OXIDATION OF MEAT PRODUCTS IN THE PRESENCE OF LACTIC ACID BACTERIA AND ANTIOXIDANT

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Background

In the manufacture of meats the cultures of lactic-acid bacteria, staphylococcus and streptococcus are used as ferments. It is known that in food systems the various kinds of active forms of oxygen (AFO) such as superoxide and hydroxyl radicals, hydrogen, peroxide, and hydroperoxides of lipids are formed. Excess oxidation of lipids impairs the colour of sausages and their nutritive properties on the score of formation of toxicants. The sausages fermented with S. xylosus, had the high content of ketones and volatile organic compounds formed from aminoacids and carbohydrates and imparted non - specific properties. The sausages inoculated with S. warneri had rancidity connected with the aldehyde formation (1).

So in the manufacture of fermented meats it's very important to check the oxidation of lipids in the stock and ready sausage.

Lactic acid bacteria and staphylococcus are facultative anaerobes and have both prooxidant and antioxidant properties.

During the growth of lactic acid bacteria in the glucose-contained medium the generation of active forms of oxygen, unfavourable for human health can take place. In the such conditions the bacteria can produce hydrogen peroxide and superoxide anions. On the other hand it was found the ability of various lactic-acid bacteria strains to inhibit the oxidation of unsaturated fatty acids, for example, lard and to decrease the methyloleate oxidation (2,3).

Antioxidant protection in the bacteria is effected by fermentative and non-fermentative ways. With the example of inhibition of ascorbate autooxidation with non whole-cell extracts of various lactic acid bacteria the possible mechanisms of protection have been studied: chelation of metal ions, intercept AFO, inhibition of ferments produced AFO and reductive ability. Among the bacteria strains studied the thermophilic streptococcus bacteria can bind iron, bifidobacteria had the high reduction ability, can bind copper hydrogen peroxide, and acidophilic bacteria intercept hydroxyl groups (4).

During ferment treatment the proteolysis of meat proteins and their interaction with microorganism metabolites occur. These processes depends on the degree of structural organization of tissues. From the biological point view the products of animal slaughter (tissues and organs) are the highly ordered structures. Technological treatment leads to thear destruction. With the decreasing of physical dimensions of cell structures and their destruction the biochemical processes take place. High temperature rupture cell membrane, the lipid components of which interact with oxygen and are oxidized.

The analysis of literature shows that use of antioxidants, especially synthetic, in the meat products in very effective in the context of decrease of radical formation in perishable meat products. At the same time the lactic acid bacteria can have a priority, becaus they are components natural for human metabolism, but we must point out that the antioxidative properties of these bacteria in meat raw material and products are not clearly understood.

Objectives

The aim of the present paper in the study of oxidation in the heat-treated meat products stored in the same conditions (temperature plus 6-8^0 C). As subjects of experiments we used fat pork and sausages contained fat pork 70 %, beef 25 % salt 2,5% species. Pork was chopped in the diameter of 3 mm. Experiments were carried out with the next objects: A - chopped fat pork; B - cooked sausage; C - cooked sausage with the addition of lactic acid bacteria Lactobacillus acidophilus; D - cooked sausage with the addition of Lactobacillus acidophilus and ethylenediaminetetraacetic acid (EDTA); A- cooked sausage with the addition of butyloxitoluene (BOT) and ascorbic acid.

Methods

Sausages were cooker to our specifications. Lactic acid bacteria were grown on the sterilizated non fat milk. The samples after addition of lactic acid bacteria were kept for 1 n at 20^0 C. Peroxide value was determined by means of hydroiodic acid oxidation with peroxide followed by the titration of iodine with sodium thiosulfate. Thiobarbituric value was determined by the formation of colour compounds during the interaction of the products of lipid oxidation with 2-thiobarbituric acid; the colour intensity was determined spectrophotometrically.

Results and discussion

Data on the degree of lipid oxidation in meat products, show that heat treatment accelerates the oxidation of lipid components. The content of peroxides after heat treatment is 2,5 times greater than before the treatment. The samples of chopped pork and samples not contained lactic-acid bacteria and antioxidants oxidize to a greater extent. The rise in peroxide value in these samples occurs after 5-7 days after storing. The degradation of organoleptic characteristics of these samples is observed at the same time.

In the presence of Lactobacillus acidophilus the oxidation of lipids is more intensive than in the samples free of lactic acid bacteria or in the samples with lactic acid bacteria and EDTA, or in the samples with BOT. It is evident that the addition of chelating agent with acidophilic bacteria leads to the reduction of oxidation intensity.

The formation of secondary products of oxidation in the samples studied depends on the peroxide content. Their greatest amount is found in the chopped pork samples. On the addition of lactic acid bacteria and EDTA to meat product the amount of secondary products is moderately increased (6-8 %) and retains on this level in comparison with the sample without additives to the finish of storage. The least of oxidation products are released in the BOT contained sample for the whole time of storage. The results show that lactic acid bacteria with EDTA decrease the oxidation of product, but to a lesser extent than BOT.

The results obtained are not the strong verification of antioxidative properties of bacteria, but are favorable for the further study of these properties manifestation in meat systems. It is necessary to take into account, that meat stock, as heterogenic system, contains polyvalent metals, heme-contained proteins and ferments which are the main catalysts of lipid oxidation. So meat stock has its own antioxidant system and may contain the additional ingredients. Such technological processes as chopping curing, and cooking also disturb the oxidative balance of muscle tissue. To suggest the functional use of lactic acid bacteria it is required to investigate the conditions of their preparation, which provide the accumulation of antioxidants in meat stock.

An prerequisite to that is the ability of lactic acid bacteria to absorb the high concentration of manganese. Manganese is present in the vegetables and products of animal origin, but its content in vegetables is higher than in meat due to high manganese content in plant's

chloroplasts. Species as ingredient of meat products, are the source of manganese (5), ant this must be allowed for designing and developing products contained lactic acid bacteria.

Pertinent literature

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