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DETERMINATION OF THE QUALITY INDICATORS OF APPLE JUICE BEVERAGES

ВИЗНАЧЕННЯ ПОКАЗНИКІВ ЯКОСТІ ЯБЛУЧНИХ СОКОВИХ НАПОЇВ

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Abstract. *The paper examined the quality of juice drinks according to the organoleptic properties, total and active acidity, content of dry substances, vitamin C using physicochemical methods of analysis.*

Key words: *apple juice, apple nectar, dry matter, active acidity, titrated acidity, vitamin C.*

Introduction.

Almost every day, people enrich their body with vitamins by consuming fruit and vegetable products. Since plant products spoil, and vitamins must be consumed all year round, juices are made. Juices preserve all the nutrients found in fresh fruits, berries and vegetables and are easily absorbed by the body. Juices are a source of the most powerful and well-known antioxidant ascorbic acid. The consumption of fruit juices by the population of Ukraine has increased significantly over the past ten years. Among the various juices in Ukraine, apple juice is produced in the largest volume. In Ukraine, the issue of the safety and quality of juice products is acute, as the latter are a convenient object of falsification with significant profitability of this business.

Main text.

1. General characteristics of fruit juices.

Juices are obtained from fruits and vegetables by mechanical action and preservation by physical methods (except treatment with ionizing radiation). Currently, the following types of juices are produced: fruit; blended; concentrated; for baby and dietary food; fruit nectars; vegetable; juicy fruit and vegetable drinks [1].

Natural juices are divided into higher and first grades. Vintage juices from specially selected varieties of raw materials are of the highest quality.

All over the world, juices are traditionally in high demand. In addition to refreshing ability, nutrition, stimulating effect and harmonious taste, juices contain vitamins and a whole complex of biologically active substances, which are necessary for people for a full and healthy diet, especially at the stage of development of a young

organism.

As a rule, no sugar or sugar syrup is added to natural juices. But in those cases when natural juices (from cranberries, black currants, cherries, plums) have high acidity, they are prepared with the addition of sugar or syrup, noting this on the labels. Organoleptically, the sensation of sour taste depends not only on the acid content in the juice, but also on the degree of its sweetness, which, in turn, is also determined by the ratio of sugars – fructose, glucose and sucrose. Therefore, in the laboratory, the total acidity and sugar content of the juice sample are determined and their optimal ratio is found by calculation. It is recommended, for example, that a certain number of parts of sugar should be added to one part of acid in the juice. So, the sugar-acid index for apples is from 20 to 30, for cherries - 20-29, for plums - 20-25 etc. [1].

Juices preserve all the nutrients found in fresh fruits, berries and vegetables and are easily absorbed by the body. The nutritional value of juices lies in their high content of easily digestible carbohydrates (glucose, fructose, sucrose etc.), a complex of water-soluble vitamins (ascorbic, folic, nicotinic and pantothenic acids, P-active substances, carotene, thiamine, riboflavin etc.), mineral salts, pectin substances, organic acids andaromatic compounds.

Juices with pulp also contain substances insoluble in water: fiber, fat-soluble vitamins, so their value is higher. They are prepared by diluting fruit purees with sugar syrup. As a rule, the content of natural fruit juice in them does not exceed 45%. From fruits containing fat-soluble vitamins A and E, such as peaches, apricots, carrots, only juices with pulp are prepared [2].

Juice products are not only juice. Juice products include nectars, juices and juice drinks. All these products differ in composition and taste.

1. 100% juice is a product made from concentrated juice and drinking water, directly squeezed juice, or freshly squeezed juice. But the latter must be prepared in the presence of the buyer.

2. Reconstituted juice is a product made from concentrated juice and specially prepared water. 100% and reconstituted juices can not contain: preservatives, artificial flavors and sweeteners.

3. Nectar is a drink made from concentrated juice (puree), specially prepared water and natural aromatic substances (fruit aroma). At the same time, the proportion of concentrated juice should be 20-50% of the total volume. In addition to water, nectar may contain sugar and natural acidifiers (for example, citric acid), pulp of fruits and vegetables. Preservatives, artificial flavors and sweeteners can not be added to nectar. As a rule, nectars are made from those fruits, the concentrated juice of which cannot be used to prepare 100% juice due to too sweet or sour taste (for example, cherry, currant, pomegranate) or because of a thick consistency (for example, bananas, peaches).

4. Juice drink - a mixture of concentrated juice (puree) and specially prepared water, provided that the proportion of concentrated juice is at least 10% (if the juice drink is made from juice lemon or lime, then the proportion of concentrated juice should be at least 5%). The range of juice drinks includes the largest number of drinks with unusual tastes and flavor combinations: blackberry, raspberry, cactus, lime etc.

5. Morse is a drink made from a mixture of berry juice (berry puree), specially

prepared water, sugar (or honey), provided that the minimum proportion of concentrated juice is at least 15% of the total volume. Instead of water in morsas, it is permissible to use an aqueous extract of the juice of those berries that were used for the production of juice or puree [3, 4].

Among the various juices in Ukraine, apple juice is produced in the largest volume. Apples are one of the most available and widespread fruits, the cultivation of which in Ukraine occupies a large specific weight, is characterized by high volumes of consumption and is of significant importance for the food supply of the population. The peculiarity of fruit consumption is, on the one hand, the seasonality of their harvesting, and on the other hand, the need to consume them all year round, and during storage, apples deteriorate and lose their consumption properties, so it is most appropriate to process them during the harvesting season.

The nutritional value of apple juices is shown in the following:

- increased content of biologically active substances, primarily vitamins, which is characteristic of most fruit juices;
- the presence of compounds necessary for the human body, which are absent or contained in small amounts in other food products. For apple juice, such typical substances are iron, given in the best biological form - in combination with fruit acids and pectin substances;
- the absence of undesirable substances or their presence in low concentrations;
- high level of digestibility of juice nutrients [5].

2. Research objects and methods.

Apple juices of various brands were chosen as the object of the study: apple nectar, grape-apple nectar - producer "Ekosphere" in Vinnytsia; apple juices - producer "Hlybkon" Hlyboka, Chernivtsi region. The samples were purchased in a retail chain in the city of Chernivtsi.

Organoleptic evaluation of quality.

During the organoleptic evaluation, taste, aroma, appearance and color of the drink are evaluated [6]. A research group of twenty students was formed to study the organoleptic properties, and in the paper the general data are given.

Determination of dry matter content.

The content of dry substances in the juice is determined by the refractometric method. Values of the refractive index n_D^{20} at 20 °C and the value of the mass fraction of soluble dry substances (sucrose) specified out according to the Table. 1 of GOST 28562-90 [7].

Determination of titratable acidity.

The titratable acidity is determined by the amount of alkali (sodium or potassium hydroxide) needed to neutralize these acids.

Fifty grams of juice (at a temperature of 18-20 °C) are transferred to a 250 ml volumetric flask, brought up to the mark with distilled water. Then 10-15 ml are transferred with a pipette into a flask and titrated with (0.1 mol/l) NaOH solution in the presence of phenolphthalein until a pink color appears, which does not disappear within 30 seconds. The mass fraction of acids is determined by the formula:

$$X_к = 100 * V * C * M * V_0 / (1000 * m * V_1),$$

where V – volume of NaOH solution used for titration, ml;

C – molar concentration of NaOH solution, mol/l;

M – molar mass of the organic acid for which the calculation is carried out, g/mol; for malic acid M ($\frac{1}{2}$ $C_4H_6O_5$) = 67 g/mol;

V_0 – the volume to which is adjusted, ml;

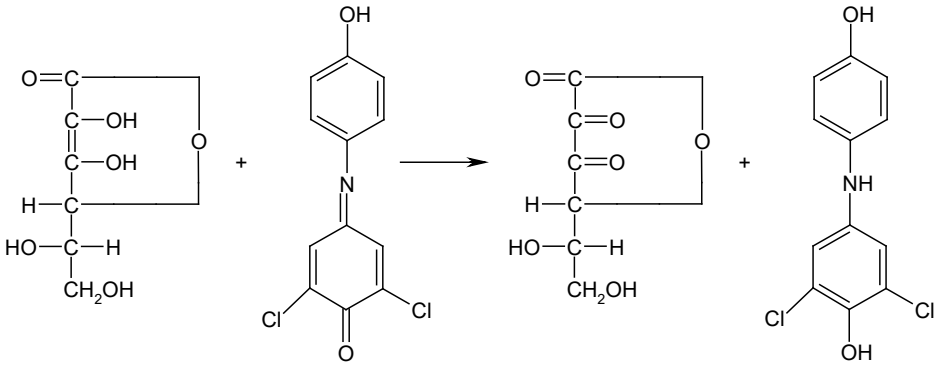
m – weight of the product, g;

V_1 – volume of the solution taken for titration, ml.

Parallel determinations were carried out simultaneously. The result of the study was taken as the arithmetic mean of the results of two parallel determinations [8].

Determination of ascorbic acid content.

The method is based on the ability of ascorbic acid to be oxidized by 2,6-dichlorophenolindophenol to dehydroascorbic acid. The amount of ascorbic acid in the studied material is determined by the amount of 2,6-dichlorophenolindophenol used for titration. When all vitamin C is oxidized, the titrated solution will turn pink due to the formation of non-dissociating molecules of 2,6-dichlorophenolindophenol (in an acidic medium). In an alkaline environment, 2,6-dichlorophenolindophenol has a blue color, in an acidic environment it is red, and after reduction it becomes colorless [9].



We weigh 1 g of the studied juices into three conical flasks and add 9 ml of hydrochloric acid solution to them. We take 3 ml of the contents from each flask. Fill the burette with 2,6-dichlorophenolindophenol and titrate to a pink color. According to the titration results, the average volume of the reagent solution is calculated and the amount of vitamin C is calculated according to the formula:

$$C = (V_1 \cdot V \cdot T)/ (a \cdot V_2),$$

where C – content of ascorbic acid, mg;

T – titer of 2,6-dichlorophenolindophenol according to ascorbic acid, mg/ml, (0.088 mg/ml);

V – volume of extract, ml;

a – mass of the studied material, g;

V_1 – volume of 2,6-dichlorophenolindophenol for titration, ml;

V_2 – volume of the studied solution, ml/

3. Results and discussion.

On the territory of Ukraine, there is a state standard for the quality of fruit and berry juices, which provides for the control of the quality of juice products according to organoleptic aspects - taste, aroma, color, appearance; physico-chemical - pH, content of dry soluble substances, acidity; microbiological indicators and safety

indicators. We evaluated the quality of juices and nectars according to organoleptic and physicochemical indicators: the content of dry soluble substances using a refractometer [7], total acidity – titration [8], vitamin C content – according to the Tillmans method [9], active acidity – using a pH meter . The values of the quality indicators of the studied samples were compared with the requirements of DSTU 4150: 2003 "Juices, juice drinks, nectars from fruit - berry, vegetable and melon crops. General technical conditions" [10].

Determination of organoleptic and physico-chemical indicators began with a random selection of products in consumer containers. 1 name of juice and 2 nectars were chosen for the study. The organoleptic parameters of the juice were determined visually in a clean cylindrical glass with a capacity of 250 ml and a diameter of 70 mm in the light.

The organoleptic indicators of the quality of fruit juices are as follows (according to the conclusion of the research group):

1. Clarified apple nectar – the juice is transparent, intensely yellow, with a moderate apple aroma. The taste is thick, sweet, sweet. After a sip of juice, a very pleasant aftertaste remains in the mouth.

2. Grape-apple nectar – transparent straw-colored juice. Bright grape-apple aroma and taste.

3. Clarified apple – juice with a brown shade, transparent. The taste is sweet, with a typical apple aftertaste. The aroma is strong, apple.

As a result of studies of organoleptic indicators, it was determined that there are no deviations in appearance, taste and aroma in all samples, without exception. All apple juices are, as stated in regulatory documents, a liquid without sediment and foreign inclusions, without extraneous tastes and smells, yellow, light brown or straw colors.

When evaluating the physico-chemical parameters of apple juices, we focused on DSTU 51433-99 and GOST R52186-2003 "Fruit juices", which are common for all juices, which indicate that the mass fraction of soluble solids for apple juice should be at least 11.2%. and the mass fraction for titrated acids in terms of malic acid - from 0.3 - 1.4% [10].

The content of dry substances is the main indicator of the degree of concentration or dilution of juices. The requirements for this indicator differ depending on the raw materials from which the juice is made, as well as whether the juice is natural or reconstituted. The results of the content of dry substances are shown in the table. As we can see, for apple juice, this indicator does not correspond to regulatory documents.

Total acidity is also called titratable – it is the amount of free organic acids and their acidic salts contained in the product under study, which is determined by titration with an alkali solution.

Active acidity and alkalinity are only a part of the total acidity or alkalinity and are determined, respectively, by the concentration of H^+ and OH^- ions and are characterized by the pH value.

In food products, the determination of acidity is of great importance due to the fact that acidity determines not only the taste properties of the studied product, but is also an indicator of its freshness and good quality.

The results of determining the mass fraction of titrated acids and the pH value are shown in table 1.

Table 1. - Physico-chemical indicators of juice quality

№	The name of the juice	Manufacturer	Dry matter content, average value, %	Acidity		Vitamin C, mg per 100 g of drink
				general, %	active, pH	
1	nectar Apple illuminated	"Ekosphere", Vinnytsia	12,3±0,1	0,40±0,03	3,24±0,01	4,9±0,1
2	nectar Grape-apple	"Ekosphere", Vinnytsia	12,7±0,3	0,30±0,02	3,25±0,02	4,9±0,3
3	Apple light	"Hlibkon", Glyboka	9,8±0,1	0,20±0,03	3,38±0,02	4,4±0,2

As for the mass fraction of titrated acids, this indicator corresponds to the norm in only two juice samples out of three, and for the clarified apple juice it does not correspond to its own stated TU, and in terms of the pH value, it does not correspond to it in any case. In our opinion, manufacturers are insuring themselves with regard to guarantees of quality preservation during the specified period – one year, because the lower the active acidity, the less likely the development of microorganisms in the juices. Although the packaging of juices and nectars takes place in aseptic conditions, residual spore-forming microflora is always present and can multiply rapidly under favorable conditions. Considering that the storage temperature of this product is in the range of 0-25 °C and juices are stored in large batches in the sales hall at room temperature (and in the summer it can be quite high), the decrease in the pH value plays a positive role, but still it must correspond the norm specified in the standard.

Quantitative determination of vitamin C in the studied material was carried out with the help of 2,6-dichlorophenolindophenol, using its titrated solution. The content of the latter in the studied material was determined by the amount of the reagent used for the oxidation of vitamin C.

Content of ascorbic acid according to DSTU 4150:2003 "Juices, juice drinks, fruit nectars - berry, vegetable and melon crops. General technical conditions" should be 2.0 mg/100 g [10]. The content of ascorbic acid in the studied samples ranged from 4.4 to 4.9 mg per 100 g of juice. Therefore, the content of vitamin C is higher in all studied juice drink samples and all studied juices and nectars are a source of vitamin C.

Conclusion

1. An expertise of the quality of one sample of juice and two nectars was carried out according to organoleptic and physicochemical parameters (dry matter content, acidity, vitamin C content).

2. The following conclusions were drawn from the conducted experimental studies: according to organoleptic parameters: transparency, color, taste and aroma, all tested juice samples correspond to the standard DSTU 4150: 2003.; nectars in terms of dry matter content (12.3-12.7%), acidity (0.3-0.4% in terms of malic acid) comply with

regulatory documents; all studied juices and nectars are a source of vitamin C (from 4.4 to 4.9 mg per 100 g of juice).

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