

Use of Bacterial Starter Cultures in Production of Meat Products

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ABSTRACT—Obtain functional meat products in our country, various types of raw materials with increased biological activity are used, looking for ways to reduce the calorie content of products by introducing various fortifiers. In this regard, the role of plant products is difficult to overestimate. They are suppliers of vitamins, enzymes, organic acids, essential oils, pectins, dietary fiber, carbohydrates. One of the priority directions of the concept of state policy in the field of healthy nutrition of the population of the republic is the creation of technologies for the production of meat products for dietary purposes, which are easily digestible and prevent various diseases and strengthen the protective functions of the body, reducing the risk of exposure to harmful substances. A reliable way to guarantee an effective solution to this problem is the inclusion in the diet of specialized foods enriched with valuable biologically active substances to a level corresponding to the physiological needs of the human body.

keywords— Amino acids, bacteria, enzymes, hydrolysis, isoflavones, oligosaccharides, microorganisms, starter cultures, proteins, prebiotics, preparation.

I. INTRODUCTION

Nowadays in the meat industry, as before, one of the main tasks remains ensuring the safety of raw materials and finished products and extending their shelf life. Effective inhibition of sanitary-indicative and pathogenic microflora in the production of meat products is carried out by introducing starter crops. In the process of their life, they synthesize specific metabolites: lactic acid, diacetyl, as well as bacteriocins, which suppress undesirable microflora during direct antagonism [1].

Promising direction is the implementation of biotechnological methods in the meat industry, associated with the creation of new technological solutions based on the effective use of both their own enzyme systems of biological objects and purposefully introduced microorganisms (bacterial starter cultures) producing enzymes, proteins, essential amino acids and vitamins. The variety of technological methods for processing meat raw materials with microorganisms allows us to produce high-quality finished products with not only functional but also probiotic properties. Many scientists have shown the promise of using starter cultures (bacterial preparations), consisting of specially selected strains of microorganisms, purposefully acting to reduce the technological process and obtain stable quality indicators of the product [2]. The biotechnological method of processing raw materials allows you to intensify the biochemical processes during meat ripening and improve organoleptic, color, physic-chemical, structural-mechanical, microstructural, microbiological indicators of

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smoked sausages, as well as increase the biological value of the finished product. The introduction of plant-derived additives with prebiotic properties stimulates the growth of propionic acid bacteria and improves the functional and technological properties of minced meat. The use of combined fermentation of propionic acid and bifid bacteria allows you to get the finished product with a high number of viable cells of probiotic microorganisms, improves taste, aroma and extend the shelf life of the finished product.

II. METHODS OF RESEARCH

Scientifically based technology has been developed for producing products of enzymatic modification of a meat product using starter bacterial cultures of various compositions and for various purposes to create new products of increased nutritional value, process intensification, partial or complete replacement of expensive raw materials in formulations, replacement of animal protein with vegetable, decrease cholesterol level.

As with any component that is used in the production of meat products, there are certain requirements for starter crops. Starting crops should be, first of all, safe for health. They must act effectively in the meat substrate, giving the products a pronounced intense color, traditional taste and aroma. As a result of the use of starter crops, the producer must obtain the desired changes in the smoked sausages. In addition, the use of starter crops should not reduce the shelf life of the finished product.

The use of starter crops in the production of fermented sausages allows you to make the production process faster and more economical. The main advantages of using starter crops are as follows:

- suppression of the growth of "wild" microorganisms;
- decrease in pH;
- creating optimal conditions for color formation reactions;
- the formation of flavor characteristics;
- increased lipid stability.

Instead of the unpredictable microflora of "wild" microorganisms, a certain flora of the desired microorganisms should dominate in raw smoked sausages. One of the essential characteristics of starter cultures is the ability to produce lactic acid from carbohydrates and thus contribute to the process of lowering the pH level. The acid-forming bacteria are divided into two groups: "homoenzymatic" and "heteroenzymatic". Heterofermentative bacteria break down sugars not only into the desired lactic acid, but also into undesirable metabolites - acetic acid, propionic acid, alcohol, CO₂ and others.

"Homozyme" bacteria produce only lactic acid from sugars. Since lactic acid is naturally present in meat, it is a typical component of enzymatic sausages. Starter cultures must contain "homoenzymatic" bacteria. "Wild" microorganisms often contribute to heteroenzymatic oxidation [2].

The characteristic of the products of the enzymatic modification of the meat product by the state of the lipid component for 30 days of storage is given. It was shown that the content of TBA-active products, which evaluated the LPO intensity, is quite stable in the analyzed products of the enzymatic modification of the meat product during storage for 30 days. It was found that in the composition of phospholipids in the analyzed samples, changes in their quantitative ratio occur during 30 days of storage.

New data has been obtained on the characterization of the functional properties of enzymatic modification products — foaming ability, foam stability, emulsifying ability, solubility, turbidity (transparency). Using the methods of mathematical design of the experiment, recommendations have been developed on the use of directional biocatalysis in the processing of meat raw materials, which allows to obtain meat products using bacterial starter cultures that have predetermined functional properties with orientation in specific sectors of the food industry.

As a prototype, the objects of bacteriological research were the starting cultures of bifidobacteria, which ensure the rapid formation of soft lactic acid, a delicate aroma, a solid consistency and a pronounced and stable color of the salting.

III. RESULTS

Determine the effect of electromagnetic radiation on starter cultures, a microbiological analysis was carried out according to the growth indicators of microorganisms on meat-peptone agar. The medium used for the initial development of microflora according to the studies does not affect the organoleptic and physic-chemical parameters of the finished product. Based on this, it can be introduced together with the processed crop in the first stages of compilation of minced meat. For preliminary activation, we placed the starter cultures in a nutrient medium and incubated them for 72 hours. After that, they were treated with an electromagnetic field (EMP). The processing results are shown in table 1.

Table 1: Development results of starter cultures after EMF treatment

№	Time, minute	Frequency, Hz	Voltage	Number of microorganisms
1	The control			8,2*10 ⁶
2	30	25	50	3,3*10 ⁷
3	60	25	50	4,3*10 ⁸
4	30	35	75	7,7*10 ⁸
5	60	35	75	2,9*10 ⁸
6	30	45	92	7,7*10 ⁷
7	60	45	92	3,9*10 ⁹
8	30	100	150	2,0*10 ⁸
9	60	100	150	1,7*10 ⁷
10	30	150	50	3,1*10 ⁸

As can be seen from the table, when processing starter cultures with electromagnetic radiation with a frequency of 45 Hz for 60 minutes, we get an intensive growth of microorganisms. From the generalized information about the change in the equilibrium and speed of most chemical reactions in a magnetic field, it follows that the interaction of a magnetic field with vapor and diamagnetic molecules that make up the bulk of the cell is characterized by the energy of the magnetic field. This energy is many orders of magnitude less than

the energy of thermal motion. Thus, we can assume that the magnetic field does not change, and therefore does not violate the nature of the chemical bonds of substances in general and in biological systems in particular.

The magnetic field affects some physicochemical properties of the water in the cells: surface tension, viscosity, electrical conductivity, dielectric constant, light absorption. Changing the properties of water, in turn, leads to a change in the single water system with molecules of proteins, nucleic acids, polysaccharides, lipids. It has been established that, by changing the energy of weak interactions, the magnetic field affects the supramolecular organization of living structures. This leads to quantitative changes in chemically specific reactions, some of which proceed with the participation of enzymes. Magnetic fields are varieties. Some of them activate biological objects. Their basis is a rotating electromagnetic field.

It should be noted that the electromagnetic field and local electromagnetic fields formed around the ferromagnetic particles are variable and, unlike the constant ones, their effect on objects can differ. The oscillatory, rotational and translational motion of ferromagnetic particles, as well as the rotation of the entire vortex layer as a whole, provide intensive mixing of the processed substance in both micro and macro volumes. In places of collision of ferromagnetic particles, pressures of up to a thousand megapascals can occur. In the impact zone, conditions are created for the occurrence of such physical and chemical processes that are difficult or impossible under normal conditions, the crystal lattice of solids is deformed, the chemical activity of substances increases sharply, their degree of dissociation, etc. Therefore, the action of the vortex layer on various systems can lead to a significant change in the state of these systems.

Thus, the electromagnetic processing of starter crops is one of the effective ways that affect their activation.

This physical method allows 1.5–2.0 times faster growth and maturation of fermented sausages.

The introduction of activated starter cultures at the first stages of cutting allows for a short time to lower the pH to the required values of 5.1–5.3. A faster decrease in pH is important not only for inhibiting the growth of putrefactive microflora, whose optimum development is in the pH range 7.0–7.4, but also has a significant effect on the drying rate. The pH value in the range close to the isoelectric point of meat proteins (5.1–5.5) creates better conditions for reducing the water-binding capacity and, accordingly, for drying, is optimal for the formation of nitrosopigments responsible for the color of smoked sausages.

The main results of the studies reflected in the scientific article were discussed and approved at the following international and republican conferences: Republican Scientific and Technical Conference "Local Raw Materials and Technology for their Processing", Tashkent Institute of Chemical Technology (Tashkent, 2018); Republican scientific and technical conference "Environmentally friendly resource-saving technologies for growing, storing and processing agricultural products", Tashkent State Agrarian University (Tashkent, 2018); International Conference "Actual Problems of the Development of Bioorganic Chemistry", Institute of Bioorganic Chemistry, Academy of Sciences of the Republic of Uzbekistan (Tashkent, 2018); Republican scientific and technical seminar "Innovative utility and investment attractiveness of Jerusalem artichoke", Tashkent State University of Economics (Tashkent, 2018); Republican scientific and technical seminar "Creating an innovative, non-tradable technology for processing Jerusalem artichoke of the Fayz Baraka variety and introducing it into production", Tashkent Institute of Chemical Technology (Tashkent, 2019); Republican scientific-practical conference "Innovative development prospects and integration in the agricultural field of

science, education and production", Tashkent State Agrarian University (Tashkent, 2019) and at a seminar under the specialized council D.067.24.03 of the Tashkent Institute of Chemical Technology.

IV. CONCLUSION

As a result of the use of starter bacterial cultures, including bifidobacteria, in the production of meat products, it accelerates the course of biochemical processes, increases the content of lactic and volatile fatty acids, free amino acids, and thereby improves the taste of meat products and their storage stability.

The growth of microflora of starter culture in minced meat prevents the development of bacteria of the colibacillus group at the earliest stages of production of meat products and increases the sanitary and hygienic indicators of the finished product.

- Bifidobacteria protect meat lipids from oxidation, improve the consistency, taste of meat products.

- The positive influence of the proposed bio-technological method of processing raw materials on the organoleptic, physico-chemical, structural-mechanical, microbiological characteristics and biological value of the finished product was revealed.

- The introduction of additives from non-traditional plant materials with prebiotic properties during salting stimulates the growth of propionic acid bacteria and increases the functional and technological properties of minced meat.

- The technology and regulatory documentation for the production of cooked smoked sausages using the combined starter culture of lactic acid bacteria *L. plantarum* and bifidobacteria, as well as a concentrate of propionic acid bacteria were developed.

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