*Досліджено зміну активної кислотності у купажованих продуктах з овочевої та фруктової сировини. Доведено можливість регулювати активну кислотність введенням у рецептуру консервів фруктів з високою титрованою кислотністю.*

*Абрикоси, аґрус, алича, чорна смородина характеризуються високим вмістом титрованої кислотності, то ж здатні замінити в рецептурі консервів органічні кислоти, отримані штучним шляхом. З кабачків, гарбузів, моркви та буряків можна виготовляти натуральні органічні пюре, соки, компоти, соуси, натуральні овочеві консерви з регульованою активною кислотністю не вище 3,9 од. рН. Для досягнення такого рівня активної кислотності у консервах варто довести масову концентрацію титрованої кислотності до 0,55–0,60 %. Виготовлені таким способом консерви мікробіологічно стабільні та безпечні за температури стерилізування 100 °С впродовж 20–25 хвилин, мають високу органолептичну оцінку, в них добре зберігається аскорбінова кислота. У пюре з гарбузів визначена масова частка титрованої кислотності 5,6 од. рН. У купажованих пюре з гарбузів та абрикос, аґрусу й аличі активна кислотність знизилась до 3,80–3,84 од. рН після додавання розрахованої рецептурної кількості фруктової частини у композиції від 11,3 до 28,1 %, вміст аскорбінової кислоти підвищився у 1,6–2,6 раза. Вміст аскорбінової кислоти у пюре з гарбузів та чорної смородини за регульованої активної кислотності 3,86 одиниць рН підвищився до 30,6 мг/100 г, тобто у 7,6 раза. Аналогічна тенденція в купажованих пюре з моркви та буряка столового.*

*Виготовлені таким способом овочево-фруктові пюре та соуси характеризуються відмінною органолептичною оцінкою якості 26,3–29,3 бала. Консервовані продукти з овочевої сировини з регульованим рівнем активної кислотності за рахунок фруктової частини є натуральними з підвищеним вмістом аскорбінової кислоти. Комбінування може бути застосованим для виготовлення органічних продуктів з відповідної сировини за збереження її високої якості*

*Ключові слова: пюре, соуси, титрована кислотність, активна кислотність, аскорбінова кислота, органічні продукти*

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# COMBINATION OF VEGETABLE-FRUIT FORMULATION COMPOSITION FOR OBTAINING HIGH QUALITY PRODUCTS

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## 1. Introduction

In addressing the food security of the country, it is of importance to ensure a stable provision of safe and high-quality food products to all citizens in sufficient quantities and assortment. Environmental pollution and intensive technologies lead to deterioration of the quality of food, to a less healthy lifestyle whose component is proper nutrition. The specified negative factors may cause the occurrence of diseases such as obesity, diabetes, ulcers, gastritis, cardiovascular, cancer and others [1]. An alternative is the consumption of natural products, specifically organic. Commonly consumed



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vegetables (pumpkin, zucchini, carrot, table beet) are distinguished by low content of titrated acidity; when manufacturing canned products, the latter are sterilized at a temperature of 120 °C. To reduce the temperature of sterilization, in order to control active acidity, the artificially manufactured organic acids are added [2]. That reduces the naturalness, and could adversely affect the health of consumers. It is relevant to utilize fruits (cherry plum, apricot, gooseberry, black currant) with high titrated acidity to adjust the active acidity that may prevent the sterilization of canned products at a temperature of 100 °C. The result implies ensuring the preservation of the naturalness of organic vegetable raw materials and elevated content of biologically active substances in the finished product.

## 2. Literature review and problem statement

The market for organic food products is rapidly growing around the world. The products labeled «organic» have been recognized by different strata of people. Most organic products are consumed in the countries of Europe and the United States. We can distinguish three categories of organic products. This is a 100 % organic product – a product made entirely from organic ingredients based on certified technologies. Organic product is a product made from not less than 95 % of organic ingredients. A product made from organic ingredients is the product manufactured from at least 70 % of organic ingredients in strict compliance with restrictions related to the remaining 30 %, including the banned GMOs [3].

In Ukraine, the plan of priority actions of the Government to 2020 implies the need to ensure the proper functioning of the market for organic products. In 2016, about 421.5 thousand hectares of agricultural land were certified, of which 82 % is arable land. 390 producers of organic products were registered. Vegetables, pumpkin, fruits, berries were certified as organic products. There is a tendency for active replenishment of domestic market with organic products by establishing local processing of organic raw materials. Juices, syrups, and jam are produced [4].

Vegetables and fruits are a source of scarce vitamins, poly phenols, pectin and other substances useful for human body [5]. These components of the chemical composition can bind free radicals, they have radioprotective, anti-inflammatory, anti-allergic properties and prevent the development of many diseases of the XXI century [6].

At present, big companies announce the launch of technological lines, increase the network of shops selling natural and organic products. About 65 % of consumers prefer organic fruits and vegetables, dairy products, bakery products, and meat products, even though organic foods are more expensive than their industrial analogs. Studies confirm the feasibility of forming a market for natural organic products through the implementation of developments and achievements of scientific-technical progress into existing technologies [7]. According to acting requirements, a product can be labeled as the «product of organic agriculture» if it was produced in compliance with Basic standards or contains at least 95 % of the ingredients certified organic in origin. In this case, the appropriate marking is applied with the label carrying a respective logo. The production of organic products is based on the following rules: crop production is not allowed to apply pesticides to control weeds, pests and plant diseases. The use of mineral fertilizers of synthetic origin is prohibited; feeding the soil and plants employs organic fertilizers. Plant protection is carried out mainly by preparations of natural origin. Processed organic products are made from organic ingredients only. During all technological operations, it is not allowed to contact inorganic products, packing materials should not affect the quality of organic products [8]. The proportion of organic fruits in the agriculture of Ukraine is growing [9]. Manufacturers prefer varieties, resistant to diseases and suitable for organic cultivation [10].

The after-harvest losses of fresh vegetables and fruits, depending on the variety, grade, and storage conditions, make up 5–10 % in developed countries and 20–50 % in developing countries [11]. The modern food industry is focused on the production of those foods that meet a broad range of consumers while bringing down production costs. The specificity of this industry is that its products must satisfy an important requirement – to maximally match a healthy lifestyle. One of the most tested ways for solving such a task is the production of food balanced in basic nutrients [12].

Especially valuable in terms of chemical composition are vegetables, such as pumpkin, which is characterized as a functional food product [13]. However, vegetables lose quality during long storage while fresh [14]. The aspiration of people to improve the quality of life with available and healthy products contributes to that vegetable raw materials account for an increasing share in daily nutrition. There are proposals of technology and formulations of the new products with a mix of vegetables and fruit to improve quality, enhance physiological and biological values [15].

## 3. The aim and objectives of the study

The aim of this study was to develop formulation compositions of vegetables and fruits to achieve the level of active acidity not higher than 3.9 pH units without the use of artificial organic acids to obtain high-quality products from organic raw materials.

To achieve the set aim, the following tasks have been solved:

– to explore the content of nutrients in vegetables and fruits grown under conditions of forest-steppe of Ukraine, specifically the content of organic acids;

– to investigate a change in the active acidity of vegetable-fruit compositions depending on the mass fraction of titrated acidity, and to propose equations for developing a formulation, and to evaluate quality of the new products;

– to implement the developed canned food products to produce organic products in the future.

## 4. Materials and methods to study the formation of quality of canned food products made from vegetables and fruit

During our study, the following instruments were used: for determining the mass fraction of dry soluble substances in fresh raw materials and canned foods – refractometer PAL-3, sugars – spectrophotometer Ulab 101, the mass share of titrated acidity and active acidity – a laboratory pH meter, model MP 511. Fig. 4 shows the photograph of the finished canned vegetable-fruit puree, made in line with the proposed formulation.

The studied materials and equipment used in the experiment, as well as the procedure for determining the indicators of the properties of samples are described in paper [16].

## 5. Results of studying the indicators of quality (properties) of canned products

For the raw materials grown under conditions of forest-steppe of Ukraine, the mass fraction of titrated acidity (%) was as follows: in zucchini – 0.09, pumpkin – 0.10, carrot – 0.25, table beet – 0.05, apricot – 1.2, cherry plum – 2.8, gooseberry – 2.3, black currant – 3.1.

According to the results over many years of research (Fig. 1), it has been proven that the natural organic acids, which are included in the composition of apricot, gooseberry, cherry plum, and black currant, can become natural acidifiers for natural foods made from vegetables. The mass fraction of titrated acidity of 0.55–0.60 % predetermined a guaranteed reduction of active acidity to the safer level in terms of microbiological indicators, not above 3.9 pH units for vegetable-fruit canned foods.

For example: according to the shown regression equation (Fig. 1), at the titrated acidity of 0.55 %, the active acidity is 3.86 pH units; accordingly, at 0.60 – 3.69.

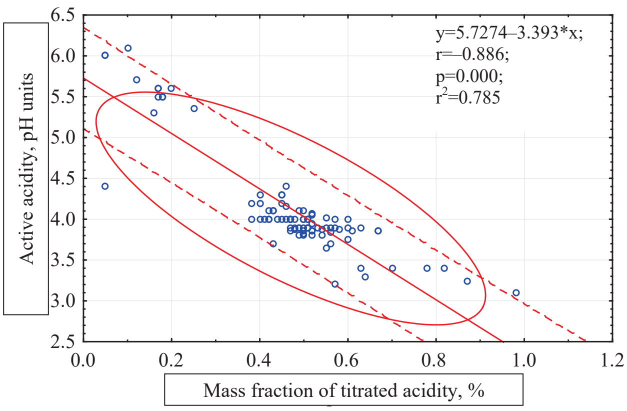


Fig. 1. Relationship between active and titrated acidity in vegetable-fruit canned foods

The specified level of active acidity ensures a decrease in the sterilization temperature of vegetable-fruit puree to 100 °C over 20–25 minutes depending on the capacity of the used container. In accordance with the provisions on the development of modes for sterilization, we can use, as the test culture, the most heat-resistant strain of mold fungus *Bissochlamys nivea*. In contrast to the typically used test culture *Clostridium botulinum* for vegetable purees made from carrots and pumpkins, at 120 °C over 55 minutes.

When developing vegetable-fruit formulations, we accepted the basic titrated acidity in finished products to be equal to 0.55–0.60 % which warrants active acidity no higher than 3.9 pH units, and the content of sugars to provide for a sugar-acidic index and organoleptic indicators.

We constructed and solved a system of three equations with three unknowns:

– a material balance of components calculated for 1,000 kg of finished product;

– a balance of dry soluble substances in the product for the mass fraction of dry soluble substances (DSS) being equal to 16 %;

– a balance of the titrated acidity at the content of 0.60 %.

We derived appropriate formulae (1) to (3) that could be used to calculate the formulations for blended purees, stewed fruit, juices, sauces, natural canned food:

$$S=\frac{\Delta K(16000-1000\cdot C_2)+\Delta C(1000\cdot K_2-600)}{\Delta C\cdot K_2+\Delta K(99{,}85-C_2)}, \qquad (1)$$

$$A=\frac{600-1000\cdot K_2-S\cdot K_2}{\Delta K}, \qquad (2)$$

$$B=1000-A-S, \qquad (3)$$

where $S$ is the amount of sugar needed to ensure a sugar-acid index, kg per 1,000 kg of finished product; A is the amount of fruit puree or fruits with respect to edible part, required to ensure the concentration of titrated acids and active acidity, kg per 1,000 kg of finished product; $B$ is the amount of vegetable puree or formulation amount of vegetables, kg per 1,000 kg of finished product; $C_1$ is the mass fraction of dry soluble substances in the fruit part, %; $C_2$ is the mass fraction of dry soluble substances in a vegetable and fruit part, %; $\Delta C$ is the difference between the content of soluble dry substances in a fruit and vegetable part, %; $K_1$ is the mass fraction of titrated acidity in a fruit part, %; $K_2$ is the mass fraction of titrated acidity in a vegetable part, %; $\Delta K=K_1-K_2$ is the difference between the content of titrated acidity in a fruit and vegetable part, %.

*Example 1.* It is required to make the canned food product «Puree from carrot and cherry plum». For the carrot-based puree, the mass fraction of dry soluble substances is 10 %; for the cherry plum-based puree, it is 11.7 %; the mass fraction of titrated acidity for carrot-based puree is 0.37 %, for cherry plum-based puree, 2.2 %, hence:

$$\Delta C=C_1-C_2=11.7-10.0=1.7;$$

$$\Delta K=K_1-K_2=2.2-0.37=1.83.$$

Substitute values in formulae (1) to (3):

$$S=\frac{1.83(16000-1000\cdot 10)+1.7(1000\cdot 0.37-600)}{1.7\cdot 0.37+1.83(99.85-10)}=$$
$$=64.15 \text{ sugar, kg;}$$

$$A=\frac{600-1000\cdot 0.37-64.15\cdot 0.37}{1.83}=$$
$$=112.71 \text{ cherry plum-based puree, kg;}$$

$$B=1000-112.71-64.15=$$
$$=823.141 \text{ carrot-based puree, kg.}$$

Total: 1,000 kg. Typically, under industrial conditions, as averaged for 1,000 kg of canned food «Puree from carrot and cherry plum», it will equal to: 64.2 kg of white sugar, 112.7 kg of cherry plum-based puree, and 823.1 kg of carrot-based puree.

The estimated mass fraction of dry soluble substances in the finished product is:

$$\frac{\left(\frac{64.2\cdot 99.85}{100}+\frac{112.7\cdot 11.7}{100}+\frac{823.1\cdot 10}{100}\right)\cdot 100}{1000}=15.94\,\%.$$

The estimated mass fraction of titrated acidity in the finished product is:

$$\frac{\left(\frac{112.7\cdot 2.2}{100}+\frac{823.1\cdot 0.37}{100}\right)\cdot 100}{1000}=0.55\,\%.$$

*Example 2*. It is required to make the canned food product «Puree from carrot and apricot». For the carrot-based puree, the mass fraction of dry soluble substances is 9.8 %, for the apricot-based puree, 13.9 %; the mass fraction of titrated acidity in carrot-based puree is 0.34 %, in apricot-based puree, 1.2 %, hence:

$$\Delta C = C_1 - C_2 = 13.9 - 9.8 = 4.1;$$

$$\Delta K = K_1 - K_2 = 1.2 - 0.34 = 0.86.$$

Substitute values in formulae (1) to (3):

$$S = \frac{0.86(16000 - 1000 \cdot 9.8) + 4.1(1000 \cdot 0.34 - 600)}{4.1 \cdot 0.34 + 0.86(99.85 - 9.8)} =$$
$$= 54.12 \text{ sugar, kg;}$$

$$A = \frac{600 - 1000 \cdot 0.34 - 54.12 \cdot 0.34}{0.86} =$$
$$= 280.93 \text{ apricot-based puree, kg;}$$

$$B = 1000 - 280.93 - 54.12 =$$
$$= 664.95 \text{ carrot-based puree, kg.}$$

Total: 1,000 kg. Under industrial conditions, after rounding: for 1,000 kg of canned food «Puree from carrot and apricot», it will equal to: 54.1 kg of white sugar, 280.9 kg of apricot-based puree, and 665.0 kg of carrot-based puree.

The estimated mass fraction of dry soluble substances in the finished product is:

$$\frac{\left(\frac{54.1 \cdot 99.85}{100} + \frac{280.9 \cdot 13.9}{100} + \frac{665.0 \cdot 9.8}{100}\right) \cdot 100}{1000} = 15.82\,\%.$$

The estimated mass fraction of titrated acidity in the finished product is:

$$\frac{\left(\frac{280.9 \cdot 1.2}{100} + \frac{665.0 \cdot 0.34}{100}\right) \cdot 100}{1000} = 0.56\,\%.$$

Thus, for the ready canned foods, it is required that the mass share of dry soluble substances should not be less than 14.0 %, active acidity – not above 3.9 pH units.

Data in Table 1 show the advantages of blended purees over similar vegetable purees taken as control. Increasing the mass concentration of dry soluble substances and sugars in blended purees (Table 1) is predetermined by the introduction of white sugar in the amount that ensured a harmonic sugar-acid index.

Active acidity is reduced in all variants of purees to a safe level, below 3.9 pH units. Improving the formulation and decreasing the temperature of sterilization to 100 °C contributed to the preservation of ascorbic acid, by the content of which the blended canned pumpkins outperformed control by 1.6–7.6 times, canned carrots – by 1.5–2.9 times. We observed a decrease in the content of carotenes in the blended purees, compared with those made from a single component, which does not affect the daily need of the human body in a given ingredient.

The semi-finished purees contained all the components that were identified in the raw materials (Table 2).

We noted a decrease in the mass share of dry soluble substances and sugars in puree compared with the content in the raw materials, due to the addition of drinking water prior to blanching the vegetables and cherry plum. For these indicators, cherry plum fruits and a semi-finished-puree differed favorably from fresh vegetables and vegetable puree, outperforming a pumpkin puree by the content of dry soluble substances by 2.3 times, by the content of sugars – by 1.7 times, as well as a zucchini puree, respectively, by 3.7 and 3.6 times.

The fruits of cherry plum and semi-finished purees markedly differed from vegetable purees in terms of the mass concentration of titrated acidity. Most of all, ascorbic acid was accumulated in zucchini; its content in the fruits of cherry plum was 2.8 mg/100 g, with the lowest content, 2.7 mg/100 g, demonstrated by the semi-finished puree. Ascorbic acid content was relatively low in pumpkin and the semi-finished purees made from it.

Sauces slightly differed by the mass share of dry soluble substances, as well as by the mass share of sugars, which were regulated by adding the estimated amount of white sugar (Table 3).

Table 1

Nutrient content of vegetable-fruit purees with the adjusted active acidity

| Puree title | Mass fraction, % | | | Active acidity, pH units | Content, mg/100 g | |
|---|---|---|---|---|---|---|
| | DSS | sugars | titrated acidity | | ascorbic acid | carotenes |
| pumpkin (control) | 6.8 | 4.4 | 0.05 | 5.60 | 4.0 | 2.00 |
| pumpkin and apricot | 14.6 | 13.2 | 0.54 | 3.80 | 10.6 | 1.65 |
| pumpkin and gooseberry | 14.0 | 12.2 | 0.49 | 3.80 | 6.3 | 1.24 |
| pumpkin and cherry plum | 14.2 | 13.0 | 0.56 | 3.84 | 9.2 | 1.23 |
| pumpkin and black currant | 15.4 | 13.8 | 0.52 | 3.86 | 30.6 | 1.34 |
| carrot (control) | 8.2 | 5.2 | 0.16 | 5.30 | 6.3 | 10.20 |
| carrot and apricot | 15.2 | 12.6 | 0.58 | 3.88 | 15.4 | 7.22 |
| carrot and gooseberry | 14.8 | 12.0 | 0.50 | 3.82 | 9.8 | 7.20 |
| carrot and cherry plum | 14.8 | 12.2 | 0.55 | 3.89 | 10.4 | 7.10 |
| table beet (control) | 16.0 | 13.0 | 0.17 | 5.50 | 9.3 | traces |
| table beet, carrot, gooseberry | 17.0 | 13.8 | 0.54 | 3.88 | 18.4 | 1.34 |
| $HIP_{05}$ | 0.4 | 0.4 | 0.03 | 0.05 | 0.6 | 0.09 |

Table 2

Content of components of chemical composition in raw materials and semi-finished products

| Title | Mass fraction, % | | | Content of ascorbic acid, mg/100 g |
|---|---|---|---|---|
| | DSS | sugars | titrated acidity calculated for malic acid | |
| Fresh pumpkin | 7.6 | 6.1 | 0.12 | 8.0 |
| Pumkin puree | 6.8 | 5.9 | 0.10 | 6.5 |
| Fresh zucchini | 4.6 | 3.4 | 0.09 | 17.6 |
| Zucchini puree | 4.2 | 2.8 | 0.07 | 16.1 |
| Fresh cherry plum | 16.8 | 11.6 | 2.82 | 14.8 |
| Cherry plum puree | 15.4 | 10.2 | 2.64 | 13.4 |
| $HIP_{05}$ | 0.2 | 0.2 | 0.02 | 0.4 |

Table 3

Physical-chemical and organoleptic quality indicators of vegetable-fruit sauces

| Title of canned food | Mass share, % | | | Sugar-acidic index | Content of ascorbic acid, mg/100 g | Organoleptic estimate, point |
|---|---|---|---|---|---|---|
| | DSS | sugars | titrated acidity calculated for malic acid | | | |
| Zucchini cherry plum sauce, variant I | 26.0 | 21.4 | 0.58 | 37.4 | 12.4 | 26.3 |
| Zucchini cherry plum sauce, variant II | 26.2 | 21.7 | 0.84 | 25.5 | 12.7 | 29.1 |
| Pumpkin cherry plum sauce, variant I | 26.1 | 22.3 | 0.61 | 36.6 | 5.9 | 27.5 |
| Pumpkin cherry plum sauce, variant II | 26.0 | 22.9 | 0.86 | 26.6 | 6.6 | 29.3 |
| $HIP_{05}$ | 0.5 | 0.2 | 0.05 | 0.2 | 0.2 | 0.7 |

When adding the cherry plum puree in the amount of 20 % (variant I), the mass fraction of titrated acidity decreased to 0.6 %, which is sufficient to ensure microbiological stability and safety of canned food after sterilization at a temperature of 100 °C. However, the most important indicators are organoleptic. Zucchini and pumpkin in a combination with cherry plum rendered sauces a specific sour-sweet taste, pleasant aroma. Sauces containing 30 % of cherry plum puree (variant II) received the highest organoleptic estimates during tasting, so they could be recommended for industrial production.

The content of ascorbic acid was highest in zucchini sauces, compared with pumpkin sauces, due to its higher content in the vegetable raw materials.

The higher content of ascorbic acid in vegetable-fruit canned products, compared with vegetable products, is due to its higher content in fruit raw materials, the introduction of organic acids that promote the conservation of ascorbic acid and milder modes of sterilization.

## 6. Discussion of results of studying the indicators of properties of canned products

The application of fruit components for the acidification of vegetable ones was adopted in canning earlier, for example in the production of pumpkin-apple, pumpkin-apricot juices, canned food «Pepper in apple juice», and others. However, formulations for these canned products were not scientifically justified and did not allow the regulation of active acidity in foods, which enables a decrease in the temperature of sterilization to 100 °C over 20–25 minutes instead of 120 °C over 55 minutes. The result is a better preservation of substances that are not resistant to heating, such as ascorbic acid.

Similarly controlled is the level of active acidity in vegetable canned foods, belonging to group B. The amount of acetic or lactic acid is added in line with the estimation. Because of the complexity of the buffer system of products, it is necessary to control the mass fraction of titrated and active acidity. Actually, this is the development proposed in this paper. While ensuring the rated level of active acidity, the sterilization of such canned products is carried out at a temperature of 100 °C over 20–25 minutes depending on the type of a container.

For example, in canned cucumbers, the mass fraction of titrated acid is rated at 0.4–0.6 %, pH not larger than 4.0 units, with the sterilization at a temperature of 100 °C for 8–15 minutes depending on the type of a container. The canned food «Carrot and carrot-fruit juices» at pH not larger than 4.0, which are regulated by adding fruit components and citric acid, is sterilized at a temperature of 100 °C over 15–20 minutes.

At present, Ukraine practically lacks canned food based on the combination of vegetable-fruit raw materials in a single product. Researchers addressed the development of formulations for pumpkin-quince canned food [17]. They used the fruits of pumpkin, quince, cranberries, as well as a milder effect of thermal treatment. They drew a conclusion on that the vegetable-fruit canned foods, made in line with the new formulation, retain rather well the food and biological value of the original raw materials and thus have high organoleptic properties. Given the lack of artificial organic acids, such canned food could be recommended for a healthy diet of different strata of people.

The research results have been tested at Uman and Moshurivsky Canning Plants in Ukraine.

The disadvantage of this study is the obligatory laboratory control at an enterprise over the content not only of dry soluble substances, but the titrated acidity in vegetable and fruit raw materials, conducting the required technological calculations and executing control over active acidity in canned foods before and after sterilization. This requires that the enterprise should have specialists of high qualification, and appropriate equipment, although that leads to that the canned products are produced at a higher level.

The research results could be applied in the production of canned food for dietary purposes, baby foods, and at plants that produce organic foods from fruits and vegetables, which comply with the current requirements for organic products. We consider it appropriate to continue research on the development and improvement of formulations for natural vegetable canned food products and marinades.

## 7. Conclusions

1. The vegetable raw materials (zucchini, pumpkin, carrot, table beet), cultivated under conditions of forest-steppe of Ukraine, contain the mass fraction of titrated acidity, recalculated to malic acid, in the amount of 0.05–0.25 %; fruit raw materials (apricot, gooseberry, cherry plum, black currant) – 1.2–3.1 %.

2. Bringing the mass share of titrated acids in blended foods made from vegetables and fruit to 0.55–0.60 % ensures a reduction of active acidity to the level not higher than 3.9 pH units, which enables the sterilization at a temperature of 100 °C for 20–25 minutes depending on the capacity of a container.

3. We propose to combine vegetable-fruit formulations of zucchini, pumpkin, carrot, table beet with apricots, gooseberry, cherry plum, black currant with adjusted active acidity not higher than 3.9 pH units. To calculate the formulations, it is proposed to apply scientifically-substantiated formulae; the sterilization of blended purees should be conducted at a temperature of 100 °C over 20–25 minutes.

4. In vegetable-fruit purees, the content of ascorbic acid is higher, compared with vegetable purees, by 1.6–7.6 times; in purees made from pumpkin and black currant, the native content reaches 30.6 mg/100 g. Sauces made from zucchini, pumpkin with the addition of 30 % of cherry plum puree, contain 26.0–26.1 % dry soluble substances, 0.84–0.86 % of titrated acidity, they have the optimal sugar-acid index of 25.5–26.6, they are distinguished by high organoleptic indicators of 29.1–29.3 points based on a 30-point scale.

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