AMARANTH CORN PROCESSED PRODUCT – PERSPECTIVE ADDITIVE DURING MANUFACTURE OF MEAT PRODUCTS

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Background

Amaranth corn rich in protein balanced by essential amino acids, lipids, vitamins, macro- and microelements, biologically active substances is classified with the most perspective kinds of non-traditional raw materials for manufacture of functional-purpose food additives [1]. By lipids it exceeds basic traditional food cultures, its corn contains up to 50 unsaturated fat acids (oleinic and linolic acids - about 70%, palmitic acid – 20% and linolenic acid – 1%), what points to the fact that it can be used for prophylaxis of cardiovascular diseases. It is characterized by presence of a great amount of physiologically active substances (styrols and tocopherols) in it [2, 3]. Among the grain cultures amaranth is distinguished by a high content of potassium, manganese, zinc and, especially, iron and magnesium. The last one favors slowing down of atherosclerosis processes and reduction of the level of cholesterol content in blood.

Experts from the Food and Agricultural Organization (FAO) consider it the culture of the 21st century which, together with other grain cultures, promotes supply of people with protein. In addition to protein, fat and carbohydrates, the amaranth corn contains pectin, dying pigments, antioxydant-effect flavonoids, and other physiologically active substances.

Objectives

To study changes taking place in the amaranth corn during its processing, among them chemical, amino acid and functional-technological properties of the modified product.

Methods

Standard methods of determination of chemical and amino acid composition of raw materials were used. Methods of evaluation of soya protein functional properties were developed by the Moscow State University of Applied Biotechnology [4].

Results and discussion

As a result of choosing optimal amaranth corn processing regimes a variety of products having nutritional quality were manufactured. Among them a protein-carbohydrate product (PCP - a beige-colour powder), manufactured by liquid carbon dioxide (CO_2) extraction of the amaranth corn, is of great interest. Investigations showed that during processing change in the chemical composition of the product (PCP) extracted from the amaranth corn took place (Table 1).

Table 1. Chemical composition

Sample	Mass share, %				
	moisture	protein	fat	ash	carbohydrates
Amaranth corn	13.0	16.5	8.5	4.9	57.0
PCP	12.4	13.1	5.3	3.7	64.4
Wheat flour, 1st grade	14.3	13.1	2.7	0.7	69.1

Thus, mass share of protein on the average decreased by 3.4%, fat – by 3.2%, and that of carbohydrates increased by 7.4%, compared to the amaranth corn. By protein content PCP is not inferior to the first-grade wheat flour, barley flour (9-10%), and rice flour (7-10%). Lipids, inclusion of which into the meat products formula will favor increase in balance of the product lipid composition due to a higher content of unsaturated fat acids, together with proteins, enter into its composition. Compared to such grain cultures, as wheat, PCP is more balanced by amino acid composition (Table 2).

Table 2. Amino acid composition of some food ingredients

Index	Egg protein	Extrusive wheat flour	Protein-carbohydrate product (PCP)
Amino acid composition, g/100 g of protein:			
valine	7.35	4.57	3.91
histidine	2.50	2.17	3.27
leucine	6.28	7.41	5.20
lysine	9.17	2.72	6.49
isoleucine	6.83	4.73	3.34
methionine	4.13	1.47	1.81
tyrosine	3.97	2.74	3.37
threonine	4.83	3.06	3.21
tryptophan*	1.69	1.08	1.08
phenylalaline	6.73	5.07	3.82
cystine	2.77	2.17	0.91
Sum of amino acids	56.25	37.19	36.41
Balance coefficient	0.70	0.42	0.63
Content of protein in sample, %	11.10	11.20	13.10
Content of effective protein, %	9.24	8.80	11.33

* Tryptophan was determined after alkaline hydrolysis.

Data given in Table 2 testify to the fact that PCP contains lysine and tyrosine 2.4 and 1.2 times as much, respectively, compared to wheat flour. The content of such amino acids as leucine, isoleucine and phenylalanine is somewhat lower than that of wheat flour, but the balance coefficient is 21% and the effective protein content is 7.7% higher.

Functional-technological properties of PCP, making possible proper evaluation of technological usefulness of the above preparation during manufacture of meat products, were studied. Thus, index of its water-binding capacity (WBC) comes to 265% (at the level of soya bean flour water-binding capacity); that of fat-binding capacity (FBC) is 450% (sufficiently higher in comparison with soya isolates and concentrates, whose index varies from 100 to 150%).

In technological practice rheological property of protein preparations – gelatinization plays a very important part (influences the consistency of finished products). It is equal to the amount of protein preparation (g) in mixture with 100 ml of water which forms gel incapable of passing through a screen with 0.5-mm meshes. For PCP this index amounts to 20 g (for soya bean isolates gelatinization value is 12-20 g).

Conclusion

Investigations carried out testify to perspective usage of the amaranth corn processing products (PCP) in meat industry thanks to a high content of protein balanced by essential amino acids; lipids; antioxydant-effect flavonoids; high functional-technological properties, not yielding by the above indices to soya bean protein preparations and the first-grade wheat flour.

Pertinent literature

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