

# AROMA COMPOUNDS OF LAVENDER FLAVOURED CHEESE

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## Introduction

Improving cheese sensory properties by adding aromatic herbs and spices has long been a tradition in cheese production, to satisfy gourmets and to preserve the cheese due to the functional properties of the added plants and spices. Lavender (*Lavandula officinalis* L.) is known for its antibacterial and antifungal properties and lavender oil produced by supercritical fluid extraction (SFE) with CO<sub>2</sub> was used here to flavour *Dalmatinski sir* (Puđa Ltd). SFE results in very pure extracts as no solvent remains in the finished product and bioactive compounds are preserved – no toxic solvents are involved and thermal degradation is limited.

**Keywords:** aroma compounds, flavoured cheese, HS-SPME, GC-MS

**Objective** → To analyse the composition and content of aroma compounds of *Dalmatinski sir*, a full-fat cow's milk hard cheese and the same cheese flavoured with two different concentrations of lavender supercritical extract.



Picture 1. Extratex fluid extraction system (Extratex-SFI, France)

## Methodology

Dry lavender flowers (Gdinj, Hvar island) were processed by supercritical fluid extraction with CO<sub>2</sub> (extraction time: 40 minutes at 300 bar; CO<sub>2</sub> flow: 150 kg/h; extraction vessel temperature: 50 °C). Flavoured cheeses were manufactured by adding the mixture of extract and sour cream in the stirring vessel just before rennet and without altering other parts of normal cheese production. The cheeses were ripened to maturity and vacuum sealed until analysis. Isolation of aroma compounds was performed by HS-SPME using DVB/CAR/PDMS fibre at 60 °C. All samples were analysed by GC-MS using a non-polar column.

Table 1. Chemical composition and content of volatile compounds in the headspace of full-fat, hard cow's milk cheese without additives (control)

No.	Compound	RI	Content (%) ± SD
1	Acetic acid	<800	10.08 ± 2.143113
2	Pentan-2-one	<800	2.48 ± 1.210137
3	Acetoin	<800	2.98 ± 0.474657
4	Butyric acid	<800	9.40 ± 0.930501
5	Oct-1-ene	<800	1.56 ± 0.961665
6	Heptan-2-one	892	11.22 ± 2.490963
7	Hexanoic acid	995	15.40 ± 3.406998
8	2,2,4,6,6-Pentamethylheptane	997	3.04 ± 0.254820
9	Non-8-en-2-one	1085	2.86 ± 0.131149
10	Nonan-2-one	1093	30.22 ± 2.174488
11	Nonan-2-ol	1101	0.23 ± 0.325269
12	Nonanal	1106	0.75 /
13	Octanoic acid	1177	2.33 ± 0.812828
14	Undecan-2-one	1295	4.47 ± 1.557869
15	Decanoic acid	1371	-

Table 2. Chemical composition and content of volatile compounds in the headspace of cheese with lavender extract addition (0.25 g extract per 100 L milk)

No.	Compound	RI	Content (%) ± SD
1	Acetic acid	<800	8.07 ± 0.470142
2	Pentan-2-one	<800	0.96 ± 0.190788
3	Acetoin	<800	1.12 /
4	Butyric acid	<800	19.25 ± 1.698009
5	Heptan-2-one	892	2.82 ± 1.162340
6	Hexanoic acid	995	36.73 ± 0.792107
7	Limonene	1033	0.39 ± 0.291318
8	1,8-Cineole	1037	1.47 ± 0.290230
9	cis-β-Ocimene	1041	0.67 ± 0.237978
10	Non-8-en-2-one	1085	0.50 ± 0.049497
11	Nonan-2-one	1093	2.51 ± 1.360012
12	Linalool	1101	9.76 ± 2.468279
13	Camphor	1149	0.49 ± 0.068069
14	Borneol	1170	1.66 ± 0.230651
15	Octanoic acid	1177	8.59 ± 0.937514
16	Terpinen-4-ol	1180	1.97 ± 0.287286
17	Linalyl acetate	1260	0.70 ± 0.195533
18	Decanoic acid	1371	0.71 ± 0.343123

Table 3. Chemical composition and content of volatile compounds in the headspace of cheese with lavender extract addition (0.38 g extract per 100 L milk)

No.	Compound	RI	Content (%) ± SD
1	Acetic acid	<800	8.18 ± 2.690099
2	Pentan-2-one	<800	1.41 ± 0.423950
3	Acetoin	<800	0.68 /
4	Butyric acid	<800	11.86 ± 2.017779
5	Ethyl butanoate	<800	0.91 ± 0.113137
6	Heptan-2-one	892	4.41 ± 0.826458
7	Hexanoic acid	995	21.38 ± 0.679289
8	Ethyl hexanoate	1000	0.60 ± 0.098995
9	Limonene	1033	0.84 ± 0.349619
10	1,8-Cineole	1037	2.82 ± 0.230723
11	cis-β-Ocimene	1041	1.61 ± 0.075498
12	Non-8-en-2-one	1085	0.26 ± 0.372409
13	Nonan-2-one	1093	2.87 ± 1.371508
14	Linalool	1101	23.04 ± 1.819899
15	Nonanal	1106	0.88 /
16	Camphor	1149	0.91 ± 0.05
17	Borneol	1170	3.47 ± 0.274287
18	Octanoic acid	1177	4.16 ± 0.350048

## Results

In all samples, carboxylic acids were the most prevalent, particularly fatty acids hexanoic, butanoic and octanoic acid as well as acetic acid. The exception was the cheese without additives, where the most abundant compound was the methyl ketone nonan-2-one. In the cheeses with the addition of lavender supercritical extract, terpenes were also identified, with linalool as the most abundant compound. No terpenes were identified in the cheese without additives.

## Conclusion

The results of the study indicate that incorporating lavender supercritical extract into *Dalmatinski sir* alters its volatile profile. When it comes to flavoured cheeses, the higher amount of lavender supercritical extract, the higher amount of terpenes was detected, notably linalool, whereas in the control sample containing no extract, fatty acids and methyl ketones predominated. Adding lavender supercritical extract to cheese not only imparts a distinctive aromatic character but may also enhance the cheeses' sensory and antimicrobial and antifungal properties.

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