

POSSIBILITIES OF UTILIZATION OF DENITRIFYING MICROORGANISMS DURING MANUFACTURE OF MEAT PRODUCTS

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Background

Utilization of nitrites and nitrates when curing meat raw materials remains actual nowadays. One of the important processes taking place therewith is transformation of nitrites into nitrogen oxide. The above process is made more effective with the use of denitrifying microorganisms when curing raw materials.

Objectives

The objective of this study was to develop a meat starter culture having denitrifying (nitrite reducing) properties when curing raw materials under conditions of low positive temperatures, halotolerance improving color formation and other qualitative characteristics of cooked products.

Materials and Methods

Cover pickles used for curing of pork and beef smoked products served as the object of isolation of psychrophilous and halotolerant microorganisms.

In this paper methods of psychrophilous microflora research, methods of cultivation and research of activity of denitrifying microorganisms as well as physicochemical methods of research of nitrite content (according to Griss) and color characteristics of meat products (visually and by the content of nitrosopigments) were used.

In order to isolate perspective strains, cultivation conditions approximated as much as possible to those of meat product curing (0...+4 °C) were created. The degree of reduction of sodium nitrite concentration served as the estimation criterion. The rate of the above process was determined at 2, 4, 6, 10, and 20 °C and common salt concentrations of 2, 3, 4, and 6 %. The initial sodium nitrite concentration was 0.005 – 0.02 %. Cultivation took place in straight-sided bottles without shaking.

Sodium nitrite was added to the meat raw material (ground through dia. 8 mm plate) at the rate of 100 p.p.m. (maximum permissible added sodium nitrite concentration during manufacture of some meat products in Russia). The starter culture was used as dry concentrate preliminarily re-suspended in the curing brine, at the rate of 1×10^7 cells per 1 g of raw material (CFU/g). Sodium ascorbate at the rate of 500 p.p.m. was added to the control as a color forming promoter. The ground meat was forced into a gastight sausage casing of 30 mm in diameter. The curing took place at 4 °C. The cooking was realized in an ultrathermostat, therewith the heating took place at a speed of 1 °C per minute until reaching 72 °C in the stick center and lasted 30 minutes, after which the sticks quickly cooled up to 8 °C.

Results and Discussion

180 strains were isolated; 12 cultures, active denitrifiers under conditions of low positive temperatures, were taken from their number.

As a result of screening, 2 perspective strains of nitrite reducing microorganisms similar by their properties were selected.

Preliminary researches on laboratory animals showed non-pathogenicity of the culture.

The properties of the above microorganism were studied. Thus, pH values within 0.6 didn't negatively affect the growth and properties of the isolated microorganism, and the saturated common salt solution had no destructive effect on it. The dynamics of reduction of sodium nitrite concentration by means of this strain depending on the temperature and the common salt content is given in Figs 1 and 2. It is seen from the diagrams, that the maximum efficiency of action on nitrite is observed on the 3rd - 5th day, and at 18-20 °C – on the 1st day of curing (what indicates to the possibility of using the starter culture during ripening of uncooked smoked sausages).

Proceeding from the given data, the degree of influence of the above starter culture on color characteristics of the cooked product was determined on the 3rd and 5th day after curing. pH of the raw material didn't change in the process of curing and amounted to 6.0-6.2; that of the cooked product was 6.3. The results of the above test are given in Figs 3 and 4.

As it is seen from the given data, this starter culture smoothly transforms nitrites into nitric oxide, what promotes the improvement of color characteristics of meat products, especially at concentrations of the introduced sodium nitrite allowed for usage when curing meat raw material in Russia. In case of usage of higher concentrations of sodium nitrite or nitrates when curing raw materials, utilization of the above starter culture will permit to reduce concentration of nitrites for the moment of thermal treatment of the product, what may decrease the possibility of formation of nitrosamines in the cooked product.

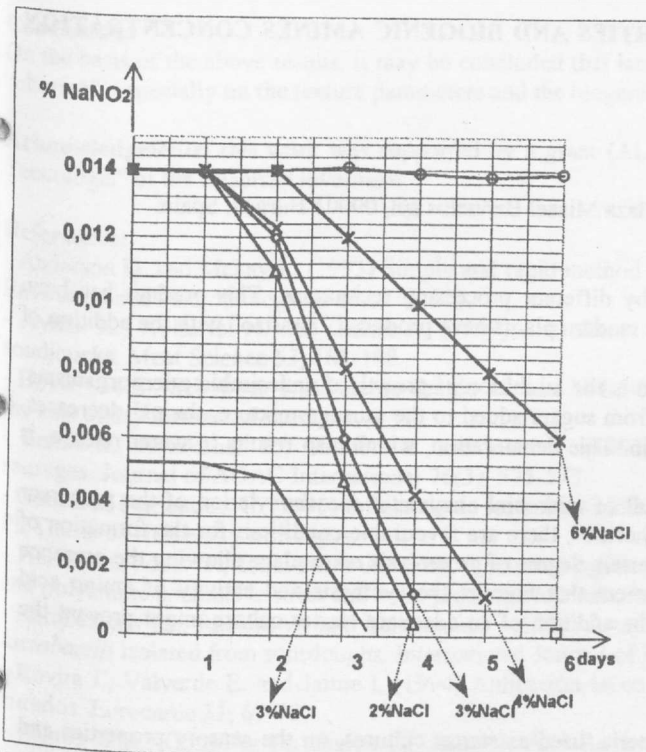


Fig.1. Effect of culture *Par.sp.* on the content of sodium nitrite in model nutrient medium at 6°C and various NaCl concentrations

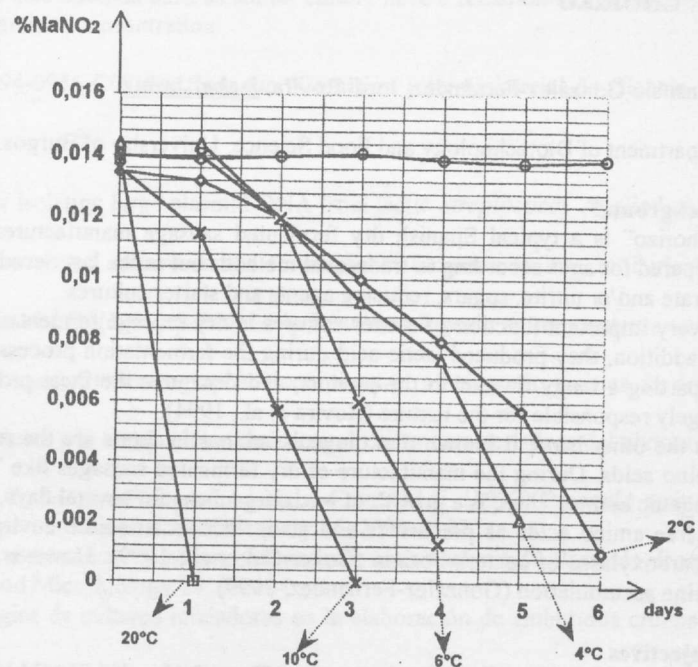


Fig.2. Effect of culture *Par.sp.* on the content of sodium nitrite in model nutrient medium at 3% NaCl content at various temperatures (2-10°C)

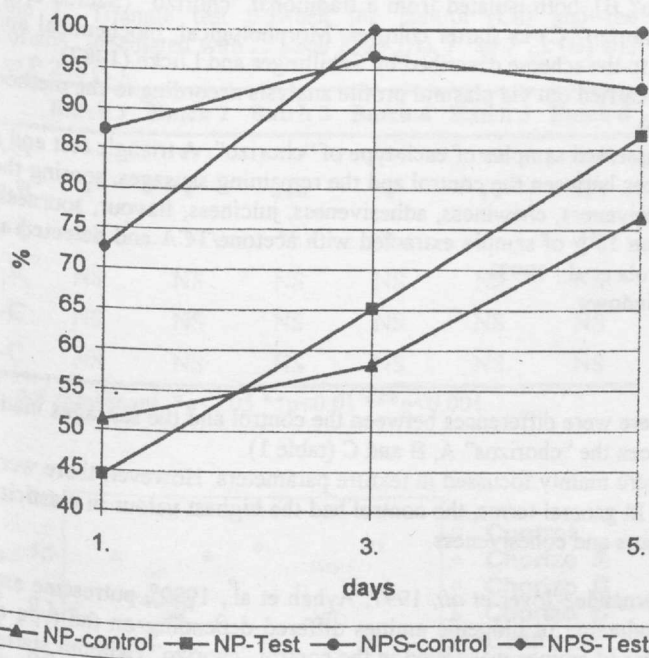


Fig.3. Color characteristics of meat model media NP-Nitrosopigments NPS-Nitrosopigment stability

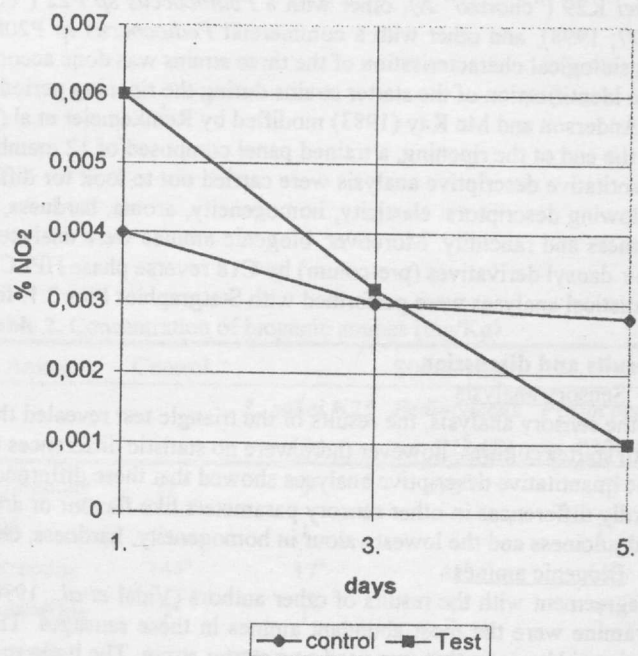


Fig.4. Dynamics of decrease of nitrites in meat model media (cooked)