increase in GV1 sample (high temperature) while the amounts of alcohols increase in sample GV3 (low temperature).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