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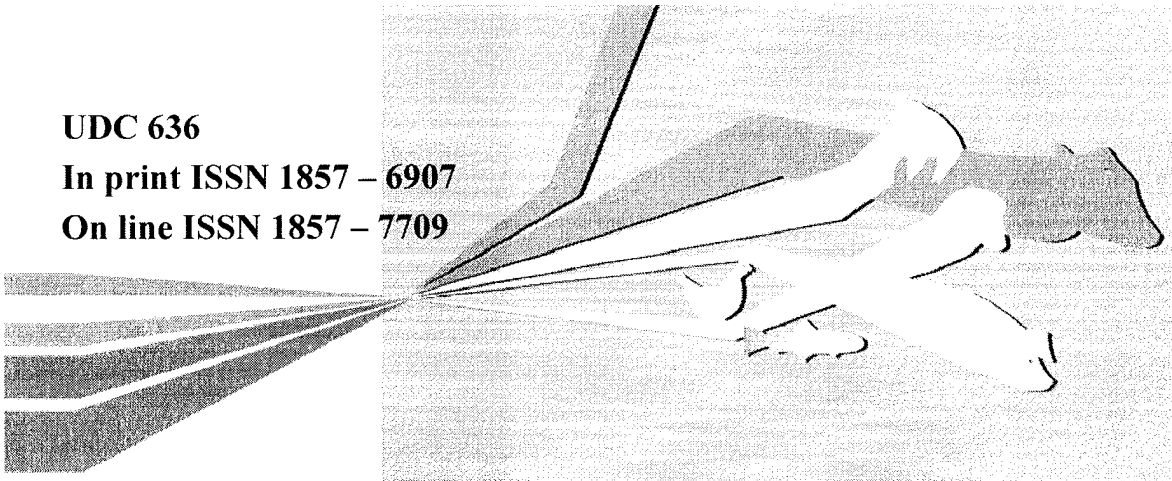

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THE NATURAL ADDITIVE WITH ANTIOXIDANT PROPERTIES FOR MEAT PRODUCTS

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The possibility of application of polyfunctional additive with antioxidant properties in meat products has been considered in the article. The additive has been obtained as a result of phenol compounds and polysaccharide combination. The biologically active components have been extracted by microwave extraction from grape seeds. The correlation of the compounds polyphenols and polysaccharide has been optimized, the mechanism of their interaction has been determined. The technology of its application in meat products has been worked through. The significant decrease of the amount of peroxide compounds in the product with the additive during storage has been found out, stability of the introduced compounds towards technological factors influence, including high temperatures, has been pointed out.

Key words: meat products; polyphenols; polysaccharide; antioxidant properties

ПРИРОДЕН ДОДАТОК СО АНТИОКСИДАНТНИ СВОЈСТВА ЗА МЕСНИ ПРОИЗВОДИ

Во трудот е разработена можноста за примена на полифункционален додаток со антиоксидантни својства во производите од месо. Адитивот е добиен врз база на соединенија на фенол и комбинација на полисахариди. Биолошки активните компоненти се екстрахирани со микробранова екстракција од семе од грозје. Корелацијата помеѓу полифенолните соединенија и полисахаридите беше оптимизирана, а механизмот на нивната интеракција утврден. Технологијата на нивната примена во месни производи се работеше целосно. Утврдено е значително намалување на содржината на пероксидни соединенија во производот со додаток за време на складирањето, стабилност на внесените соединенија кон влијанието врз технолошките фактори вклучувајќи и високи температури.

Клучни зборови: месни производи; полифеноли; полисахариди; антиоксидантни својства

INTRODUCTION

Manufacture of meat products requires a significant amount of additional ingredients, ensuring the necessary commodity characteristics. These supplements don't always provide safety of manufactured products. Some meat auxiliaries have strict limitations in the dosage, however, their use is necessary technological condition, for example, sodium nitrite.

Necessary antioxidants are taken into a separate group of additives. Triglycerides of fat-containing food products, in particular meat products, are exposed to rapid rancidification. Used preservatives in small concentrations do not always have an antioxidant effect if concentration is higher the preservatives may negatively affect the organoleptic and functional performance of the product, as well as the human health. The most commonly used synthetic antioxidants are butylhydroxytoluene (BHT, ionol E321), butylhydroxyanisolum (BOA, E320) isoascorbic (erithorbic) acid (E315), izoaskorbat sodium (E316). The content limit of these substances, the product storage period of which is not increasing any more, is 0.02%. However, some manufacturers do not adhere to the

strict limitations on the dosage and use higher concentrations of antioxidants. According to WHO, if these substances dose exceeds 0.5 mg/kg of the body weight, they constitute danger to the human body [1].

Alternative to synthetic additives may be the use of substances derived from natural sources – plants. Many natural substances have antioxidative properties, but the degree of their manifestation is different and depends on various factors. They include vitamins, flavonoids, amino acids, etc. These substances act on the human body softer than the ingredients of synthetic origin [2].

Lately flavonoid bandings are of great interest to the scientists. Flavonoids are oxygenated heterocyclic compounds, at the base of which lies diphenyl-propane carbon skeleton [3]. Bioflavonoids conduce capillary strengthening, work against water retention and develop antimicrobial action on the human body. They are also known as weak cardiac funds which can regulate heart rhythm reductions and increase their amplitude, normalize pulse, influence blood composition, and reduce cholesterol, have positive influence on digestion, increasing the intestine tone [4, 5]. In addition, some of the bioflavonoids evince antioxidant properties, in particular catechin, epikatechin, etc.[6]. It is the antioxidant effect of polyphenols which finds its application in the food industry.

The most widely used additives for food products on the base of polyphenols extracted from medicinal plants are: Manzanita (*Arctostaphylos uva-ursi* (l.) Spreng.), bergenia (Bergenia Moench), terminal block (*Scutellaria* L.), St. John's wort (*Hypericum* L.), bark of oak (*Quercus* l.) and others [7], grape seeds [8]. The peculiarity of the considered examples is technology using crushed vegetative raw material, or extracts phenolic connections. However, in these cases it is possible to decrease the biological activity of the polyphenols due to oxidation, the influence of external factors. Therefore, the aim of our research was creation of supplements with antioxidative properties for food products, in particular for meat products.

EXPERIMENTAL OR THEORETICAL BACKGROUND

The main source of polyphenols with a high biological activity was grape seeds of «Isabella», the choice was influenced by the preliminary studies of the antioxidant activity of the same raw material received in the southern region of Ukraine. The direct extraction of the required substances was produced by microwave extraction at a temperature of no higher than 45 °C, extractant – water-alcohol solution. The obtained extract has two drawbacks – it is unstable during storage due to the oxidation of phenolic compounds by air oxygen, and by the light quanta and is not acceptable for use in meat products because of alcohol presence. Therefore it was necessary to create a Supplement with high technological properties and a strong antioxidant effect.

In the course of the studies different methods and techniques have been used. Determination of phenolic compounds in the extract was carried out at the liquid chromatograph "Agilent 1100" with matrix-diod detector for time exposure standards and spectral characteristics. The content of phenolic compounds was determined in mg/l, the derivative of genestein in terms of the genestein, kempferol in terms of rutin. The data of chemical composition of the extract is given in the following Table 1.

Table 1

Chemical composition of extract

№	Connections	mg/l
1	Gallic acid	33.3
2	(+) – D-Katechin	103.3
3	(-) – Epikatechin	125.4
4	Quercetinum	5.3
5	Oligomerous procianidins	350.0
6	Polymeric procianidins	1803.4
7	Sum of phenolic high-efficiency liquid chromatography	2420.6

Objects to create a composition of additives were polysaccharides that had traditionally been used in the meat industry: carrageenan, gum of the carob tree, gum of guara and maltodextrin, that were mixed with the polyphenols extract in different proportions. The evaluating criterion for assessing the efficiency of the admixture was antioxidant activity (AoA) [9]. The optimal variants of studied compositions were dried by a lyophilization dryer at a temperature of no higher than 40 °C and were included into the model meat stuffing (poultry mechanical extra chisel), and then into semi-finished products (meat raw materials: 50%

of chicken fillet and 50% of mechanical extra chisel meat). The storage of meat samples was carried out at a temperature of –18 °C.

The research was carried out according to the following scheme: polysaccharide-media choosing for the obtained extract – optimization of the meat making system concentration – technology development of making the chopped frozen semi-finished products.

At the first stage of studies the impact of selected polysaccharides on the antioxidative activity of polyphenols was examined. For comparison anionic polysaccharide carrageenan and neutral: guara comedy, guara carob tree and maltodextrin were chosen. The testing results of the optimal ratio of the extract polyphenols and polysaccharides are shown at Figure 1. The analysis of the data of Figure 1 shows that the neutral polysaccharides take the antioxidant activity themselves from 32 to 36%, anionic carrageenan – 6%. It may be assumed that the manifestation degree of antioxidant activity by polysaccharides is explained by their chemical nature, and neutral compounds form a protective shield around the polyphenols, and sulphate group carrageenan contribute to their oxidation. The mixing extract with non-ionic polysaccharides we can observe an antioxidative activity reduction due to the mass fraction of polyphenols decrease in the system. However, in the composition with maltodextrin in the ratio of the extract: polysaccharide – 1:4 there is maximum AoA, which is explained by the synergetic effect. This composition became a base for a comprehensive supplement with antioxidant properties. After drying by the lyophilization dryer, the system retains its original properties within 6 months with the moisture maintenance not more than 20%.

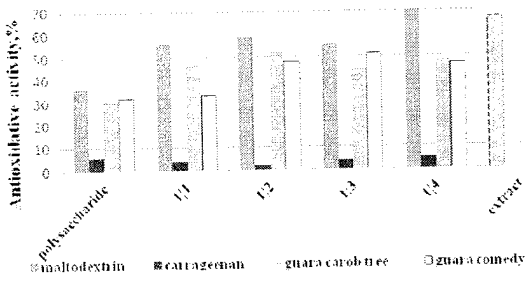
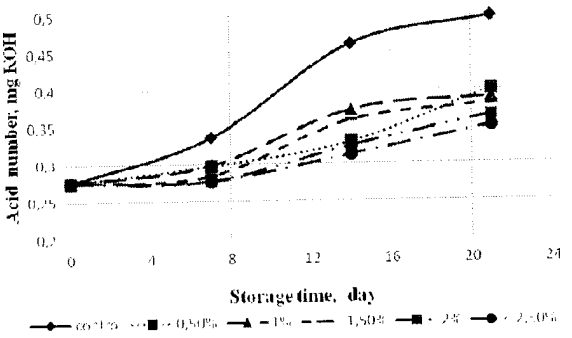
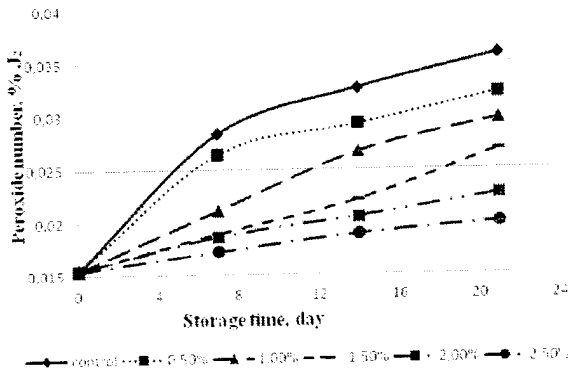


Fig. 1. Correlation influence of extract fenolic connections of grape seeds and polysaccharides on AoA composition

The next stage of the research was to study the possibility of using the additives in forcemeat systems. The Figure 2 shows the changes of acid and peroxide numbers in model forcemeat systems storage at a temperature of –18 °C. The additive was included into the samples in the range of concentrations from 0.5 to 2.5%. The curve analysis shows that the concentration increase of additive including reduces the speed of hydrolytic and oxidative stuffing processes. It should be noted that significant differences in the values of the acid number of prototypes with the additive after 3 weeks of storage is not observed. The speed of accumulation of peroxide compounds during the storage is decreased as the concentration of additives is increased (Fig. 2b), that is the evidence of a sample with the additive of 2.5% almost two times less than that of the control. Taking into account the fact that the difference between the peroxide number of samples with the additive of 2.0 and 2.5% is negligible (0.0029% J_2) we accept concentration of 2.0% for operating with the content of phenolic compounds of 6.8 mg/dm^3.



a)

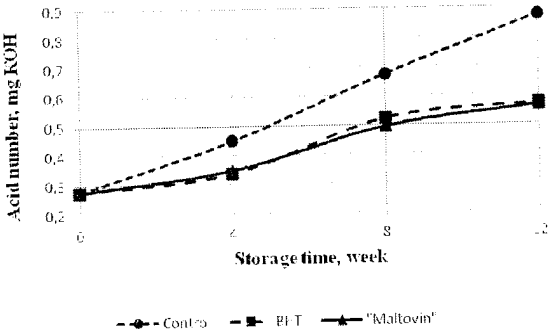


b)

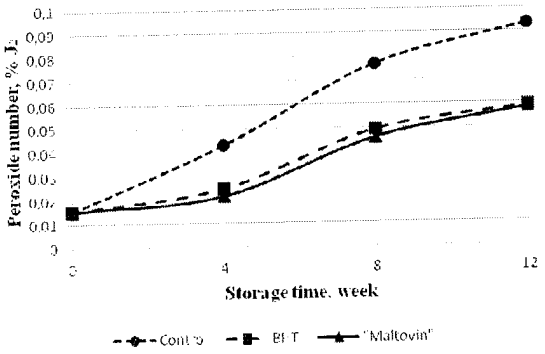
Fig. 2. Study of influence of additive on acid (a) and peroxide (b) number of the stuffing systems at storage

The next stage of the research was testing the created composition on the frozen chopped semi-finished products from chicken meat. The choice

of the product was based on the fact that these products had a long shelf life, as well as in their composition was enriched with raw materials unsaturated fatty acids (due to the meat of mechanical extra chisel), that were exposed to rapid oxidation even at sub-zero temperatures. To determine the efficiency of the developed additive, in parallel a serie of experiments with classical antioxidant – butylhydroxytoluene (BHT) at a concentration of including 0,006% was conducted. The results are presented in Figure 3.



a)



b)

Fig. 3. Study of influence of addition on acid (a) and peroxide (b) number of the chopped ready-to-cook foods at storage

From the data of Figure 3 (a, b) it can be seen that the proposed additive slightly reduces the rate of hydrolysis of triglycerides and slows the process of oxidation, which in general is not inferior to Osh, and although the frozen semifinished peroxide number is not normative in the assessment of the quality of the product it is seen in the diagram, that the reference samples can be attributed to spoiling after 3 months of storage, because of lipids oxidation, tested ones – have a great amount of the storage time.

RESULTS AND DISCUSSION

According to the presented research, we can make the following conclusions:

1. Grape seeds are rich in phenol compounds, which can be extracted from the raw material microwave extraction.

2. To create a high-tech supplement with antioxidant properties it is rational to use maltodextrin in the ratio of the extract polysaccharide – 1:4.

3. When used in meat stuffing systems, the created additive shows a stable antioxidant effect at a concentration of registration of 2.0% to the weight of the main raw material. It will allow producers to increase significantly the storage time of frozen chopped semi-finished products.

4. The proposed additive consists of natural origin raw materials, and used in food will not cause harm to human health.

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