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Application of Quantitative Analytical Organoleptic Method of Analysis for Determination of Fruit Juices Adulteration

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The correlation between intensity of odour and taste of fruit juices as odour-taste index characterizes the connection between high in volatility and low in volatility compounds. The values of the odour-taste indexes determined in accordance with the stimulus thresholds of sensory attributes range between 1: 2 and 1: 4.5 for juices have been studied. The artificial aromatization leads to increasing of odour-taste index to 1 : 1 that gives opportunity to determine the fact of adulteration of juices.

Introduction

The economical reasons and the presence of different food theories are responsible for production and appearance of new kind of foodstuffs on the market. From the other side, the falsification of foodstuffs, which takes place, makes the situation of the realized option for customers more complicated. The procedure of the authenticity analysis of fruit juices is associated with etermination of many characteristics and application of complex methods and apparatus [3,5].

It is clear that the exceeding of the natural intensity of the taste, odour and color proves that the juice is adulterated. Modern analytical quantitative methods of organoleptic analysis allow determining the intensity of the taste, odour and color [6]. But specific properties of raw materials cause major difference in absolute dates for similar obtained juices [4, 6, 9]. It shows advisability of using relative attributes.

The odour and aroma taste intensity of juices is caused by structure and concentration of volatile compounds [1]. It is known [6], that the nerves of the pharynx and tongue, and vagus of larynx become excited by action of aroma forming agents badly. This times the connection between oral and nose cavities allows the transference of aroma forming agents into the nose cavity during taste analysis of the solution. Such connection allows to propose the correlation between intensities of juices odour and aromatic taste as their quality index. The recent information about olfactory organs shows their perfection and the connection between the limbic system of the brain, which plays a key role in emotions, memory, hormone secretion, appetite and nose's olfactory nerve [2].

There is connection between concentration of volatile compounds, odour and aromatic taste of juices [1, 6] that causes advisability of studying the odour-taste correlation as quality index and allows using the quantitative method of organoleptic analysis for determination of fruit juices adulteration.

Materials and methods

The dilution index method [6] based on the calculation of dilution index from values of stimulus and recognition thresholds. But the stimuli that induce the sensitive, which are necessary for establish the recognition thresholds of natural and adulterated juices are not

the same. The determination of the presence of the stimulus is more accurate. The senses "water – not water", needed for establishing the stimulus threshold are more exactness against of "typical" taste, needed for establishing the recognition threshold. This causes the advisability of the determination only of a stimulus threshold.

For this purpose we dilute the juices studied by water up to the concentration, where sensory attributes are not determined by sensory analyses. The shaking of the solution leads to the increasing of the interphase surface and allows intensifying the forming of even distribution of the substances. This way we can intensify the analysis of an odour.

The shaking of the solutions of the orange juice allows five times to increase the sense of the odour. The connection between an odour of the fruit juice and its aromatic taste we have characterized by an odour – taste index.

We have received the odour-taste index as correlation between the volumes of water which are in accordance with stimulus threshold of odour and of taste, respectively. This index allows by ocular demonstration to compare the intensity of an odour and an aromatic taste of juice. For example, the 1 : 2 index of the orange juice shows the double increasing of the aromatic taste intensity comparatively with the odour ones.

Results and discussion

On some stages of dilution, which are according to recognition threshold, the sense of taste forms due to the presence of aroma agents and the presence of organic acids and sugars, concentration of which is left over the threshold value. It is possible to show, that the dilution of the carrot juice by water to correlation 1 : 125 provides the 0.55 g.l of sugars. Similar dilution of the orange juice provides the 0.08 g.l of the organic acids (on conversion to citric acid). Such concentration of these taste forming agents calculated from middle values of contents of them in conforming juices [4,9] justify the characteristic of sense like "acidity-orange" or "sweetish-carrot" taste. The forming of "orange" or "carrot" taste tones is caused by the presence of the aromatic substances. The further dilution (1: 1 000) in which the acidic and sweetish tones are lost, allows to scent typical aromatic taste (for juices obtained from high-aroma raw materials). This scent allows differentiating the sample of diluted juice from clean water.

The lowering of raw material fragrance makes conditions for lessening the taste index studied. The intensity of aromatic taste decreases that leads to change this index from 1: 1 000 to 1: 500 for orange juice. In the mentioned juice the odour stimulus also decreases (from 1: 500 to 1: 125). We observe the change of odour – taste index from 1: 2 to 1: 4. This characterizes the connection between the taste and odour senses and shows the influence of the volatile compounds in forming the odour and the aromatic taste of juices. We can propose the key role of high in volatility compounds in forming the odour. The lesser decrease of taste intensity (50%) against odour one (75%) shows major part of low in volatility compounds in forming taste of juices. In such way the odour-taste index characterizes the connection between high in volatility and low in volatility compounds.

Our values (table 1) of the stimulus threshold of odour, color, and aromatic taste, which are delineated by the juice to water ratio, the literary values of the dilution index [6] allow to determine the 1 : 2 correlation between the intensity of the odour and taste for many juices and syrups obtained from high aroma raw materials. In case of using the raw materials with low aroma characteristics (for example, red currant) the stimulus threshold of taste (1:250) approaches to dilution which is typical to threshold concentration of sugars and acids. We must determine recognition thresholds of aromatic taste in such case. In the juice from red currant the recognition thresholds of aromatic taste is 1: 143. The presence

of major amount insoluble fraction (esters, ethers) among aroma forming agents of pineapple juice [8] has influence on forming more difference between taste and odour. The 1:4, 1:4.5 odour-taste indexes (table 1) show significant exceeding of odour intensity by aromatic taste ones in such juices (pineapple, black currant, cherry).

Tab. 1.

Comparative characteristics of stimulus thresholds of sensory attributes of hand-squeezed juices.

Juice	Stimulus threshold of			Odour-taste index
	aromatic taste	odour	color	
Orange	1 : 1 000	1 : 500	1 : 50	1 : 2
Grapefruit	1 : 600	1 : 250	1 : 16	1 : 2.4
Strawberry	1 : 800	1 : 400	1 : 250	1 : 2
Cherry	1 : 1 000	1 : 250	1 : 600	1 : 4
Raspberry	1 : 3 000	1 : 1 500	1 : 200	1 : 2
Sweet cherry	1 : 833	1 : 333	1 : 50	1 : 2.5
Black currant	1 : 4 500	1 : 1 170	1 : 200	1 : 4
Pineapple	1 : 5 700	1 : 1 280	1 : 30	1 : 4.5

The artificial aromatization of the juices by introduction of the aroma agents leads to increasing the absolute values of odour and taste intensities and changes the natural balance of the volatile substances. According to the Konovalov's laws [7], the introduction of the soluble volatile substances leads to increasing the pressure of their vapors about the surface. This contributes the lowering of the difference between taste and odour intensities. Indeed, the solutions of volatile substances have got higher level of odour comparatively with taste intensity (table 2).

Tab. 2.

Taste and odour intensities of solution of volatile substances.

Substances	Stimulus threshold of aromatic taste, [g.l]	Stimulus threshold of odour, [g.l]	Odour-taste index
Ethanol	0.48	0.38	1.25: 1
Acetic acid	0.36	0.17	2.1: 1

The analysis of the juice, sold with mark "100% grapefruit juice" has shown the increasing of the intensity of its taste and its odour against natural indexes. The dilutions which characterize the stimulus threshold of taste and odour are 1: 5 000. The odour-taste correlation is 1: 1. This has proved the adulteration of this juice.

Conclusions

According to our investigations, the aroma forming agents offer the influence upon the intensity of the taste sense. The correlation between aromatic taste sense and odour ones can be characterized by comparing stimulus thresholds of taste and odour. Our dates

shows the possibility to characterize the quality of juices by odour – taste index, because this index characterizes the connection between high in volatility and low in volatility compounds from one side, and dependences on quality of raw materials for juices and on technology of processing from other side.

The artificial aromatization of juices leads to the increasing of the absolute values of the intensity of odour and aromatic taste and to the lowering of the difference between them. That allows using the quantitative method of organoleptic analysis for determination of fruit juices adulteration.

References

1. Bratus, I. N.: Ximiya dyshistux veshestv. Moskva: Pishevaya prom-st, 1979. 304 pp.
2. Castleman, M.: Nature's Cures. Pennsylvania: Rodal Press, Inc.Emmaus, 1996. 507 pp. ISBN 0-87596-301-3.
3. Colesnov, A.: Metodu analyza kachestva sokov i sokosodergaschix napitkov. Pishevaya promushlennost, *11*, 1997, pp. 49-51.
4. Namestnykov, A.P. - Zagibalov, A.P. - Zverkova, A.S.: Technologiya konservirovaniya tropicheskix i subtropichskix fryktov i ovoshej. Kiyev-Odessa: Vischa shkola, 1989. 352 pp. ISNB 5-11-001370-5.
5. Roberds, K.-Antollovych, M.: Methods for assessing the authenticity of orange juice. Analist., *120*, 1995, pp. 1-28.
6. Rodyna, T. G.: Sensornuj analyz prodovolstvennux tovarov. Moskva: Akademiya 2004. 208 pp. ISBN 5-7695-1380-2.
7. Stromberg, A. G. – Semchenko, D. P.: Fizicheskaya ximiya. Moskva: Vusshaya shcola, 1988. 496 p.
8. Tressler. Ph. D. –Joslyn, M.: Ximiya i texnologiya plodoyagodnux i ovoshnux sokov. Moskva: Pishepromizdat, 1957. 600 p.
9. Ximicheskyj sostav pischevux produktov. Pod red. Nesteryna, M.P.- Skurixyna, I. M.: Moskva: Pishevaya prom., 1979. 247 p.

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