Characterization of key aroma compounds in vegetable proteins foods

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ChemoSens

Tereos

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.

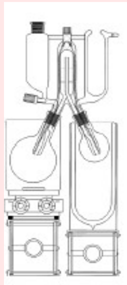
Materials and Methods

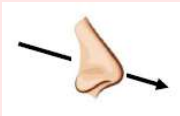
Two vegetable protein samples
Standard composition : Cereal + peas

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

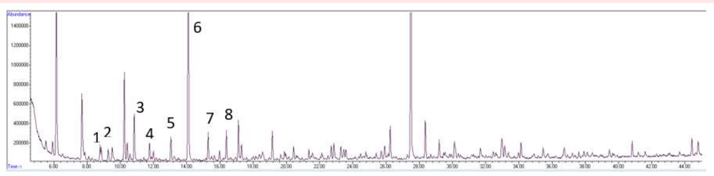


Figure 1 : Chromatogramm of a vegetable protein extract

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

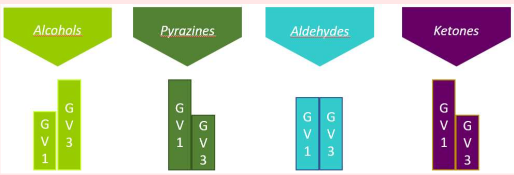


Figure 2 : High GV1> Low GV3

GC-O Analysis

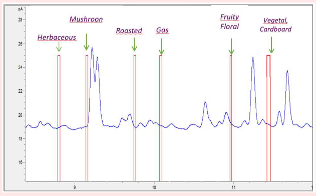


Figure 3 : Part of Chromatogramm of a vegetable protein extract

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

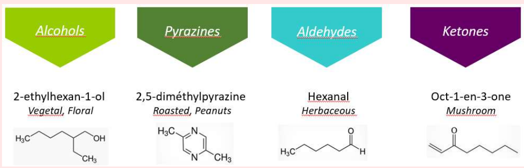


Figure 4 : Correspondence identification description odour and chemical compounds

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).

Bure J.(1970), La production de viandes végétales, Volume 85, n°1, Article : 177-181 - Dereuder A. (2015), Tereos se lance dans les analogues de viande, *Process Alimentaire* - MagaJ. (1978), Cereal Volatils, A review, *Journal of Agricultural and Food Chemistry: 175*

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