NEW EXTRUDED COMBINATION PRODUCTS

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SUMMARY

On the basis of research data,technology of combination products manufacture using the method of extrusion was developed. Protein components of bones and blood of slaughter animals were chosen as sourcesof raw material of animal origin.

INTRODUCTION

Profound study of different aspects of live activity of human beings revealed necessity of creating new technologies for new food products, containing different rarely used types of raw material of animal origin. This problem acquires global importance and is not limited by food products deficiency alone. The problem is also bound with various diseases from which a lot of people suffer due to high calorie content of consumed food and to nutritive disbalance of food products. In this connection development of new products based on vegetable raw materials and some slaughter by-products (animal blood and bones) acquires special importance.

Various studies of bone and blood processing and their use for food purposes (Faivishevsky et al.,1986,1989; Jobling et al.,1983) created conditions for broad application of these valuable raw material for manufacturing of different food products and medicines. However, complexity of the processes, connected with discolouration of blood, specificity of organoleptical characteristics of products, manufactured with its use, hamper fuller use of blood in food products and medicines.

The aim of the present study was to develop technology for new dietetic food products manufacture on the basis of protein components of bone, blood and vegetables.

MATERIALS AND METHODS

For the new combination products the following components were used: dry bone broth, corn grits, semolina, dried blood of beef animals, dry milk and wheat flour.

Dry broth was manufactured from protein-containing bone extract obtained in course of hydrothermal destruction of bone tissue. Chemical composition of this extract is very close to the product "lensol" (Lensfild Ltd.,England) which is shown in the table.

Using this extract which is a dry protein product, we manufactured a new type of product - dry edible broth, including animal fat, salt, dry vegetables, flavourings. Composition of this dry broth is characterized as follows: moisture 6-8%, fat 19-24%, protein 18-20%, salt 47-52%, calcium 2050-2800 mg/kg, phosphorus 1670-2100, potassium 192-255 mg/kg, iron 3.6-4.7 mg/kg, β-carotine 3.1-3.5 mg/kg, vitamin B_1 0.02-0.03 mg/kg, vitamin B_2 0.04-0.06 mg/kg, vitamin PP 0.32-0.53 mg/kg, vitamin C 20.6-21.5 mg/kg, active acidity of the 2.5% water solution 6.5.

For manufacturing of the combination product with dry broth method of extrusion was used (Treiber, 1990). Extrusion regimes were tested on the double-screw extruder Werner und Pfeider (germany). The process was controlled by temperature, pressure,consumed power of

the main motor of extruder. In the process of work speed of screws varied from 190 to 240 rotations per min., water addition - to 1.5 dm^3/hr, production capacity - from 10 to 21 kg/h. Dried edible blood possessed the following chemical composition: moisture 7.0%, fat 1.5%, protein 86.2%, minerals 5.3%.

TABLE Comparative Chemical Composition of Dry Protein Product and of "Lensol" Product

Indices	Dry protein product	Lensol
Content, %		
moisture	4.7 - 8.0	5.0
nitrogen	13.6 - 15.2	15.5
fat	3.5 - 4.0	3.5
mineral salts	2.7 - 3.0	2.0
Solubility, %	99.0	99.0
Active acidity of the 10% water solution	6.0 - 6.2	5.0 - 7.0

Chemical analysis of the obtained products was done according to standard methods, aminoacid composition was determined with the help of analyser Alfa of LKB (Sweden), vitamins and iron - by standard methods.

In order to characterize these extrudates we used coefficients of explosion and expansion. Under coefficient of explosion we mean the ratio of density of the chopped extrudate and density of the initial raw material, and under expansion coefficient - ratio of diameter of extrudate granules to diameter of die.

Microstructural research of extrudates was performed by cryostate techniques. Cuts were dyed by hematoxyline of Erlich with subsequent dying by osmic acid.

Microbiological studies were conducted by common methods.

RESULTS AND DISCUSSION

As a result of numerous tests on formulations and process parameters we obtained product without burning and adhesion, which was easily cut and dehydrated through evaporation during 20-40 sec.

Finally formulated composition showed good granularity allowing to meter out this mass into extruder using a screw-type batchmeter and to conduct the process at predetermined parameters.

The developed product based on dry bone broth is characterized by the following physicochemical indices: moisture 7.9%, density of the initial mix 0.73 g/cm^3, density of the granulated extrudate 0.35 g/cm^3, explosion coefficient 2.1, expansion coefficient 3.5. The product is highly soluble and has low dymanic viscosity (at dry matter concentration 15%, dynamic viscosity constitutes 0.106 MPa x sec), these parameters evidencing about deep destruction of starch, contained in corn grits, this ensuring good assimilability of the product. Comparative analysis of aminoacid composition of the product and of corn grits confirms this conclusion.

The developed product shows increased content of essential aminoacids as compared to initial corn grits. Thus, total content of the 7 essential aminoacids (except tryptophane) in extrudate equalled 2561 mg/100 g and in initial corn grits - 2055 mg/100 g, namely content of lysine was 250 and 125 mg/100 g, accordingly. These figures prove that the use of bone protein component allows to increase biological value of the finished product. It should be noted that though extrusion destructs flavouring agents (Reineccius, 1990), the use of dry bone broth permits to minimize this effect and extrudate showed favourable taste and aroma. Evaluation of vitamins of B-group proved that the chosen technological regime doesn't lower vitamin content of the product: the content of B_1 was higher than in corn grits, however, the amount of PP decreased.

Extrudate, obtained with the use of dried blood and named "Extruhem", has increased amount of lysine (357 mg/ 1oo g) as compared to product, manufactured with dry broth (250 mg/100 g). This also refers to total amount of sulphur-containing aminoacids (246 mg/100 g vs 174 mg/ 100 g).

For evaluation of bacteriological parameters of finished products, raw material (before extrusion) was inoculated with daily culture of E.coli 1257, 1 x 10^9 cells/ml. Suspension of culture was added at the rate of 500 ml/hr. Analysis of ready extrudates, manufactured with dry broth and blood, didn't show any presence of Bacillus coli, molds, yeasts and Salmonella.

By microstructural research it was established that granules of extruded products look like a mass with large pores, these pores being composed of carbohydrate and lipoprotein substance, which is part of any cereal. This substance links all elements of the product. When corn grits are used, the structure of product consists of smaller pores due to worse hydration of corn starch (fig. 1,2).

Besides a poorly coloured carbohydrate mass the product also contains fragments of cellular membranes of the vegetable component (corn grits), a lot of particles of lipoprotein origin (semolina), and also dark-coloured globules of protein enriched by broth or blood components. These particles have different form, their size varies from 50 to 100 μm. In general they have irregular round contours, some particles acquire protruded form. The main volume of the product is occupied by hollows or pores, their maximum diameter being 200-900 μ m. The presence of large and small hollows ensures porous structure of the product with high rate of its solubility.

CONCLUSIONS

The obtained extruded products possess high solubility and increased biological value and can be used as dietetic foods.

Microstructural research showed that the proposed technology creates lipoprotein complexes and multiple hollows, ensuring high solubility and assimilability of the developed products.

Microbiological research affirmed that the chosen technological regimes inhibit growth of pathogenes and make these products sterile.

fig. 1

Structure of product based on corn grits

X 250

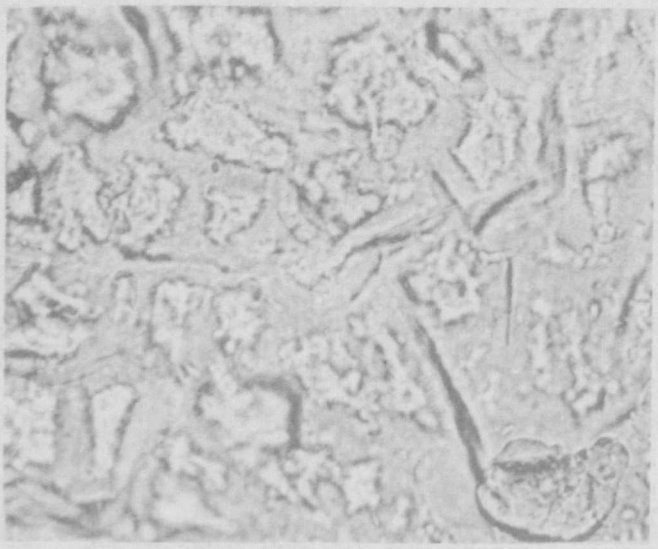
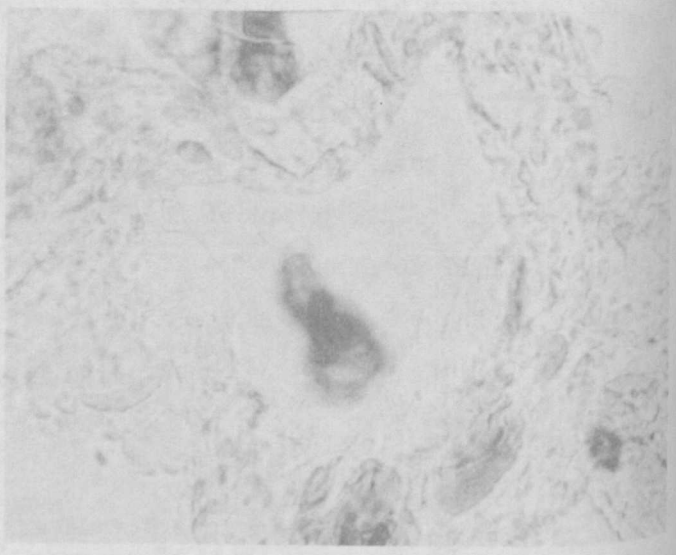


fig. 2

Structure of product enriched by dry blood

X 250



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