STUDY OF TRANSFORMATION PROCESSES OF PROTEINS IN STERILIZED MEAT-PLANT PRODUCTS IN POLYMER CONSUMER PACKAGE DURING THEIR PRODUCTION AND STORAGE

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Abstract - results of investigations of proteins destruction of meat-plant sterilized products "Beef with lentil" manufactured in polymer consumer package during their production and storage are presented.

Index terms: meat-plant sterilized products, proteins, products of transformations

I. INTRODUCTION

It is known that thermal treatment of protein-bearing foods at 100-120^{0}C leads to destruction of proteins' macromolecules with dissipation of peptide bonds and formation of complex and simple compounds of non-protein nature. The data about transformation of proteins of canned food products after their production and during storage were obtained earlier (Oreshkin, Timchenko, 1992, Oreshkin, Krokha, Ustinova, 1983). However, such studies relating to sterilized products in new consumer package are actually absent, but this is without doubt is of particular scientific and practical interest in connection with the increase of the range of such products.

Study of dynamics of reduction-oxidation potential value (Eh) of the recipe mixture both during production of foods, and their storage is interesting. It is known that the reduction-oxidation potential is one of the hurdles influencing the quality and shelf life of meat products (Rodel, Scheur, 1998, Rodel, Scheuer, 1999, Rodel, Scheuer, 2000). But thus far, the role of this hurdle in preserved foods technology has not been studied adequately.

II. OBJECTS AND METHODS OF INVESTIGATIONS

Meat-plant sterilized products "Beef with lentil" taken after their production and also during storage served as the objects of investigations. The products were manufactured in flexible polymer package – bags from multi-layer polymer material PET-Al-Bonyl-PP with high hurdle properties. Sterilization of the products was carried out under conditions, ensuring the value of the achieved sterilizing effect of thermal treatment of 10 conditional minutes.

The experimental samples of the products were stored at a temperature not higher than 20^{0}C and relative air humidity not exceeding 75%.

In the course of experimental investigations the following indices were determined: mass fraction of protein, pH value, redox potential (Eh), content of amino-ammonia nitrogen (AAN) and fractional composition of protein.

III. RESULTS AND DISCUSSION

The sterilized products by their appearance were the mixture of lentil, beef and vegetables, uniformly mixed, and having the aroma of spices. The mass fraction of meat – 37%

according to the prescribed norm. The products had high food value with the mass fraction of protein not less than 10% and the ratio protein-fat, equal to 1 :1.2, that is close by its value to the recommended one; energy value of 100 g of the product was 200 kcal.
The obtained experimental data have shown that the process of sterilization influenced primarily the proteins of meat-plant sterilized foods. Thus, the alkaline-soluble fraction, the content of which reduced after sterilization on the average by 19.8-20.0% had undergone the largest changes. Water-soluble fraction of proteins reduced by 14-15%; salt-soluble fraction – by 12-12.5%. The mass share of AAN in the sterilized products in the period of dispatch for storage was 45.4 mg% with the corresponding value prior to sterilization – 42.0 mg%.

Thus, the obtained data suggest about insignificant destructive effect of selected sterilization regimen on protein fractions of meat-plant sterilized products.

Fig. 1 shows the character of changes in the content of AAN of sterilized products during their storage. Analysis of the diagram allows reveal three areas with differed dynamics of AAN content: the first – up to 15 months of storage, the second – from 15 to 39 months of storage, and the third one – after 39 months of storage.

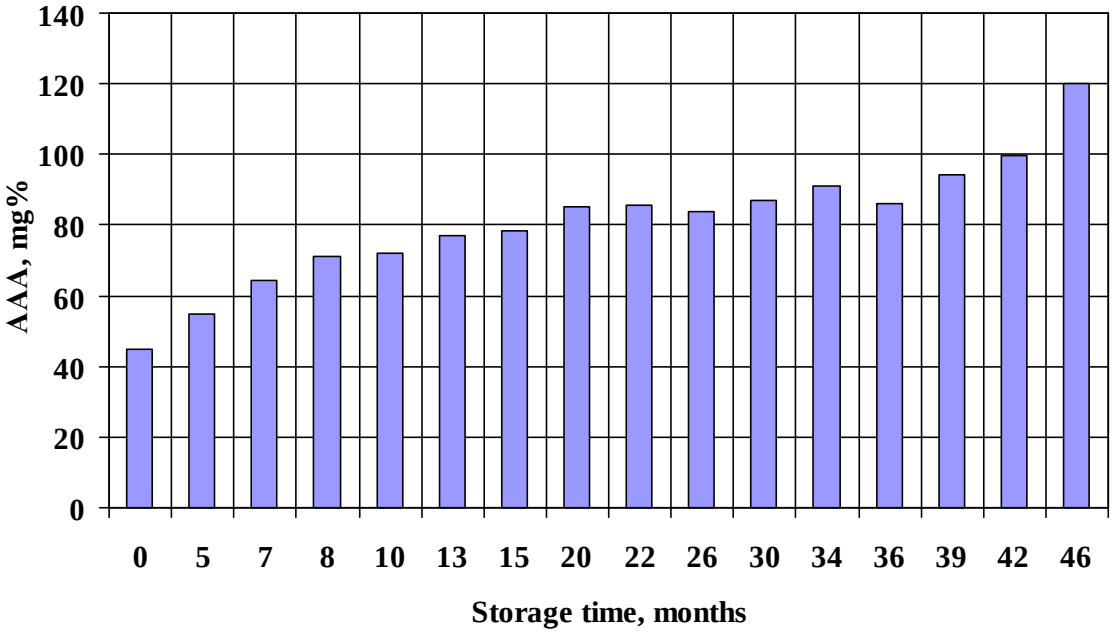

Fig.1. Changes in amino-ammonia nitrogen of sterilized products during storage

Processing of experimental data by least square method led to obtaining the following regression equations for respective storage times of sterilized products:

y_1 = 17.976 ln(x) + 44.136 logarithmic dependence (1)

y_2 = - 0.8446x^2 = 7.5411x = 71.541 polynomial dependence (2)

y_3 = 40.968 ln(x) = 73.565 logarithmic dependence (3)

with correlation coefficients, respectively R^2_1 = 0.99, R^2_2 = 0.64 and R^2_3 = 0.99

Comparison of the values of coefficients B_I in equations 1 and 3 suggests about sharp acceleration of destruction of protein molecules with production of AAN more than twofold after 42 months of storage.

The oxidation processes are known to reduce the acid-base equilibrium index of the system (the higher Eh is, the lower pH is), and the reduction processes promote increasing pH.

Hydrogen possesses the highest reducing capacity, but other substances that are present in the product perform the function of reducing agents, though to a less extent.

The results obtained by us suggest about reduction of the value of oxidation-reduction potential of meat-plant sterilized foods from 145.5 to 135.0 mV, after their sterilization, pH of preserved products in this case actually didn't change.

Fig.2 shows diagrams of change of the redox potential values and pH of sterilized products during their storage.

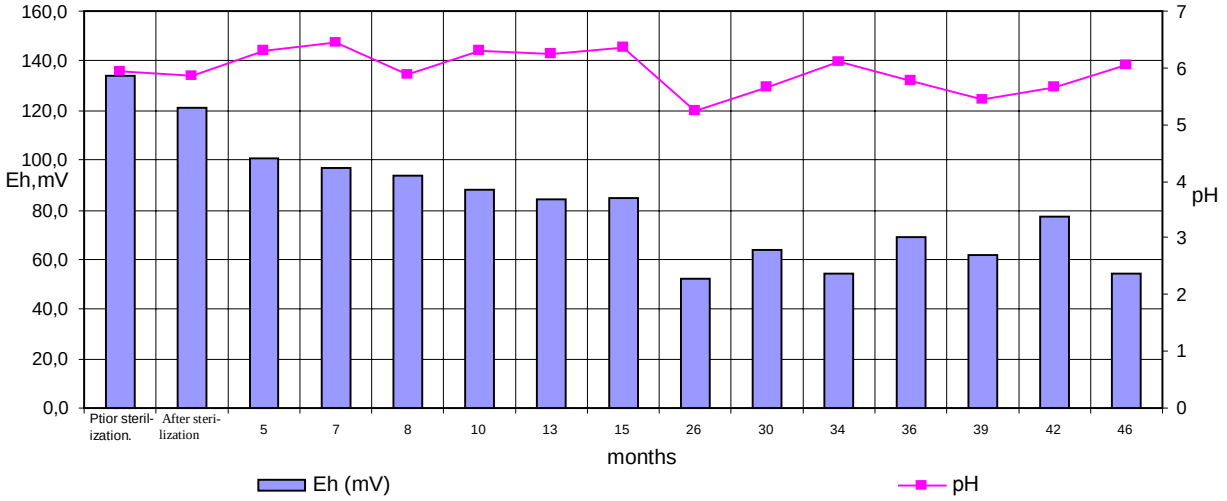

Fig. 2. Dynamics of changes of Eh and pH of sterilized products after production and during storage

Up to 15 month storage period the system was in acetic-alkali equilibrium: Eh value reduced smoothly, and pH actually was constant. After 15 months of storage a jump-like changes in Eh and pH values were observed. As this took place, by 36 an 46 months of storage, while Eh values fell, the growth of pH of the system was observed, in other words, the system tried to be in equilibrium. However, by 39 months of storage an increase in Eh value was observed with simultaneous fall of pH value. This dynamics of the values probably indicates that reduction-oxidation processes in our system are in transition form. Under these conditions both weak oxidation and weak reduction of system elements take place.

Thus, the selected regimes of sterilization led to insignificant changes in fractional composition of proteins. The velocity of proteins breakdown with the accumulation of AAN is most intensive by 15 months of storage, and from 39 to 46 months of storage. After 15 months of storage a disturbance of reduction-oxidation equilibrium of the system was observed.

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