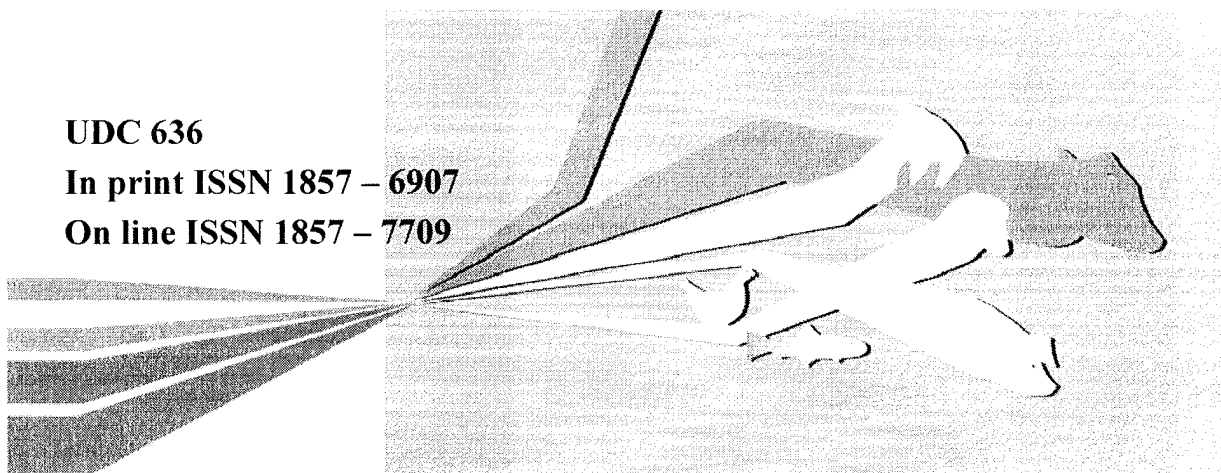


UDC 636

In print ISSN 1857 – 6907

On line ISSN 1857 – 7709



# MACEDONIAN JOURNAL OF ANIMAL SCIENCE



<i>Maced. J. Anim. Sci.</i>	Vol. <b>2</b>	No. <b>4</b>	pp. <b>363–428</b>	Skopje <b>2012</b>
-----------------------------	------------------	-----------------	-----------------------	-----------------------

<b><i>Maced. J. Anim. Sci.</i></b>	<b>Vol. 2</b>	<b>No. 4</b>	<b>pp. 363–428</b>	<b>Skopje 2012</b>
------------------------------------	-------------------	------------------	------------------------	------------------------

## MACEDONIAN JOURNAL OF ANIMAL SCIENCE

<http://www.mjas.ukim.edu.mk>

Published four a year Излегува четири пати годишно

Published by: Издава:  
 “Ss. Cyril and Methodius” University in Skopje. Универзитет „Св. Кирил и Методиј“ во Скопје.  
 Institute of Animal Science Институт за сточарство

### ADVISORY BOARD ИЗДАВАЧКИ СОВЕТ

**Vasil Kostov (Skopje, Republic of Macedonia), President**

Dunixi Gabiña (Saragosa, Spain), Antonio Borghese (Monterotondo, Rome, Italy), Bone Palaševski (Skopje, R. Macedonia),  
 Marek Bednarczyk (Bydgoszcz, Poland), Oktay Gürsoy (Adana, Turkey), Stojan Beličovski (Skopje, R. Macedonia), Birger Svihus (Ås, Norway),  
 Nikola Jordanoski (Skopje, R. Macedonia), Juha Kantanen (Jokioinen, Finland), Frits van Vugt (Den Haag, Netherlands),  
 Risto Ilkovski (Skopje, R. Macedonia), Salah Galal (Cairo, Egypt)

### EDITORIAL BOARD

*Editors in Chief*

**Nikola Pacinovski, Ph. D.,** Skopje, Republic of Macedonia

**Goce Cilev, Ph. D.,** Skopje, Republic of Macedonia

*Secretaries*

**Natasha Gjorgovska, Ph. D.,** Skopje, Republic of Macedonia

**Zoran Naletoski, BSc.,** Skopje, Republic of Macedonia

*Editors*

**William Hohenboken,** Oregon, USA

**Matthias Gauly,** Goettingen, Germany

**Sandra Edwards,** Newcastle, United Kingdom

**Elżbieta Martyniuk,** Warszawa, Poland

**Mirjana Menkovska,** Skopje, Republic of Macedonia

**Miran Kastelič,** Ljubljana, Slovenia

**Sandor Kukovics,** Herceghalom, Hungary

**Erbay Bardakcioglu,** Aydin, Turkey

**George Dimov,** Sofia, Bulgaria

**Giovanni Martemucci,** Bari, Italy

**Jozef Bulla,** Nitra, Slovak Republic

**Milan Adamović,** Belgrade, Serbia

**Mohamed Refaei Mostafa,** Cairo, Egypt

**Zvonko Antunović,** Osijek, Croatia

**Nedeljka Nikolova,** Skopje, Macedonia

**Roland Poms,** Vienna, Austria

**Ivan Bahelka,** Lužjanky, Slovak Republic

**Branislav Živković,** Belgrade, Serbia

**Rodne Nastova-Gjorgjioska,** Skopje, Republic of Macedonia

**Hayati Köknaroglu,** Isparta, Turkey

### UREDUVACHKI ODBOR

*Главни уредници*

**Д-р Никола Пачиновски,** Скопје, Република Македонија

**Д-р Гоце Цилев,** Скопје, Република Македонија

*Секретари*

**Д-р Наташа Ѓорговска,** Скопје, Република Македонија

**Д-р Зоран Налетоски,** Скопје, Република Македонија

*Уредници*

**William Hohenboken,** Орегон, САД

**Matthias Gauly,** Гетинген, Германија

**Sandra Edwards,** Њукастл, Велика Британија

**Elżbieta Martyniuk,** Варшава, Полска

**Mirjana Menkovska,** Скопје, Република Македонија

**Miran Kastelič,** Љубљана, Словенија

**Sandor Kukovics,** Херцегхалом, Унгарија

**Erbay Bardakcioglu,** Ајдин, Турција

**George Dimov,** Софија, Бугарија

**Giovanni Martemucci,** Бари, Италија

**Jozef Bulla,** Нитра, Словачка

**Milan Adamović,** Белград, Србија

**Mohamed Refaei Mostafa,** Каиро, Египет

**Zvonko Antunović,** Осиек, Хрватска

**Недељка Николова,** Скопје, Република Македонија

**Roland Poms,** Виена, Австрија

**Ivan Bahelka,** Луџанки, Словачка

**Бранислав Живковиќ,** Белград, Србија

**Родне Настова-Ѓорѓиоска,** Скопје, Република Македонија

**Hayati Köknaroglu,** Испарта, Турција

Cover by: **Blagoja Bogatinoski**

Нацрт на корицата: **Благоја Богатиноски**

Technical editor: **Blagoja Bogatinoski**

English language adviser: **Iliinka Grubović**

Macedonian language adviser: **Georgi Georgievski**

Proof-reader: **Alena Georgievska**

UDC: National and University Library “St. Kliment Ohridski” – Skopje (Valentina Dojcinovska-Ilioska)

Технички уредник: **Благоја Богатиноски**

Лектор за англиски јазик: **Илинка Грубовиќ**

Лектор за македонски јазик: **Георги Георгиевски**

Коректор: **Алена Георгиевска**

УДК: НУБ „Св. Климент Охридски“ – Скопје (Валентина Дојчиновска-Илиоска)

Address

**MACEDONIAN JOURNAL OF ANIMAL SCIENCE**

(Editorial Board)

“Ss. Cyril and Methodius” University in Skopje

**Institute of Animal Science**

P.O. Box 207, MK-1001 Skopje, Republic of Macedonia

E-mail: [mjas@ukim.edu.mk](mailto:mjas@ukim.edu.mk)

Adresa

**MACEDONIAN JOURNAL OF ANIMAL SCIENCE**

(Редакција)

Универзитет „Св. Кирил и Методиј“ во Скопје

**Институт за сточарство**

п. факс. 207, МК-1001 Скопје, Република Македонија

п. факс. 207, МК-1001 Скопје, Република Македонија

Printed by: „Grafotisok“ – Skopje

200 copies

Price: 1600 den.

Printed in May 2013

Печати: „Графотисок“ – Скопје

Тираж: 200

Цена: 1600 ден.

Бројот е отпечатен во мај 2013

<b><i>Maced. J. Anim. Sci.</i></b>	<b>Vol.</b> <b>2</b>	<b>No.</b> <b>4</b>	<b>pp.</b> <b>363–428</b>	<b>Skopje</b> <b>2012</b>
------------------------------------	-------------------------	------------------------	------------------------------	------------------------------

## TABLE OF CONTENTS – СОДРЖИНА

### Genetics and selection – Генетика и селекција

#### 129 Yalcin Bozkurt

- Performance of Holstein male and female calves grown under Mediterranean winter climate conditions**  
(Перфоманси на машки и женски телиња од расата холштајн одгледувани во медитеранските зимски климатски услови)..... 365–368

#### 130 Blerta Mehmedi, Taulant Kastrati, Luigj Turmalaj, Klajdi Nallbani

- Increasing the level of fertility in cows by hormonal treatment**  
(Зголемување на нивото на плодноста кај крави со хормонален третман)..... 369–372

#### 131 Ratko Mijatović, Stoja Jotanović, Marinko Vekić, Đorđe Savić, Mustafa Podžo, Blagoje Stančić

- Influence of hormone-vitamin-mineral treatment of Württemberg ewes on reproductive efficiency in deep off-season**  
(Влијание на хормонско-витаминско-минерален третман врз репродуктивната ефикасност кај овци од расата Württemberg, длабоко надвор од сезоната) ..... 373–377

#### 132 Atanas Nitovski, Milenko Milenković, Bisa Radović, Valentina Milanović, Dragana Grčak, Milovan Grčak

- Making a plan of biosecurity on a pig farm**  
(Изработка на план за биосигурност на свињарска фарма)..... 379–387

### Animal nutrition – Исхрана на домашни животни

#### 133 Nese Nuray Toprak, Aydan Yilmaz

- Effects of phytase and DCP supplementation on performance, egg quality, some serum, tibia and excreta characteristics of barley based protein deficient quail diets**  
(Влијание на додавањето фитаза и ДКФ во храната за препелици составена од јачмен со пониска содржина протеини врз перформансите, квалитетот на јајцата, некои карактеристики на серумот, тибијата и екскретите) ..... 389–396

### Food safety and quality – Квалитет и безбедност на храна

#### 134 Julijana Tomovska, Velina Stefanovska, Vesna K. Hristova, Nikola Georgievski

- Examination of aflatoxins B<sub>1</sub> and G<sub>1</sub> in feed**  
(Испитување на афлатоксините B<sub>1</sub> и G<sub>1</sub> во добиточна храна)..... 397–404

135 Oksana Savinok, Inna Litvinova, Aco Kuzelov

**The natural additive with antioxidant properties for meat products**  
(Природен додаток со антиоксидантни својства за месни производи) ..... 405–408

**Sustainable livestock production, fishery and honey-bee keeping**  
**Одржливо сточарско производство, рибарство и пчеларство**

136 Rodne Nastova, Vasil Kostov, Nedeljka Nikolova

**Influence of a different water exchange rate on the growth of rainbow trout (*Salmo trutta*)**  
(Влијание на различните нивоа на протокот на вода врз растежот на калифорниската пастрмка  
(*Salmo trutta*))..... 409–412

**Economics in animal husbandry – Економија во сточарството**

137 Zornitsa Stoyanova

**Strategies for rural development in Bulgaria within the LEADER approach**  
(Стратегии за рурален развој во Бугарија во рамките на пристапот LEADER) ..... 413–418

138 Tošo Kostadinov

**The state of rural entrepreneurship in the Republic of Macedonia**  
(Состојбата на руралното претприемништво во Република Македонија) ..... 419–424

**Instructions to authors** ..... 425–428

## THE NATURAL ADDITIVE WITH ANTIOXIDANT PROPERTIES FOR MEAT PRODUCTS

Oksana Savinok<sup>1</sup>, Inna Litvinova<sup>1</sup>, Aco Kuzelov<sup>2</sup>

<sup>1</sup>Odessa National Academy of Food Technologies, Odessa, Ukraine

<sup>2</sup>Faculty of Agriculture, University Goce Delčev, Štip, R. Macedonia  
savoksamit@mail.ru

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 ma-

terial 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	Oligomeric 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 guar 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  $-18^{\circ}\text{C}$ .

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: guarana comedy, guarana 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 antioxidative 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%.

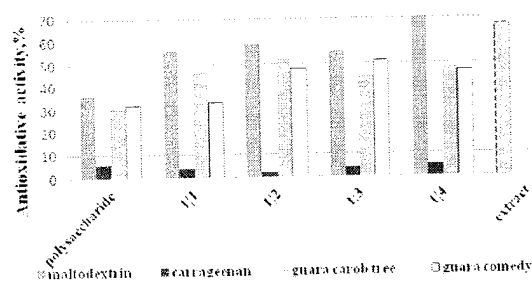


Fig. 1. Correlation influence of extract fenolic connections of grape seeds and polysaccharides on AoA composition

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  $-18^{\circ}\text{C}$ . 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 ( $0.0029\% \text{ J}_2$ ) we accept concentration of 2.0% for operating with the content of phenolic compounds of  $6.8 \text{ mg/dm}^3$ .

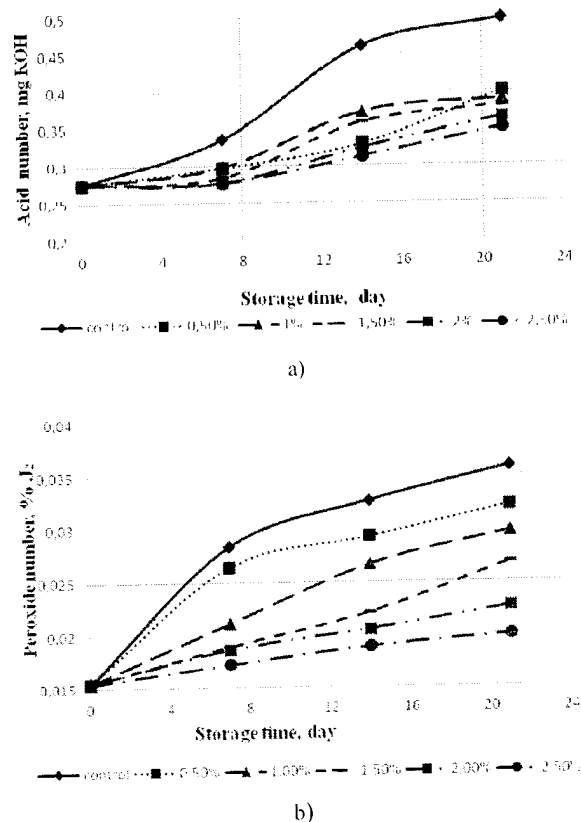


Fig. 2. Study of influence of additive on acid (a) and peroxide (b) number of the stuffing systems at storage

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 series of experiments with classical antioxidant – butylhydroxytoluene (BHT) at a concentration of including 0,006% was conducted. The results are presented in Figure 3.

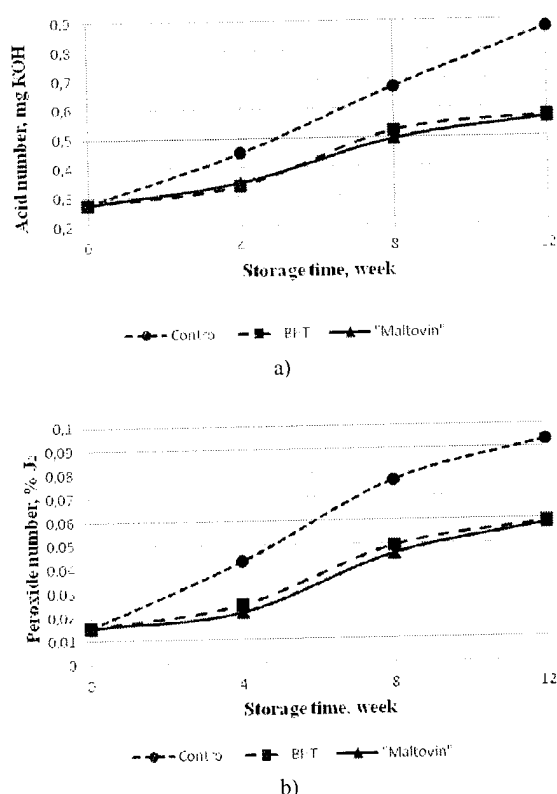


Fig. 3. Study of influence of addition on acid (a) and peroxide (b) number of the chopped ready-to-cook foods at storage

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.

## REFERENCES

- [1] Кушнир Ю. (2004): Пищевые добавки для производства мясной продукции. Антиокислители. *Мясной бизнес*. № 1 (19). с. 26–31.
- [2] Shahidi F. (1997): *Natural Antioxidants*. Chemistry, Health Effects and Applications. Champaign, Illinois: AOCS Press. 414 p.
- [3] Харборн Дж. (1968): *Биохимия фенольных соединений*. Изд-во Мир, Москва, с. 451.
- [4] Барабой В. А. (1976): *Биологическое действие растительных фенольных соединений*. Изд-во Наукова думка, Киев, с. 253.
- [5] Фенольные соединения и их физиологические свойства. *Материалы 2-го Всесоюзного симпозиума по фенольным соединениям*. Изд-во Наука, Алма-Ата. 1973. с. 237.
- [6] Запрометов М. Н. (1964): *Биохимия катехинов*. Изд-во Наука, Москва, с. 294.
- [7] Плотников Е. Е., Глазова Г. В., Ашихина Л. А., Гавриленко А. П., Жучков А. А., Толкунова Н. Н. (2010): Растительные антиоксиданты в производстве мясных изделий. *Мясная индустрия*. № 7. с. 26–28.
- [8] Токаев Э. С., Манукян Г. Г. (2009): *Сравнительная характеристика антиоксидантной активности растительных экстрактов. Хранение и переработка сельхозсырья*. с. 36–38.
- [9] Салькова Е. Г., Амзашвили М. Г. (1987): Изучение антиокислительной активности экстрактов кутикулы яблок. *Прикладная биохимия и микробиология*. Т. 23. № 5. с. 686–691.