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Identification of Quality of Complex Flavour Mixtures Used in Meat Industry

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1. Abstract

Multifunctional complex flavour mixtures, which simplify and speed up food production, are of great importance in the meat processing industry. The aim of the research was to identify the quality of complex food spice mixes prepared by a producer. It was found that the compositions of the grill spice mix met the regulations in terms of organoleptic, physical, and chemical parameters. The garlic mixture sample revealed the presence of edible salt, not declared by the manufacturer. Dietary fiber was present in all the mixes under study. Garlic 1:6 sample differed from the other complex additives by the increased content of Al, Li, Mg, P, Si, Sr, Te, as well as the presence of Mo, Ti, V, and W. The 'grill spice mix' had relatively high amounts of Ca, Cr, and Fe, but did not contain detectable amount of Si, declared by the manufacturer as part of E551. The composition of the grill spice mix stood out because of the high content of Mn, Na, and Zn, an aroma mixture – Cu. It should be noted that E627 and E631 flavor enhancers were found in an aroma mixture, whereas E450 stabilizer and emulsifier was found in a grill aroma mixture.

According to a number of experts, these components pose a threat to the human body as they can cause intestinal and stomach disorders. In this regard, it is necessary to understand which food additives need to be excluded from a person's diet, which are especially dangerous, and which are safe to consume from time to time in small quantities as part of meat products.

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2. Introduction

The use of food spice mixtures in the meat industry simplifies and speeds up production, reduces the cost of goods and to a certain extent helps to solve problems of their quality, safety, and preservation. Food additives have come into common use in the production of smoked meat products, semi-finished products, sausages, which are the most demanded meat products in this country **[1, 2, 3]**.

Recently a great deal of interest has been drawn to multifunctional complex food flavour mixes, which include flavorings, water-binding phosphate preparations, color stabilizers, as well as preservatives and antioxidants that slow down microbial and non-microbial spoilage of meat products **[4, 5, 6]**.

All food additives must be tested for quality and prove safe for the health of consumers **[7, 8, 9, 10, 11]**. The purpose of the study was to identify the quality of complex spice mixtures for the meat industry.

3. Materials and methods

The material for the research were complex food additives produced by a Russian producer (Moscow Region) in accordance with TU 10.89.19-008-58251238-20 specification, having the following ingredients:

- Sample 1 (aroma mixture) dextrose, maltodextrin, edible salt, E621, E627, E631, yeast extract, extracts of garlic, pepper, cardamon, and coriander; E551;
- Sample 2 (grill mixture 1) dextrose, E450-E452, maltodextrin, E300, E301, edible salt, E1442, E407, E415, granulated vegetable-based broth, E508, extracts of pepper and celery, E551;
- Sample 3 (grill mixture 2) edible salt, granulated vegetable-based broth, spices (onion, garlic, pepper, caraway), E621, “Grill” flavoring, extracts of celery and caraway seeds, E551;
- Sample 4 (garlic product) dextrose, garlic powder, garlic extract, E551.

Organoleptic characteristics of the additives were tested according to GOST 15113.3-77. Moisture content was determined according to GOST 15113.4-77, edible salt – according to GOST 15113.7-77, metal and foreign impurities, contamination with grain pests – according to GOST 15113.2-77, protein and food fibers – using the generally accepted methods **[12]**, minerals – according to MUK 4.1.1482-03 and MUK 4.1.1483-03 guidelines.

4. Results and discussion

In terms of appearance ***(Figure 1)*** the additives under study were finely ground loose powders with specific rich odors, characteristic of their constituent spices, of white color, white color with a cream hue (garlic), light cream color (grill mixture), and creamy color with a gray hue (hickory).

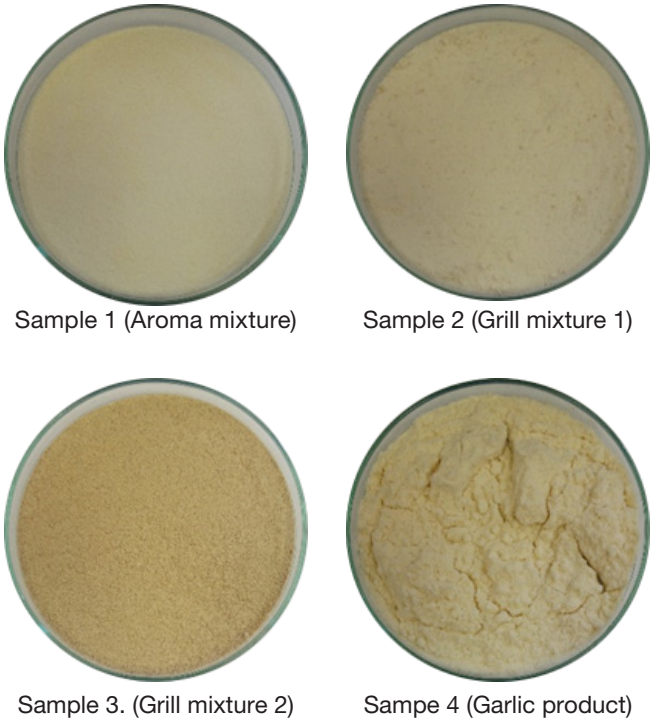

Figure 1. Appearance of spice mixture products

Based on the test results, organoleptic, physical, and chemical indicators of the quality of the raw materials were compliant with the regulations (Table 1).

It should be noted upfront that the documents accompanying the goods, namely specifications, did not specify the limits (minimum or maximum) for the content of certain nutrients in the composition of the mixtures under study. In this regard, it was difficult to compare the obtained results in terms of the amount of protein and fat with the levels declared by the manufacturer. Regardless of this, the garlic spice mixture had protein content 4.6 times higher than the regulated value, the aroma mixture – 2.9 times, the grill mixture – 2.2 times, the hickory product – 1.9 times. The protein content in the raw materials was primarily due to the presence of vegetable-based broth, and E621 and E627 flavor enhancers.

Table 1: The Quality of Spice Mixtures

<table>
<tr><th rowspan="2">Indicator</th><th rowspan="2">Declared in Product Specification</th><th colspan="4">Results</th></tr>
<tr><th>Aroma mixture</th><th>Grill mixture</th><th>Hickory product</th><th>Garlic product</th></tr>
<tr><td colspan="6">Physical and Chemical Indicators</td></tr>
<tr><td>Mass fraction of moisture, %</td><td>not more than 15.0</td><td>4.8±0.3</td><td>5.5±0.2</td><td>5.7±0.3</td><td>11.7±0.3</td></tr>
<tr><td>Mass fraction of metallic impurities, %</td><td>not more than 0.001</td><td colspan="4" rowspan="3">not detected</td></tr>
<tr><td>Pests infestation</td><td rowspan="2">not allowed</td></tr>
<tr><td>Foreign impurities</td></tr>
<tr><td colspan="6">Main Components</td></tr>
<tr><td>Mass fraction of protein, %</td><td>as per the composition</td><td>4.1±0.2 (1.4*)</td><td>2.4±0.1 (1.1*)</td><td>18.0±1.3 (9.3*)</td><td>3.2±0.2 (0.7*)</td></tr>
<tr><td>Mass fraction of edible salt, %</td><td rowspan="2">not stated</td><td>19.3±1.6</td><td>9.4±0.7</td><td>44.5±3.2</td><td>3.5±0.2</td></tr>
<tr><td>Dietary fiber content, g/100 g</td><td>3.5±0.2</td><td>1.8±0.1</td><td>1.5±0.1</td><td>6.0±0.5</td></tr>
<tr><td colspan="6">Note: * as declared by the manufacturer in the specification, g/100 g</td></tr>
</table>

Of particular interest was edible salt, which performs several functions as part of complex food flavour mixtures used in the production of meat products. Namely, it affects the moisture content in the product, its yield, water activity, shelf-life stability during storage, etc. **[13]**. Its content was maximum in 'grill spice mixture 2' and minimum in Garlic, which is accepptable for the first one and is unacceptable for the second (as not declared in the composition of the product).

The presence of plant ingredients (garlic powder), carrageenans (E407), and xantal gums (E415) in the tested additives prompted further study of the amount of dietary fiber in them. It was found that the dietary fiber level in the garlic sample was the highest among the tested samples, which is important, for example, when making minced meat, as dietary fiber affects its adhesive, as well as functional and technological properties (moisture, fat holding capacity, etc.) **[14]**. Also, the introduction of dietary fiber into meat products solves the technological problem of obtaining the necessary consistency and improving the properties of the product, as well as preventing fatting out **[15]**.

Taking into account that the composition of food flavour mixtures included salts, metal oxides, and other chemical compounds, their mineral composition was studied in detail ***(Table 2)***. The garlic sample can be singled out in this respect, as it differed from the other complex mixtures by the extensive list of minerals present (containing 22 elements), the increased content of Al, Li, Mg, P, Si, Sr, Te, as well as the presence of Mo, Ti, V, and W. This product was the only one containing lead, the level of which did not exceed standards of TR CU 021/2011 and SanPiN 2.3.2.1078-01. Taking into account the composition of the above spice mixture we can see that the main contribution to its mineral value was made by garlic powder. In this regard, we compared the data on the amount of certain mineral elements contained in dried garlic published in a number of scientific papers **[16, 17]** with the results obtained. It was found that the garlic sample lacked K, an important macronutrient, the content of which in similar raw materials was 8622 mg/kg. The content of Ca was undeniably low (25.2 against 3976 mg/kg), the levels of Fe, Na, Mg and P were consistent with the generally known data (36; 378; 561 and 3435 mg/kg respectively).

Table 2: Mineral Composition of Flavour Mixtures

Tested Element	Test Results, mg/kg			
	Aroma mixture	Grill mixture 1	Grill mixture 2	Garlic product
Al	3.55±0.22	-	1.45±0.09	4.38±0.27
B	-	0.74±0.03	0.80±0.01	0.52±0.02
Ba	-	0.15±0.01	-	0.13±0.01
Ca	-	-	28.03±1.17	25.21±1.11
Cr	0.50±0.02	2.50±0.12	4.80±0.33	0.11±0.01
Cu	1.15±0.07	-	0.75±0.04	0.33±0.02
Fe	2.50±0.11	7.87±0.41	16.00±1.20	6.22±0.38
Li	-	1.48±0.09	-	2.88±0.13
Mg	0.60±0.02	2.50±0.14	3.45±0.25	65.20±3.04
Mn	0.30±0.01	1.75±0.12	-	0.27±0.01
Mo	-	-	-	0.047±0.002
Na	25.00±1.90	94.90±4.18	28.00±1.81	75.52±5.08
P	2.50±0.12	115.02±8.32	7.50±0.44	496.11±20.41
Pb	-	-	-	0.088±0.003
Si	1.50±0.08	161.14±9.16	-	381.09±17.63
Sn	0.10±0.01	0.10±0.01	0.10±0.01	0.13±0.01
Sr	-	0.05±0.01	-	0.26±0.02
Te	-	1.60±0.08	-	2.28±0.14
Ti	-	-	-	0.59±0.02
V	-	-	-	0.11±0.01
W	-	-	-	0.096±0.004
Zn	4.50±0.20	12.50±1.03	7.50±0.31	3.15±0.16

The 'grill spice mix 2' had relatively high levels of Ca, Cr, and Fe. At the same time Si was not detected in its mineral composition, despite the presence of the anti-caking agent E551 (silica), as stated by the manufacturer.

The 'Grill mixture2' composition was distinguished by the increased content of Mn, Na, and Zn, the aroma mixture – only in Cu content.

It is a known fact that small doses of a substance, if consumed frequently, can pose a greater threat to the human body than large but rarely consumed ones. For example, citric acid (E330), the content of which in products is not regulated, can cause an attack in patients with stomach ulcer **[10]**. If we refer to the list of ingredients in the tested products, we can notice the presence of E627 and E631 in the aroma mixture and E450 in the grill mixture. According to a number of experts, these are harmful components because they can cause intestinal and stomach disorders **[7, 8]**. So, it is vital to understand which food additives need to be excluded from a person's diet, which are especially dangerous, and which are safe to consume from time to time in small quantities as part of meat products **[10]**.

5. Conclusions

The tested food flavour mixtures met the regulations in terms of organoleptic, physical, and chemical parameters. However, the garlic sample revealed the presence of edible salt, not declared by the manufacturer. Dietary fiber was present in all the tested products. The garlic sample stood out from the other products under study because of the high content of Al, Li, Mg, P, Si, Sr, Te, and presence of Mo, Ti, V, and W. The 'grill spice mix 2' had relatively high amounts of Ca, Cr, and Fe, but did not contain Si, declared by the manufacturer as part of E551. Grill Combi PF composition was distinguished by the increased content of Mn, Na, and Zn, whereas Aroma Perfect – Cu.

6. Conflicts of interest

We declare that we have no financial and personal relationships with other people or organizations that can inappropriately influence our work, there is no professional or other personal interest of any nature or kind in any product, service and/or company that could be construed as influencing the content of this paper.

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