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Processing of meat and co-products

FLAVOURINGS FOR MEAT INDUSTRY ON THE BASE OF NATURAL ESSENTIAL OILS

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The Russian company "AROMAROS" manufactures more then 60 different kinds of flavourings and premixes containing essential oils, spices and spicy plants for meat products [1]. To check up the quality of purchased essential oils and oleoresines, the system of input control based on analytical test of their composition by means of gas chromatography was developed at "AROMAROS" plant. The objective of this work is to analyze essential oil composition, compare and select samples of essential oils having the highest level of balanced aroma-forming substances.

EXPERIMENTAL

Sample characteristics.

Natural spices. Composition of volatile substances was determined in samples of natural nutmeg (India), laurel leaves (Georgia), and garlic (Russia). Volatile substances were extracted from spices by co-distillation [2]; 100 ml of distilled water, 20 ml of freshly distilled diethyl ether, 0.5 mg of n-dodecan (as inner standard) were mixed with 5 g samples of ground spices. Then the mixture obtained was shaken during 1 hour and volatile components were distilled simultaneously with ether-water mix; the ether layer was separated, dried with 2 g of anhydrous sodium sulfate, and analyzed by means of gas-chromatography.

Essential oils. 3 samples of nutmeg essential oil (France, India), 3 samples of coriander essential oil (Russia), and 6 samples of garlic essential oil (India, France, Russia, Austria) were used for the test. 20 g of each essential oil sample were dissolved in 1 ml of n-pentane and analyzed by gas-chromatograph.

Conditions of gas-chromatographic analysis. The samples were analyzed in Hewlett-Packard chromatograph 5730A with flame-ionization detector on quartz capillary column SE-30 (50 m x 0.32 mm, d_f =0.25 mcm). The temperature of the analysis was programmed from 60°C to 250°C with the rate of 8°C/min. Evaporator and detector temperature was 250°C. The rate of helium gas carrier was 1 ml/min., split division at the column input was 1 : 40. Volume of analyzed samples was 1 mcl. To estimate indices of retention, n-alcanes C_7-C_{17} mixture was added to each sample.

RESULTS AND DISCUSSION

When comparing compositions of three samples of nutmeg essential oil and volatile components of natural nutmeg (Table 1), it became evident that all samples had actually similar qualitative composition and quantitative correlation of basic components. Their composition is similar to the composition of volatile substances contained in the natural nutmeg. The high concentrations of pinenes, sabinene 1.8-cineole, γ-terpinene, 4-terpineol, and miristicin provide good quality of all three samples of nutmeg essential oil.

Table 1. Difference in composition of nutmeg volatile substances and three samples of nutmeg essential oil.

Compound	Natural nutmeg, %	Nutmeg volatile oils, %		
		1	2	3
α-thujene	1.1	2.0	2.0	1.9
α-pinene	7.5	22.0	30.0	25.0
Camphene	0.1	0.4	+	+
Sabinene	20.8	16.0	20.0	20.0
β-pinene	8.8	18.0	18.0	17.5
β-myrcene	2.9	2.8	3.0	2.9
α-phellandrene	0.7	0.6	0.8	0.8
3-carene	0.9	1.6	1.2	1.1
p-cymene	1.6	2.5	3.1	3.0
Limonene	1.6	0.6	0.6	0.8
1.8-cineole	11.2	8.2	8.0	7.6
γ-terpinene	3.2	5.2	5.0	4.6
Sabinene hydrate	3.3	0.1	+	+
α-terpinole	1.4	1.5	2.0	1.9
Linalool	3.4	+	+	+
Camphor	0.5	+	+	+
4-terpineol	10.1	4.2	4.3	4.2
α-terpineol	1.1	-	0.8	0.7
Isobornylacetate	1.5	1.2	-	-
Eugenol	0.5	0.1	+	+
Methyleugenol	7.5	-	-	-
Karyophyllen	0.4	0.1	+	+
Myristicin	5.9	9.2	7.0	6.8
Elemizin	2.7	+	+	+
α-cadinene	+	+	+	+

Note. + Content of substance is less 0.1%.

The analyzed sample of coriander essential oil (Table 2) had also a similar qualitative and quantitative composition of basic components. Essential oil No. 1 differed by higher content of p-cymene and linalool oxide that was probably the result of long storage of the sample.

unstable compounds were oxidized during storage. E. g. γ-terpinene concentration was 18 times lower in the sample No. 1, than in the sample 3, that also indicated the long storage of the sample.

Table 2. Difference in component composition of coriander essential oils.

Compound	Content, %		
	1	2	3
α-thujene	0.1	0.1	0.1
α-pinene	7.0	8.0	6.5
Camphene	1.3	0.7	1.0
Sabinene	0.1	0.1	0.2
β-pinene	0.5	0.2	0.4
β-myrcene	0.4	0.6	0.8
p-cymene	7.7	0.4	5.9
Limonene	3.0	3.4	4.6
γ-terpinene	0.3	8.2	5.0
Linalool oxide	1.1	0.1	0.3
Isoborneol	0.9	0.1	0.2
Linalool	68.0	65.0	63.0
Camphor	4.5	6.3	6.0
4-terpineol	0.3	0.1	0.2
α-terpineol	0.2	0.1	0.3
Linalylacetate	0.7	0.7	1.7
Geranylacetate	2.7	2.5	3.1

The analysis of volatile substances content in the natural garlic showed that the main compounds responsible for the specific garlic aroma appeared to be diallyldisulfide and diallyltrisulfide (Table 3). Symmetric and asymmetric mono-, di-, and trisulfides with methyl, propyl, allyl, and 1-propenyl substitutes were always present in the natural garlic [3]. Presence of these compounds in the essential oil confirmed the fact that this sample was prepared from natural garlic. During extracting volatile substances from the garlic as well as during obtaining essential oil, two cyclic dithianes with vinyl substitute were formed. Their concentration increased during storage of garlic oil. Thus, analyzing the garlic oil composition, it was possible to make grounded conclusion about its origin. Thus, samples of garlic essential oil Nos 1-3 did not contain methyl- and propenyl-containing di- and trisulfides, therefore samples 1-3 were supposedly synthetic. The sample 4 had the high concentration of cyclic dithianes, but allylpropenyltrisulfide and diallyltetrasulfide were not found. Thus, it was possible to conclude that technological conditions during the preparation of essential oil No. 4 were violated, most probably the temperature conditions or the conditions and time of oil storage were violated. The sample No. 5 had optimal composition and organoleptic characteristics, that's why nowdays it is used for the preparation of flavourings at the "AROMAROS" plant.

Thus, gas-chromtographic analysis of aroma-forming substances contained in essential oils allowed to make objective evaluation of their properties, to select samples of higher quality, to obtain new aromatizers and flavourings.

Table 3. Difference in composition of garlic volatile substancesand samples of natural garlic essential oils.

Compound	Natural garlic	Content, %					
		1	2	3	4	5	6
Methylallylsulfide	1.5	9.0	3.2	14.1	1.6	4.5	1.5
Dimethyldisulfide	1.1	0.9	+	4.0	1.3	1.7	0.9
Diallylsulfide	0.9	17.6	30.3	11.4	3.6	11.5	6.6
Methylallyldisulfide	7.2	14.4	4.3	24.1	4.4	9.5	3.9
Methylpropyldisulfide	0.6	-	-	-	-	0.2	0.1
Methylpropenyldisulfide	0.8	-	-	-	2.8	0.4	0.1
Dimethyltrisulfide	0.8	1.5	+	1.8	3.6	2.3	1.8
Diallyldisulfide	26.8	31.9	36.1	28.1	15.3	27.5	17.9
Allylpropyldisulfide	3.4	-	-	-	+	1.0	0.4
Allylpropenyldisulfide	5.4	-	-	-	-	2.8	0.7
Methylallyltrisulfide	9.2	11.8	7.2	8.7	5.7	15.4	18.8
3-vinyl-1.2-dithian-5-en	2.1	-	-	-	12.7	0.2	0.2
4-vinyl-1.2-dithian-5-en	8.0	-	-	-	31.7	0.7	1.0
Diallyltrisulfide	28.0	11.1	17.3	6.8	11.7	21.2	41.4
Allylpropenyltrisulfide	0.4	-	-	-	-	0.6	0.3
Diallyltetrasulfide	0.5	0.4	0.7	-	-	0.1	3.4

REFERENCES

1. Andreenkov V.A., Alekhina L.V., Ivashov V.I. et. al. Methods of obtaining new aromatizers and aromatic compositions for sausages. Proceedings of the 41 ICOMST, San-Antonio, USA, 1995, p. 456.
2. Misharina T.A., Golovnya R.V. Effectiveness of volatile substances extracting from food products by different methods. J. Analyt. Chem. 1992. v.47, No.4, p.650-659.
3. Maarse H., Visscher C.A. Volatile compounds in foods. Qualitative and quantitative data. V.1-111. TNO Biotechnology and Chemistry Institute. Zeist. 1989-1990.