**International Journal of Academic Information Systems Research (IJAISR)**
**ISSN: 2643-9026**
**Vol. 7 Issue 3, March - 2023, Pages: 39-45**

# Ensuring Food Safety

**Zafar Sadikov**

Associate Professor at the Customs Institute of the Customs Committee of the Republic of Uzbekistan
e-mail:zsadikovs@mail.ru

***Abstract:*** *The article highlights alternative ways of solving problematic situations that have arisen in the customs system and economic systems by ensuring the importation into Uzbekistan's domestic markets of goods of good quality and fit for consumer consumption, stopping the importation of goods that pose a threat to human health and regulating the domestic market.*

**Keywords:** vegetable oils, animal fats, fat and oil products research methods, triglycerides, sunflower oil, margarine, trans fats, trans isomers.

## 1. Introduction

Food safety, nutrition and food security are inextricably linked. Unsafe food creates a vicious cycle of disease and malnutrition, particularly affecting infants and young children, the elderly and the sick.

It is estimated that consumption of food contaminated with micro-organisms or chemicals sickens 600 million people annually, almost one in 10 of the world's population, and kills 420,000 people, resulting in the loss of 33 million years of healthy life (DALY).

Each year in low- and middle-income countries, the economic losses due to lost productivity and medical costs resulting from the consumption of unsafe food amount to $110 billion. The economic damage is estimated at $110 billion U.S. per year in low-and middle-income countries.

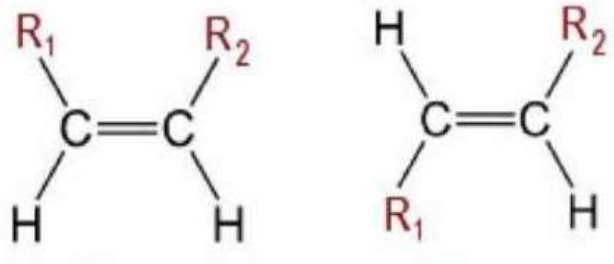
Children account for Forty per cent of the burden of foodborne diseases under 5 years of age, killing 125,000 children every year.

Foodborne diseases are an obstacle to socio-economic development by overburdening health systems and damaging national economies, tourism and trade [1].

## 2. Methods

In recent years, the use of trans fats by food manufacturers has increased dramatically. So what are trans fats? What negative effects do they have on the human body?

First, what are trans fats? Trans fats (or trans-isomers of fatty acids) are a type of unsaturated fat. In nature, they are present in meat and dairy products derived from ruminant animals (cows, sheep, goats). Trans-fats in these products are naturally formed because of bacterial activity during normal digestion in the stomach. On average, natural dairy products contain 2-6% trans fats, ruminants contain 3-9%, and chicken and pork contain only 0-2% [2]. The trans-isomer of the most common naturally occurring fatty acid is conjugated linoleic acid (CLA), which is found in milk fat and is considered beneficial.




***Cis*** ***Trans***

*Isomerization of fatty acids in oils*

From the producers point of view, for example, the more 'trans-isomers' or in other words trans-fats the product contains, the higher its melting point, which means it will keep its shape well.

By adopting a "trans-configuration", the molecule has a straight form rather than a curved one. This configuration is considered wrong because the human body simply cannot accept it at the cellular level. But fatty acids are the building material of our body, and, in fact, by consuming trans-fats we are introducing defects into the structure of cells and the whole body. This naturally leads to a disturbance of the exchange between cells and, as a consequence, to the development of many pathologies.

The consumption of trans-fats and saturated fats, such as palm oil, increases the risk of atherosclerosis and other vascular and heart diseases - which, according to the World Health Organization, are the most frequent causes of death on the planet [3].

In particular, the fact those such trans-fats cause gastrointestinal, cardiovascular and even cancer diseases points to the need to limit the consumption of these products.

Industrial trans-fats are bad for cardiovascular health: they increase 'bad' cholesterol and decrease "good" cholesterol. This leads to atherosclerosis - the accumulation of cholesterol on the walls of blood vessels. Every year more than 500,000 people die of cardiovascular disease due to the consumption of trans-fats.

Because trans-fats are so dangerous to human health, the World health organization (WHO) has even released a package of measures to help countries eliminate hydrogenated oils altogether [4].

Researchers recently compared the trans-fat content of foods that commonly use margarines and palm oil from 25 countries. It turned out that Denmark ranked last.

In 2004 Denmark became the first country to ban partially hydrogenated oils and artificial trans-fats from the diet. The law governing this states that the trans-fat content must not exceed 2% of the total fat in a product.

In the USA, a law has been in place since 2006 that requires the packaging of a product to indicate how much trans-fat it contains. According to a study published in 2013 in the WHO Bulletin, policies implemented in Brazil, Canada, Denmark, the Netherlands, the Republic of Korea and the USA) over the past two decades have been successful in eliminating trans fats from food.

You can and should reduce your consumption of trans fats. First, read the contents of the products you buy. If any hydrogenated or partially hydrogenated oil is listed as an ingredient, the product contains trans fats.

Foods that contain dangerous trans fats:

- margarine
- creamer
- dairy butter
- Mayonnaise and sauces based on it
- any fast food
- fish fingers or breaded cutlets
- chips
- popcorn
- frosted cakes
- chocolates
- Cakes with whipped cream
- Gingerbread
- biscuits
- ice cream
- puff pastry
- Quick food (cubes, noodles)

As already written above, domestic producers and some foreign ones do not indicate trans-fat content on packaging. Nowadays, going into any shop or fast food chain, it is almost impossible to distinguish the presence of harmful trans fats in products on one's own.

However, there are ingredients whose names encode that they contain trans-fats [5].

The names of the trans fats on the packaging:

- margarine
- Confectionery fat
- cocoa butter substitute
- vegetable fat and vegetable oil (vegetable oil, vegetable fat);
- hydrogenated oil
- milk fat substitute (milk fat substitute)
- powdered hydrogenated fat (powdered hydrogenated fat)
- "dairy, cottage cheese or cheese product with vegetable fats"

The table below shows the amount of fatty acid trans-isomers (FATs) in some products.

| Products | TI FA, g/100 g | Quantity of TI FAs, in total FAs |
|---|---|---|
| Corn sticks without added oil | 0,34 | 19,6 |
| Crisps | 5,5 | 31,5 |
| Shortenings | 20,6 | 21,5 |
| Mayonnaise | 3,4 | 4,5 |
| Margarine (soft) | 10,2 | 13,2 |
| Margarine (solid) | 21,1 | 26,6 |

The table shows that the content of trans-isomers is high in most of the products presented.

One such dangerous trans-fat is hydrogenated palm oil, which is added to almost all confectionery products, including cakes and pastries. This, in turn, causes an increase in various diseases in the population.

Palm oil itself is not dangerous to health. Whether sunflower, corn or any other oil, if hydrogenated, will become a source of industrial trans-fats. The use of trans-fats, especially hydrogenated palm oil, by food producers demonstrates the need for strict controls on the importation of these products into the country.

The only danger of palm oil lies not in its melting point but in its high-saturated fatty acid content. The more of this product consumed, the greater the harm.

The rules state that the total percentage of saturated fat should not exceed 10% of your total fat intake.

Currently 100% of palm oils imported into our country are processed (hydrogenated) products. Although importers do not always give correct information about the goods. Therefore, it is an important task to carry out customs expertise when carrying out customs control of such goods.

The main task of customs expertise is to protect the domestic market from low-quality goods that pose a threat to human health. This is a very complex task, and products have to be tested from different angles. Often, checking documents is only the first step, as certificates do not always fully correspond to the actual quality. For this reason, some products are subject to epidemiological control. This will help to prevent and detect the entry of potentially dangerous goods into the country's domestic territory.

## 3. Results and discussion

Animal and vegetable fats and oils, products of their decomposition, finished edible oils; waxes of animal and vegetable origin are included in Group III, Section 15 of the current Commodity Nomenclature of Foreign Economic Activities of the Republic of Uzbekistan, and hydrogenated palm oil is classified in item 1516 of this group. In the above commodity item, all types of palm oil are classified regardless of their physical state (liquid, solid and solid) and whether they are crude or refined. The melting point of palm oil is 33-56°C, depending on whether it is crude or refined (partially or fully hydrogenated). It is therefore advisable to detail them at the level of specific commodity sub-items in the nomenclature of foreign economic activity of the Republic of Uzbekistan, and at the same time to limit the importation of oils containing trans-isomers into the territory of our country. Restrictions on the importation of these goods will increase the number of cases of disguised importation of such goods with similar goods. Therefore, an important process is the examination of imported processed palm oil.

In order to identify processed palm oils, their organoleptic and physicochemical characteristics as well as their physical properties are studied. The physical indicators used for identification are density, refractive index, melting and solidification temperatures.

The melting point is the temperature at which fat goes from a solid to a liquid and depends on the ratio of fatty acids in the triglyceride molecule. As the amount of low molecular weight and unsaturated fatty acids increases, the melting point decreases.

The pour point is the temperature at which the oil changes from liquid to solid.

The iodine number describes the amount of unsaturated compounds in 100 g of oil and is equal to the reagent consisting of halogens bound to the oil, expressed in grams of iodine. The iodine number describes the quality and degree of saturation of the oil.

The acid number is the quantitative content of free fatty acids in the oil; its increase causes the hydrolytic decomposition of the glycerides.

The measurement of the melting point is one of the most important parameters in the analysis of refined palm oil. Measurement checks are carried out based on the requirements of GOST ISO 6321-2019.

**Method for determining the melting point of palm oil or its fractions**

The essence of the method. The essence of the melting point method is to measure the temperature at which palm oil or a fraction thereof changes from a solid to a liquid. The method is applicable to a melting point range of 12°C to 70°C.

Carrying out the measurement. The sample to be analysed is heated to its melting point in a water bath, stirred without introducing air and filtered through a paper filter at this temperature.

The filtered palm oil or its fraction is collected in two clean capillaries with one end touching the surface of the melted palm oil or its fraction.

The height of the column of palm oil or its fraction in the capillary must be (10±1) mm. Capillaries with palm oil or palm oil fraction are kept on ice until solidified.

Capillaries filled with solidified palm oil or palm oil fraction are placed in a beaker with a capacity of 50 $cm^3$ and kept in a refrigerator or thermostat at (10±1)°C for 16 hours.

Capillaries with solidified palm oil or its fraction are then attached to the thermometer with a thin rubber ring so that the column of palm oil or part of it is flush with the mercury bulb of the thermometer and the capillary is in a vertical position.

The thermometer with the capillary attached to it should be immersed in a beaker of distilled water to such a depth that its temperature is 8-10°C below the expected melting point, the capillary is submerged 30 mm into the water and its base is 30 mm from the bottom of the beaker and water is opened into the capillary, care should be taken to ensure that it does not enter the tip.

The beaker is placed in the stirrer and the stirrer and heater are switched on. The water in the beaker is initially heated at a rate of 1.0°C/min, the heating rate is reduced to 0.5°C/min as the beaker approaches the expected melting point.

The heating continues until a column of palm oil or its fraction starts to rise in each capillary.

Processing and presentation of results

The melting point is the temperature at which the palm oil or its fraction in the capillary starts to rise.

The result shall be recorded in the first decimal place with an indication of the holding time at (10±1) °C in rapid measurement mode. The arithmetic mean of the two parallel measurements shall be taken as the final measurement result.

Reproducibility limit of results

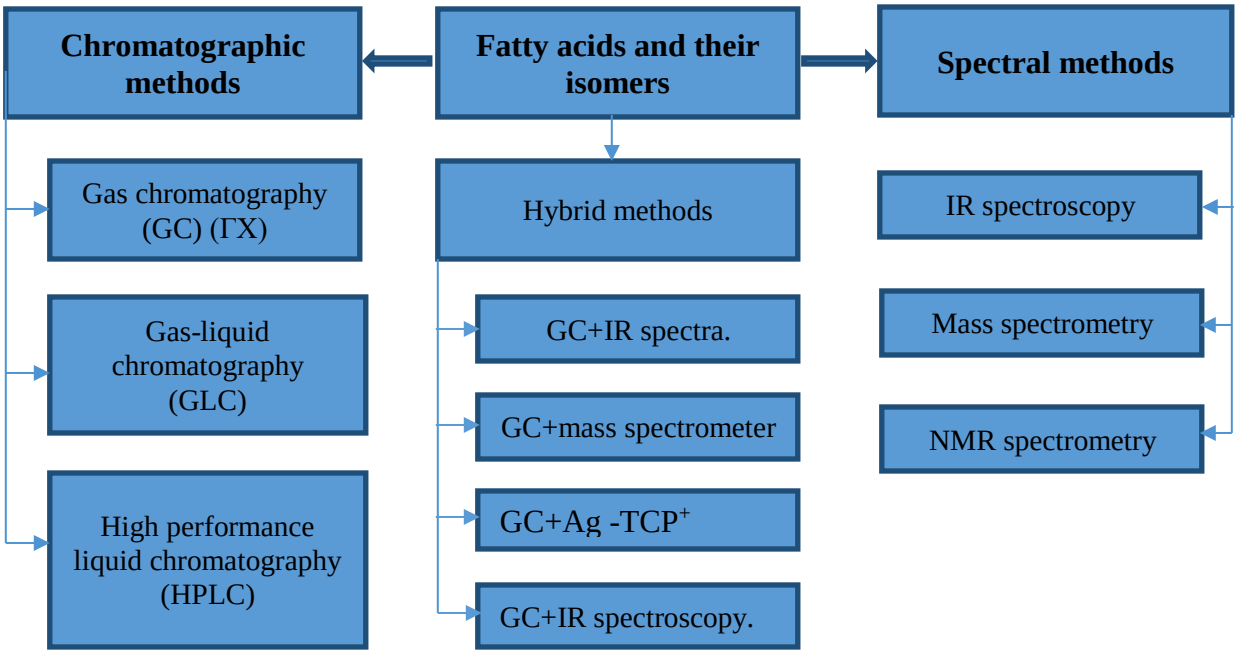
The discrepancy between the results of two independent single measurements carried out with the same method, the same test material, in the same laboratory, by the same analyst, using the same equipment, shall not exceed 7 % (at a probability R=0.95).

Result processing limit

When the same method is used, the difference between the results of two units measured on the same test material, in different laboratories, by different analysts, using different equipment, shall not exceed 15 % (at a probability R=0,95).

**Methods for the determination of fatty acid trans-isomers**

Chromatographic, spectral and hybrid methods of analysis are often used for fatty acid trans-isomers [6].




Chromatographic methods for the determination of hydrogenated fats

The most promising chromatographic methods for the determination of hydrogenated fats are capillary gas-liquid chromatography (GC) [7, 8, 9-13], high performance liquid chromatography (HPLC) and ion-silver HPLC [14-17], because any hybrid methods are much more expensive.

Now, gas chromatography (GC) using capillary columns with polar cyan silicone fixed phase obtain satisfactory analyses for fatty acids containing trans-fatty acids. In capillary gas chromatography techniques, the key limitation has been the incomplete

separation of the trans isomers from its cis acid; however improvements in separation are achievable with the use of 100m columns. These columns, allow for negligible overlap between cis- and trans-isomers.

Trans-fatty acids in food are often analyzed by gas-liquid chromatography (GLC) as methyl esters [7-9]. However, this method is fraught with misleading results due to insufficient separation of cis- and trans-isomers. The separation can be optimized by prior Ag+ thin layer chromatography (Ag-TLC), but this is time consuming. An efficient method has been developed to separate the 18-carbon trans-isomers of fatty acids by combining GLC of LC methyl esters with GLC of fatty acid derivatives of 4,4-dimethyloxazoline compounds. The combination of GC determinations of methyl ester derivatives and 4,4-dimethyloxazoline fatty acid derivatives improves the quantification of 18-carbon fatty acid isomers and possibly replaces the difficult and time-consuming Ag-TLC [10,11].

Silver ion HPLC is commonly used for the separation and determination of trans 18:1 isomers in partially hydrogenated oils and milk fats [14, 15]. Application of HPLC with Ag* ions for the separation of isomers of unsaturated monaenoic and polyenoic fatty acids is discussed. The influence of the type of chemical derivatization of LC on their separation efficiency is discussed, and it is noted that specific aromatic LC derivatives are the most optimal for analysis. Achievements of Ag-HPLC for the determination of octadecenoates and actadecadienoates with conjugated triple bonds in partially hydrogenated oils and milk fat are described [16-17].

Spectroscopic methods for the determination of hydrogenated fats

A large number of works are devoted to the identification and determination of hydrogenated fats by spectral methods: infrared spectroscopy, FTIR spectroscopy. Disturbed total internal reflection (TIR) infrared spectroscopy method.

The determination of the mass fraction of isolated trans-isomers of fatty acids by the method of disturbed total internal reflection (TDIR) is known [8, 18]. The method is designed for rapid (about 5 min) determination of the mass fraction of isolated trans-isomers in fatty products with a trans-isomer level of 1% or more. The method is not applicable to products: containing high levels (more than 5%) of conjugated unsaturated bonds (eg, tung oil): containing functional groups that change the intensity of the C-H deformation double bond in the transconfiguration (e.g. castor oil containing ricinoleic acid or its geometric isomer, ricinelaidic acid (12-hydroxy-E-oitadecenoic acid)) which are mixed triglycerides having long and short chain radicals (such as diacetostearin); any other containing components having functional groups which give absorption bands sufficiently close to the C-H band of a deformation isolated double bond in transconfiguration with a frequency (wave number) of 966-968 $cm^{-1}$.

A new and fast (5 min) Fourier infrared spectroscopy method for the determination of total isolated trans fatty acids which absorb at 966 cm was developed, jointly studied and applied to food products containing 1-50% trans-fat (as percentage of total fat) [6].

Quantitative and qualitative evaluation of trans-fatty acid isomers is difficult because of the wide range of positional mono-, di- and trienoic fatty acid isomers that are present in hydrogenated oils.

The possibility of using Fourier transform infrared spectroscopy for rapid simultaneous determination of cis- and trans-isomers, iodine number and saponification number of edible oils was shown. Measurements were performed in the near infrared region of the spectrum 10000-4000 $cm^{-1}$ with processing of the obtained data using an application software package. Using the method of least squares, we obtained 2 calibration graphs for hydrogenated soybean oils and for oils of different types. The method is recommended for widespread use in the food industry [19].

**Hybrid and combined methods for the determination of hydrogenated fats**

New groups of promising methods of analysis are hybrid and combined methods that reduce detection limits, increase selectivity and extend the field of application.

Hybrid methods are used: gas chromatography combined with thin-layer chromatography techniques [20-23] with mass spectrometric detection following pre-methyl transesterification of the fatty acids [23-27].

More accurate analyses of trans-fatty acids can be obtained by hybrid methods: gas chromatography with silver thin layer chromatography or liquid and gas chromatographic mass spectroscopy [15-17, 23-27].

Nuclear magnetic resonance spectroscopy (NMR) has become one of the most promising methods for the determination of organic structures, providing analytical information in the analysis of the fatty acid composition of edible oils. The main advantage of NMR is that each fatty acid is identified by means of specific signals. Fatty acid composition is identified by GC, trans fatty acids are identified by 13C NMR spectroscopy. Results obtained by 13C NMR method were quite close to those obtained by GC [21].

## 4. Conclusion

Based on the above, the following proposals are made to ensure the quality and safety of foodstuffs imported into the territory of the Republic, including oil and fat products:

1. Specification at the level of specific commodity items in the Commodity Nomenclature of Foreign Economic Activity of the Republic of Uzbekistan depending on the melting point of raw and processed (partially or fully hydrogenated) palm oil. Currently palm oil (partially or fully hydrogenated) is classified in commodity subheading **1516 20 960 8** as “other” of the current Commodity Nomenclature of Foreign Economic Activity of the Republic of Uzbekistan.

2. Establish expertise on fat and oil products, especially processed palm oil, given that the Central Customs Laboratory is equipped with modern equipment and techniques.

3. Restricting the importation of refined (hydrogenated) palm oil creates another problem, namely the smuggling of such products with similar products. It would therefore be appropriate to develop risk profiles for imported processed palm oil.

**References**

1. www.who.int
2. Food ecology guide. www.ncbi.nlm.nih.Gov/ pubmed
3. Riya Ganguly, Grant N. Pierce. The toxicity of dietary trans fats. Food and Chemical Toxicology, V. 78, 2015, P.170-176.
4. V. Vishnyakova. What is hydrogenated palm oil and should you be afraid of it? www.journal.tinkoff.ru
5. Ekaterina Solovyova. Trans-fats and palm oil. www.azbyka.ru
6. F.A. Chmilenko, L.P. Sidorova, N.P. Minaeva. Methods and objects of chemical analysis. 2010, -vol.5, №3, -P.106-117.
7. GOST P 51483-99. Vegetable oils and animal fats. Determination by gas chromatography of the mass fraction of methyl esters of individual fatty acids to their sum.
8. GOST P 52677-2006. Vegetable oils, animal fats, and derived products. Methods for determination of the mass fraction of trans-isomers of fatty acids.
9. Study of individual trans- and cis-16:1 isomers in cov, goat and ewe cheese fats by gas-liquid chromatography with emphasis on the trans-delta3 isomer / Destaillats F, Wolff RL, Precht D. Molkentin J. // Lipids. - 2000. - vol. 35(9). -P.1027-1032.
10. Rapid analysis of the isomers of trans-octadecenoic acid in milk fat / Dietz Prechta, Joachim Molkentirne // International Dairy Journal. -1996. -vol. 6(8). -P.791-809.
11. Determination of trans octadecenoic acids by siiver-ion chromatography- gas liquid chromatography: an intercomparison of methods // Buchgraber, M: Ulberth, F // J. Amer. oil Chem. Soc. Int. - 2001. -vol. 84(5). -P. 1490-1498.
12. Precision of low trans fatty acid level determination in refined oils. Results of a collaborative capillary gas-liquid chromatography study / Bruggen, F., Duchateau, G., Maughan, M., Oosten, H. // J. Amer. Oil Chem. Soc. -1998. - vol. 75(4). -P.483-488.
13. Analysis of cis- and trans- fatly acid isomers in hydrogenated and refined vegetable oils by capillary gas-liquid chromatography / G. S. S. M. J. E. Duchateau, H. J. van Oosten, M.A. Vasconcellos // J. Amer. Oil Chem. Soc. -1996. -vol. 73(30). -P. 275-282.
14. Utilisation of reversed-phase high-performance liquid chromatography as an alternative to silver-oin chromatography for the separation of cis- and trans-C13:1 fatty acid isomers / Pierre Juaneda // Journal of Chromatography A. - 2002. - vol. 954(2). -P.285-289.
15. Trans-free margarine from highly Saturated Soybean Oil / Li Lee Kok, Walter R Fehr, Earl G. Hammond and others // J. Amer. Oil Chem. Soc. - 1999, -vol. 76(10). -P.1175-1180.
16. Silver ion HPLC four the analysis of positionally isomeric fatty acids / Nikolova-Damyanova B., Momchilova Sv. J. // Liq. Chromatogr. and Relat Technol. 2002. 25, №13-15. P.1947-1965.
17. Wolff, R.L. Content and Distribution of trans-18:1 Acids in Ruminant Milk and Meat Fats. Their importance in European Diets and Their Effect on Human Milk // J. Amer. Oil. Chem. Soc. -1995, -vol. 72(3). -P.259-272.
18. Fourier transform infrared spectroscopy: a newly developed, non-invasive method to measure body fat: non-invasive body fat content measurement using FT-NIR // Azizian H. // Lipids. 2007. -vol. 6. -P.154-160.
19. Simultaneous determination of iodine value and trans content of fats and oils by single-bounce horizontal attenuated total reflectance Fourier trans-form infrared spectroscopy / Sedman J., Van de Voort F.R., Ismail A.A. // J. Amer. Oil Chem. Soc. 2000. 77, №4, -P.399-403.
20. Methods for analysis of conjugated linoleic acids andd trans-18:1 isomers in dairy fats by using a combination of gas chromatography, silver-ion thin layer chromatography/gas chromatography, and silver-ion liquid chromatography /

Cruz-Hemandez Cristina, Zeyuan Deng, Jianqiang Zhou and others // J. Amer. Oil Chem. Soc. International. - 2004. - vol. 87(2). - P. 545-562.

21. Quantification of trans fatty acids in food products by GC. ATR-FTIR and FT-NIR methods / Hormoz Azizian. John K.G. Kramer, Anthony R Kamalian and others // Lipid Technology. - 2004. - vol. 16(10). -P. 229-231.
22. Detection of trans-fatty-acids content in margarine - an intercomparison study of GLC, GLG+TLC, FT-tR, and optothermal window / D Bicanis, M. M Chirtoc, Jp Favier and others // Analytical Chemistry. - 1999. -vol. 68(5). - P.00729-00733.
23. Trans fatty acids (TFA): analysis, occurrence, intake and clinical relevance / Steinhart H, Rickert R, Winkler K. // E u r . J. M e d Res. - 2003. - vol. 8(8). - P.358-362.
24. Gas chromatography - mass spectrometry determination of metabolites of conjugated cis-9, trans-11, cis-15 18:3 fatty acid / Frederic Destailatsa, Jean-Louis Sebediob, Olivier Berdeauxb and others / Journal of Chromatography B. -2005. - vol. 820(1). -P.15-22.
25. A simple method for the analysis of trans fatty acid with GC-MS and AT$^{TM}$ -Silar-90 capillary column / Zhiliang Huanga, Baowu Wang, Aneesha A. Grenshawa / Food Chemistry. -2006. -vol. 98(4). -P.593-598.
26. Recent developments in instrumental analysis for food quality / Andre Muller, Hans Steinhart // Food Chem. 2007. 101, №3, P.1136-1144.
27. Analysis of isomeric long-chain hydroxy fatty acids by tandem mass spectrometry Application to the diagnosis of long-chain 3-hydroxyacvl CoA dehydrogenase deficiency / Jonson D. W., Trinh M.U. // Rapid Commun. Mass Spectrometry, 2003. 17, №2, P.171-175.