

MODERN METHODS FOR IDENTIFICATION OF COUNTERFEIT FOOD PRODUCTS

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Abstract: There are presented the commonly encountered concepts and forms of food tampering. The study of quality indices for wide range of foods, including apple and grape juices, vegetable and dairy fat, was performed. The expertise methodology was developed to identify the counterfeit products. The investigation results apply to production laboratories and food inspection.

Key words: adulterated products, gas chromatography, HPLC, juices, vegetable oils, butter.

Problem of revealing of adulterated products and their removal from circulation has centuries-old roots. However, this problem got more stringent aspect at the beginning of 1990's when considerable amounts of low quality and adulterated food products both domestic and imported ones have penetrated to food markets of many countries [1].

Adulteration of food products and raw materials as a fraudulent action manifests itself in production and realization of counterfeited foods, which do not correspond with name and marking, while dubious quality and nutritional value of such products can constitute a threat for the consumer health.

Adulteration types that are considered as most spread are: *assortment-related* one, which manifests itself in realization of goods under foreign trademark and with foreign commercial parameters; and *qualimetric* one representing falsification of qualities through resorting, replacement of some expensive raw constituent by another cheaper one, addition of some additives in order to increase the product quantity, reconditioning of degraded products in order to conceal their defects and others.

At the same time, falsification can be accompanied by incorrect and incomplete information qualified as *informational falsification* intended to mislead consumers with regard to essential characteristics of a product.

Falsification by itself presents not only economic threat through illegal commercial economic activities, but also social one that can manifest itself through effect on the health of population within a country (sanitary fraud).

Alcoholic and refreshing drinks, juices, meat and fish preserves, fats and oils, milk and milk products, confectionary and many other products are subjected to counterfeiting.

Thus, every year, counterfeiting of food products is perfected from simple examples (dilution with water, addition of cheap ingredients) to elaboration of complex methods of creation of “chemical cocktails”, which contain necessary amounts of substances ensuring concealment of falsifications.

For this reason, exporters or importers of food products in many countries carry out for many years investigations oriented toward elaboration of reliable falsification revealing methods: selection of optimal controlled indices for identification of product naturalness; accessible experimental-statistical argumentation of controlled indices; studying of

corresponding methods and means of control; elaboration of legal systems for termination of production of adulterated food products and their removal from circulation.

In the Republic of Moldova, investigations are carried out that are oriented toward revealing of adulteration of juices, vegetable oils, milk fats, as well as adulterations in coffee, cacao and products prepared on the basis of these agricultural food raw materials.

Material and methods

Natural apple and grape juices, vegetable oils of soya, sunflower and rape and grape seeds, as well as spreads both imported and produced in the Republic of Moldova have served as a subject of research.

Standardized quality control methods were used:

- juices: pH indices; dry matter mass fraction; absorbancy; titrable acidity; organoleptic indices;
- vegetable oils: relative density at 15°C; coefficient of refraction at 20°C; saponification indices; iodine, acidic and peroxidic indices;
- butter: under GOST 37-91 „Butter. Technical Specifications”.

Also, methods for determination of organic acids, glucides and alcohols in grapes by means of liquid chromatography (HPLC), as well as chromatographic methods for determination of α -tocopherol and higher fatty acids in oils and milk fats in gaseous state were adopted.

Macro- and microelements were determined by means of flame absorption spectroscopy.

Results and discussions

For identification of adulterations of fruit juices, methods for determination of specific indices defining naturalness of juices were selected, approved and partially modified; variation ranges of every index of domestic products were determined; rated content and values of indices of the similar imported products were verified. All controlled indices are in conformity with legislation of the Community states, Codex Alimentarius standards and normative acts of the Association of juice and nectar producers.[2].

Basing on the obtained data, methodological guidelines for determination of authenticity of apple and grape juices were elaborated. At the same time, scheme for identification of products was determined. Under this scheme, examined juice passes several stages of investigation. At first stage, product packing as well as label inscriptions – product name and content, name of manufacturing company – are examined. Initially, factors of inconsistency can be revealed. For example: product is named as “juice”, while it is indicated that the content of fruit base constitutes 25%. It is an apparent informational falsification. Then, organoleptic testing of a product is performed through estimation of its appearance, smell, taste and presence of foreign inclusions and indices are determined by traditional chemical and physical-chemical analytic methods under normative acts.

Second stage provides determination of biochemical indices, including organic acids, glucides, proline and formol index. Said indices are determined under liquid and gas chromatography methods, as well as fermentative methods. Following these analyses are performed, basing on results obtained in respect of composition of organic acids, it is possible in some cases to establish the fact of replacement of one juice by another or addition of another juice (for example, replacement of grape juice by apple one or addition of apple juice into grape one). Results obtained at the second stage of examination are compared and

interpreted in accordance with standards and requirements to the juice quality. Should parameters of the juice sample presented for examination meet corresponding requirements, examination is interrupted.

If obtained result do not allow univocal conclusion on the quality of presented sample to be made, it becomes necessary to pass to the third stage of examination – determination of the content of mineral substances and microelements (ions of potassium, sodium, magnesium, calcium, as well as chlorides, sulfates, phosphates, nitrates). To this end, ratio of calculated values and the determined content of ions (for example, between K and Mg, K and Ca) is used. In order to obtain more ample characteristic of a product, volatile substances that define its aroma can be studied. Such kind of examination makes it possible to reveal adulterated products more reliably. However, practice demonstrates that first two stages of examination are sufficient to provide an answer in respect of the product quality.

General scheme of identification of adulterated products is presented in Fig.1.

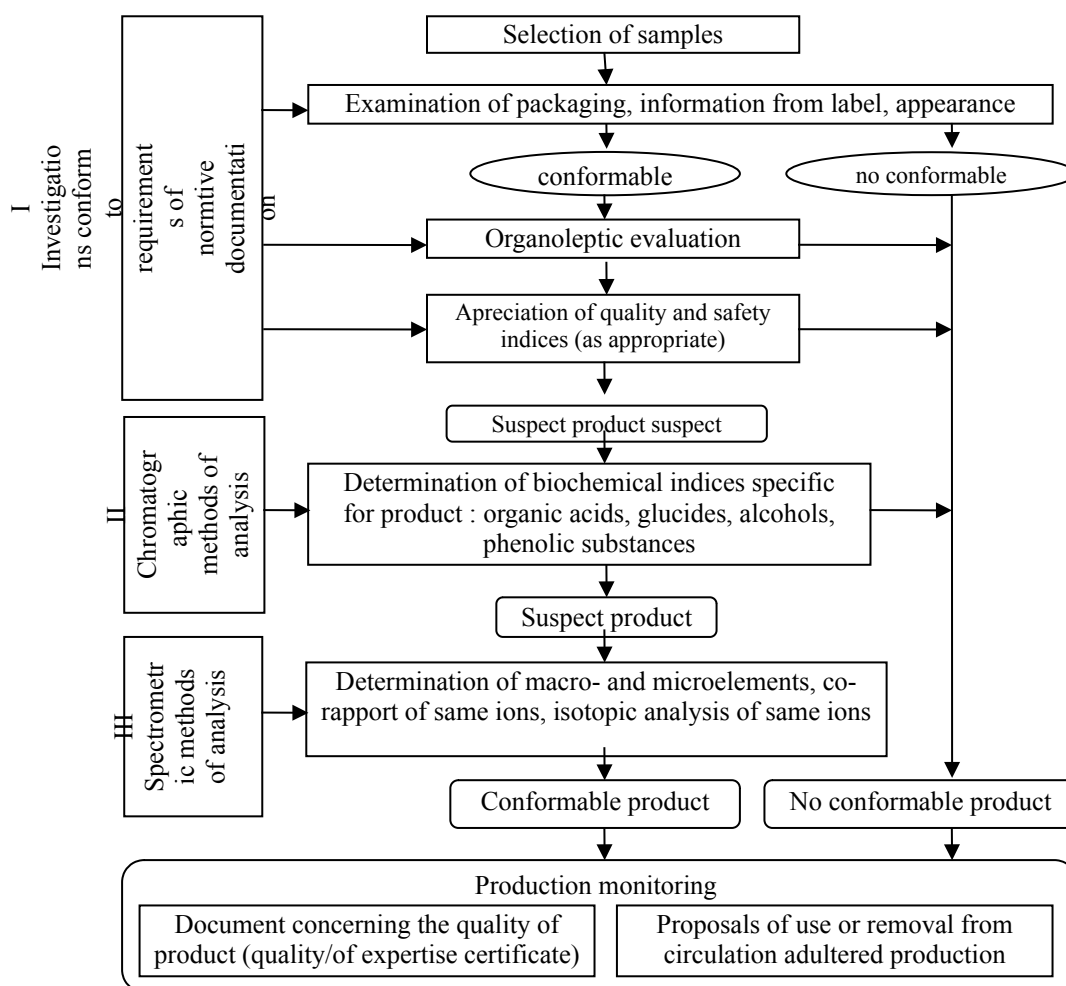


Fig. 1. Identification scheme of no-conformable/adulterated food product

Problems concerning adulteration of vegetable oils were resolved within the Institute basing on examination of composition of fatty acids [3,4]. Oils produced by enterprises of the Republic of Moldova, Ukraine and Romania were studied. For this purpose, stage-by-stage scheme of examination similar with one described for juices was used.

It was established that vegetable oils both produced in the Republic of Moldova (of sunflower, sunflower with increased content of oleinic acid, soya, rape, grapeseeds) and imported ones correspond with quality indices under normative acts and Codex Alimentarius standards for natural products. At the same time, cases of adulteration were revealed especially with samples selected from individual sector. These samples had bitter taste and additions of soya-bean and rape-seed oil to sunflower-seed oil.

These studies were implemented directly in production through scientific-technical support in determination of composition of fatty acids and identification of the product naturalness provided to producers of vegetable oils.

Modern market of food products offers wide range of butter both domestic and imported one packed in different packing of different weight. In the Republic of Moldova, as well as in CIS countries, composition and quality of butter is regulated by the GOST 37-91 „Butter”. Water content can be increased and mass fraction can be decreased, but not more than by 0.2%.

In recent years, in the light of modern concept of healthy alimentation, requirements to composition and nutritive value of food products were transformed essentially. It means revision of requirements to butter quality: reduction of traditional fat/plasma ratio in order to improve biologic values and dietetic properties; admission of adjustments in composition of fatty acids of fatty phase, including by means of partial use of vegetable fats [5].

Possibility of combining composition and properties of these products, as well as their economic expediency has provoked considerable interest in different countries. Such products continue to be named traditionally as sweet butter with improved composition and properties - „lightened” or „light”. However, principles of healthy alimentation remained the predominant economic reasoning. Addition of nondairy fats remained unjustified and fats of not so good quality are used many times. Many products similar with domestic and imported ones have appeared at the market. But, products only where there are no nondairy fats at all can be called as “sweet butter”. As a rule, there is no impartial information on these products, which is qualified correctly as apparent falsification both informational and qualimetric.

For revealing of adulterations of butter, new methods were elaborated or existed ones were modified in order to find out additions of vegetable fats or their substitutes in butter.

To reveal adulterations of butter, methods were selected, tested and modified for analysis of the specific quality indices of these products: the content of water-soluble volatile fatty acids; their sterols; higher fatty acid; and ratio of acids [6].

Convincing results were obtained during application of gas chromatography method for determination of higher fatty acids and Reihert- Meissel chemical method for analysis of water-soluble volatile fatty acids (capronic and butyric).

The last one is known, though it was not used for revealing of butter adulterations due to the absence of standards for these milk products.

These standards were established on the basis of simulation of mixture of milk fats with vegetable ones and substitutes of milk fats. Currently, analyses are performed that are

directed toward revealing of adulterations of butter produced by enterprises of the Republic of Moldova.

It should be noted that products are examined stage by stage similarly with adulterations of juices paying special attention to determination of specific components.

Problem of adulteration of food products became the national one in every country. Presence of the large volume adulterated products leads to economic losses both for the state and fair producers of high quality products [7,8].

This situation appeared in the result of absence of the state system preventing production and circulation of counterfeited goods in the course of merchandise logistics, absence of administrative and legal responsibility for production, introduction in circulation and realization of adulterated products.

Conclusions

By application of standardized methods and original methods elaborated within the frames of study, methods of (liquid and gas) chromatography were modified for determination of organic acids, glucides, proline and formol index in juices, composition of fatty acids in vegetable oils, higher fatty acids $C_{10} - C_{20}$ and water-soluble volatile fatty acids $C_4 - C_8$ in margarine and butter.

Methodology of examination of food products with revealing of adulterated ones (informational, assortment-related or qualimetric falsification) provides several consecutive stages.

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