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# Qualitative indicators affecting the oxidation of rapeseed and linseed oils

**Abstract.** The production of high-quality and safe vegetable oils is an important economic task.

This article analyzes the applied aspects of improving the quality and safety of rapeseed and linseed oils. The factors affecting the quality and safety of rapeseed and linseed oils are analyzed. Studies of consumer preferences for rapeseed and linseed oils in the city of Nur-Sultan have been conducted. The results of the analysis showed that the consumer prefers the quality and safety of vegetable oils.

Since the composition and technological properties of oilseed raw materials are influenced by many factors, to regulate the production process and improve the quality and safety of vegetable oils, it is necessary to have information to what extent the quality of oilseed raw materials affects the characteristics of the finished product developed on its basis.

By applying an individual approach to the selection of parameters of oilseed raw materials, it is possible to ensure traceability of results and processes for each production cycle of vegetable oils, as well as to effectively implement a production control program by the requirements of regulatory documentation and TR CU 024/2011.

The article takes steps to improve the current regulatory and technical documentation for vegetable oils. It is proposed to use an approach based on the traceability system of vegetable oils. From these positions, some key features, and aspects of measuring qualitative indicators affecting the oxidation of rapeseed and linseed oils are considered, and the creation of a national standard «Traceability in the production chain of vegetable oils» is justified. The methodology and methods of research are determined by a systematic approach that allows us to study and identify the relationship between the processes of processing, storage, transportation, and sale of vegetable oils.

**Keywords:** Rapeseed oil, linseed oil, quality, safety, traceability, consumer.

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## Introduction

One of the leading places in the food complex of Kazakhstan is occupied by the fat-and-oil industry, which is connected both with the diversity and uniqueness of fat-and-oil raw materials, and with the important role of fats in human nutrition. The global volume of production and consumption of the main types of vegetable oils (palm, soybean, rapeseed and sunflower) is growing annually.

The leaders in the global food consumption market are four types of vegetable oil – palm, soybean, rapeseed and sunflower – and the shares of the latter two in the structure of world consumption have been stable over the past years. Currently, rapeseed and linseed oils remain quite popular and in demand in the world.

The natural conditions of Kazakhstan allow us to grow various types of oilseeds in demand on the market – rapeseed, soy, sunflower, curly flax and others. The key oilseeds grown and, accordingly, exported from the Republic of Kazakhstan are flax, rapeseed and sunflower seeds.

The unique properties of vegetable oils allow them to be widely used in the food industry. Their valuable properties are due to the content of unsaturated fatty acids, phospholipids, fat-soluble vitamins (A, E) in them. In terms of the content of polyunsaturated fatty acids, rapeseed and linseed oils are not

inferior to olive oil and even surpass it. They are classified as the best edible vegetable fats by the composition of fatty acids. [1-5]

Rapeseed oil, due to its ability to withstand high temperatures when heated, is very popular in the restaurant business, as it significantly speeds up the cooking time.

In terms of taste, rapeseed oil is equated with olive oil (in many respects the composition of these products is quite similar), is in demand and is considered one of the best vegetable oils. Rapeseed oil retains transparency for a long time, does not acquire an unpleasant odor under the influence of air.

Currently, rapeseed oil with a reduced content of erucic acid is very widely used in the production of baby food products — in the production of milk-based dry baby cereals, dry infant formula for feeding young children, and is also added to the composition of sterilized vegetable mixtures. Rapeseed oil contains the most alpha-linoleic acid, it is very useful for the human body, and is absolutely indispensable for the development of the body of a small child. Rapeseed oil improves metabolism and is absorbed by itself much easier than other vegetable oils. The oleic acid contained in rapeseed oil in excess allows diabetics and dieters to consume it. This acid participates in metabolism, and also stimulates regenerative processes in skin cells, moisturizes and nourishes it.

Rapeseed oil is considered especially useful for women, because the substances that make up it are necessary for the formation of female sex hormones. Thus, regular use of this product helps to reduce the risk of infertility, as well as diseases of the female genital area, including cancer. Rapeseed oil is also useful for pregnant women: the substances contained in it contribute to the normal development of the fetus [6-14].

Linseed oil occupies a leading position among vegetable oils. Studies of the effects of flaxseed on the body have already proven that it reduces the development of breast, prostate and colon cancers, as well as prevents lung diseases. And scientists have also determined that the use of flax seeds can reduce the risk of cardiovascular diseases, stroke and diabetes. What is the secret of the healing properties of flax? Linseed oil contains a large amount of vitamins and other biologically active compounds necessary for our health: alpha-linolenic acid - 60% (Omega-3); linoleic acid – 20% (Omega – 6); oleic acid – 10% (Omega-9); other saturated fatty acids - 10%.

Linseed oil prevents inflammatory reactions that lead to the formation of plaques on the walls of arteries and circulatory disorders.

Recently, there has been an increase in flax processing due to the emergence of a new demand for it as a functional nutrition product, an increase in industrial consumption and an increase in production [15-20].

The quality and safety of any food product are formed not only in the production process. An important role is played by the quality and safety of raw materials. Immaturity of seeds, their high defectiveness, etc. they are the reasons for obtaining highly acidic oils. There are known data on pathological changes in the body when using oxidized and thermally oxidized fats [3-10].

In recent years, seeds with a high peroxide number have been increasingly processed. The higher the peroxide number in the seed oil, the higher the content of oxidation products in the finished product. The oxidation of the oil destroys essential fatty acids and leads to the formation of toxic and oxidized products [27-30].

It is known that the process of oxidation of vegetable oils is influenced by many conditions, including humidity, enzymatic, photo- and thermal processes, the presence of metals of variable valence, etc. Vegetable oils are subject to penalties, and therefore it is necessary to strictly observe storage regimes, especially in relation to sunlight and oxygen, which are catalysts for oxidative processes. Regimes and warranty periods for the storage of vegetable oils are often violated. And the warranty periods of storage are set depending on the fatty acid composition of triglycerides of oils

Unfavorable storage conditions of vegetable oils, especially in the presence of moisture, lead to an increase in the content of free fatty acids. This reduces the quality of the oil, worsens its nutritional value. [21-25]

Therefore, an important aspect of the consumption of vegetable oils is not only their nutritional and biological value but also safety and quality, which depend on several factors related to the technological processes of processing oilseeds, oil production, storage, transportation, and subsequent heat treatment.

The relevance of research on the safety of rapeseed and linseed oils is due to the need for a systematic approach to the implementation of the new Law of the Republic of Kazakhstan "On Technical Regulation" in the field of assessment and safety of consumer goods.

One of the most important requirements of legislation in the field of consumer protection is to provide the consumer with objective, reliable and understandable information about the product. This requirement in the Republic of Kazakhstan is implemented by the provisions of the Law «On Consumer Rights Protection» and applies to any products submitted by manufacturers to the domestic market of the country.

Legislative requirements for food products by the Law of the Republic of Kazakhstan «On Technical Regulation» include not only requirements for product safety, but also requirements for the prevention of actions misleading purchasers. The first and main stage of the implementation of this requirement is to provide the consumer with complete information about the product. As a rule, such information is provided to the consumer in the form of labeling, the main purpose of which is to identify the product in order to enable consumers to choose the necessary or desired product.

The issues of identification of products in circulation on the market, including vegetable oils, are extremely relevant. It is known that without identification it is impossible to present specific requirements to products, including those provided for by technical regulations and standards. If an object is identified incorrectly, it is difficult to talk about its quality and safety.

Currently, it is quite difficult to prove the conformity of products with their name indicated on the label. In this regard, in order to effectively regulate the circulation of vegetable oils, it is advisable to develop a system for its identification.

The solution to this problem should be comprehensive and focus on the following elements: regulatory, methodological, laboratory and informational.

First. It is necessary to consider the existing regulatory framework in terms of terminology and the development of methods that can be used in the identification of vegetable oils. In many cases, national (interstate) standards for these methods require updating both for a clearer description of aspects related to the identification of vegetable oils, and for the revision of technical or metrological provisions. The use of standardized methods will avoid the problem of reproducibility of results for summing up identification tests.

Second. It is necessary to develop standards for modern express identification methods. Currently used chromatographic, spectral (optical), electrochemical, radiometric and mass spectrometric methods require the use of the latest test equipment and measuring instruments.

The third. It is necessary to improve the regulatory framework regulating the requirements for the quality and safety of rapeseed and linseed oils, based on the principle of traceability applied to the entire life cycle chain.

Fourth. It is urgent to develop a methodological tool for designing information for the consumer, based on process and system approaches, which will increase consumer guarantees regarding the purchase of high-quality and safe products that meet legislative requirements and consumer requirements. The lack of a clear methodology for designing information for the consumer, despite the apparent certainty of labeling requirements, leads to the fact that at present regulatory authorities identify in retail chains a significant number of oilseed processing products with violations in label labels, which, among other things, can lead to undesirable consequences for consumer health.

## Research methodology

The work was carried out in the Laboratory of processing of oilseed raw materials of the Kazakh Research Institute of Processing and Food Industry.

The research was carried out in three directions. At the first stage, a marketing assessment of the market, consumer preferences and consumption structure of rapeseed and linseed oils in Nur-Sultan was carried out.

A marketing assessment of the consumer market of vegetable oils of the city of Nur-Sultan was carried out in the autumn of 2021 by a survey of the population. Everyone who bought oil in the store was interviewed in a row. At the first stage, a target portrait of the consumer was created. According to the results of statistical processing, it turned out that 82% of respondents were women and 18% were men. More than half of the respondents (59.3%) are respondents 46 years and older, 28.5% are 26-45 years old and 12.2% are 18-25 years old. Respondents were asked to fill out a questionnaire, the purpose of which was to identify the preferences and intentions of consumers, as well as to evaluate the types of rapeseed and linseed oils currently on the market. 1,275 people took part in the survey.

The second stage was associated with the development of a methodology for designing consumer information for vegetable oils based on the systematization of identification features of products and documents united by a common purpose and establishing requirements for labeling consumer packaging.

An expert assessment questionnaire was developed to determine the level of consequences for the consumer in case of a violation in the labeling of consumer containers for vegetable oil. The experimental data obtained were processed by methods of mathematical statistics. Work has been carried out to study the identification features of vegetable oils and their influence on the labeling features of consumer packaging.

Identification of vegetable oils was carried out by visual verification of the presence of identification marks using the markings applied to it and (or) accompanying documentation. 245 samples of labeling of consumer containers of vegetable oils were taken for analysis.

Normative documents according to which rapeseed and linseed oils were identified and their quality was assessed, rapeseed [6-10]: GOST 8988-2002, GOST 31759-2012, ST RK 1429-2005; linseed - GOST 5791-81, ST RK 2645-2015.

The characteristics of vegetable oil products were grouped according to the principle of uniformity:

- a group of features reflecting the raw origin of the product and the composition of vegetable oils;
- a group of features reflecting technological processes that are decisive for various groups of vegetable oils;
- a group that combines organoleptic characteristics that determine the consumer properties of the product;
- a group of physico-chemical indicators, including a list of quantifiable indicators of the product;
- a group of microbiological indicators, including a list of quantifiable and qualitative indicators of the product;
- a group of features that characterize the special properties of the product.

Considering legislative and regulatory requirements, only those identification signs were used that would not mislead the consumer about the composition of the product, nutritional value, nature of origin and other information indirectly characterizing its quality and safety. To select and describe the properties of products, a list of labeled and unmarked identification features has been developed.

At the third stage, the analysis of legislative documents, regulatory legal acts, regulatory and technical base for rapeseed and linseed oil was carried out and recommendations for its improvement were proposed.

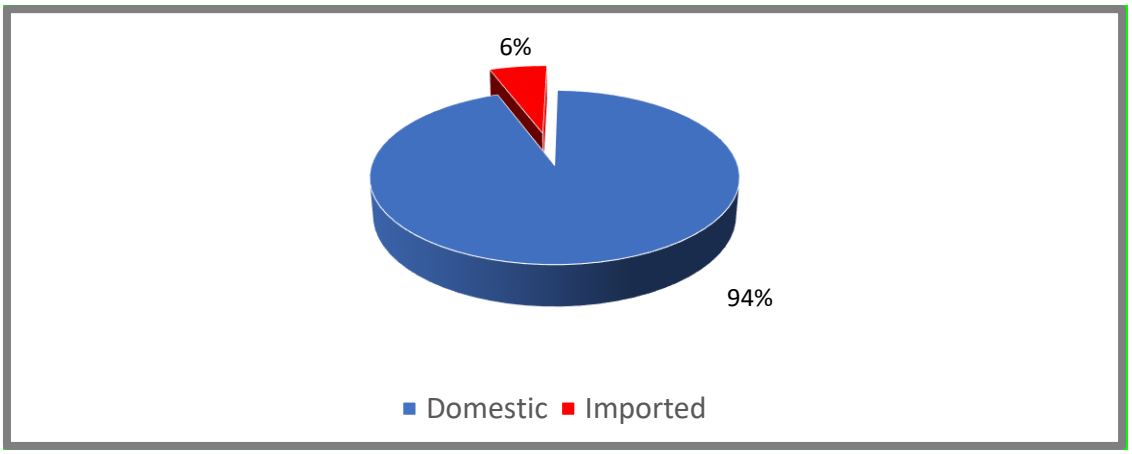
The authors examined how the procedure for the identification of vegetable oils is reflected in legal,

regulatory, and methodological documents. By the Law of the Republic of Kazakhstan «On Technical Regulation», technical regulations should contain provisions on identification for a specific type of product.

In the fourth stage, a draft of national standards «Traceability in the production chain of vegetable oils», «Vegetable oils. Terms and definitions». The issues of the terminology of vegetable oils are of particular importance. This applies both to terms and definitions related to finished products and technological terminology. The lack of standardized requirements in this area leads to the falsification of products and the deception of consumers.

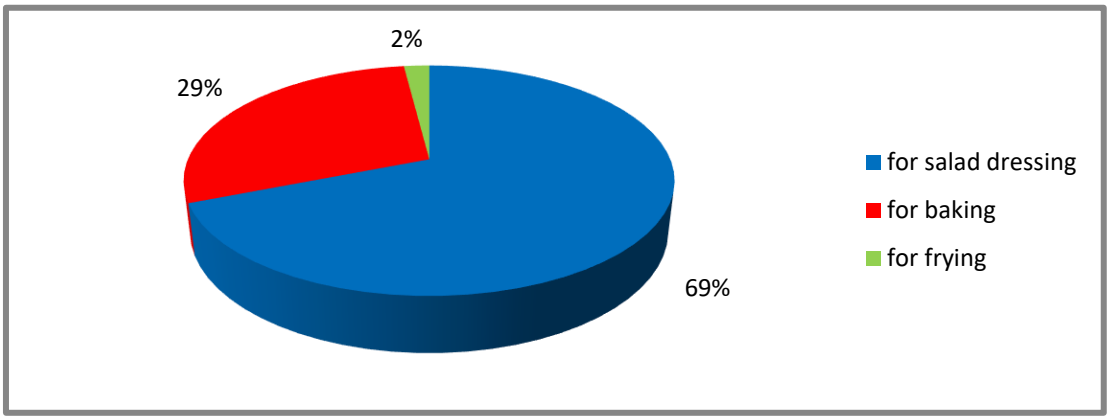
## Research results

The first question we asked consumers: «Do you prefer vegetable oils of domestic or imported production? » The data is shown in Picture 1. As can be seen from the diagram, many consumers (94.2%) prefer domestic products, and only 5.8% of respondents buy imported products



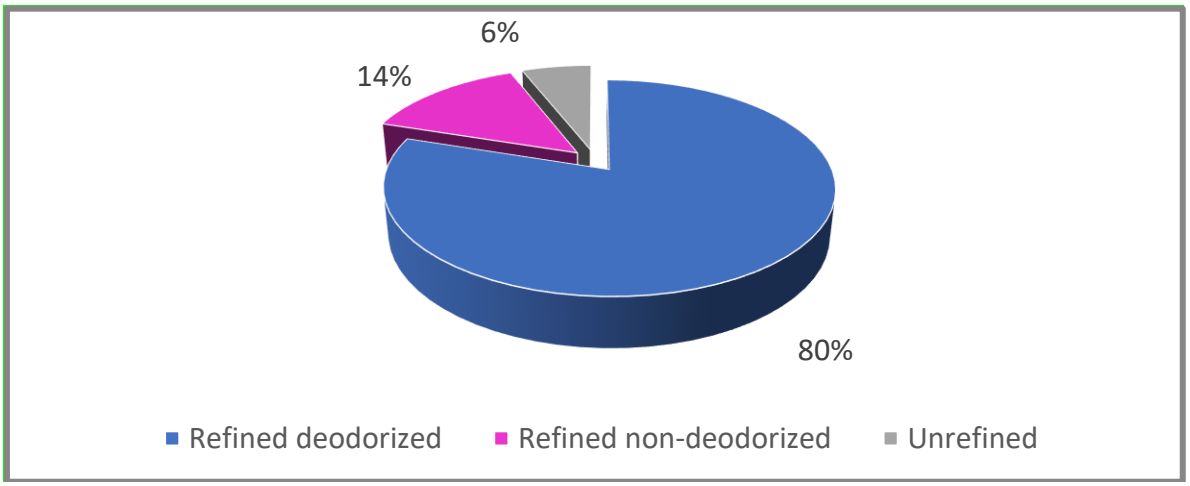

**Picture 1. Preferences of residents of the city of Nur-Sultan to producers of rapeseed and linseed oils**

For the most part, consumers use rapeseed and linseed oil for salad dressing (69%), for baking (29%), for frying (2%) (Pic. 3).



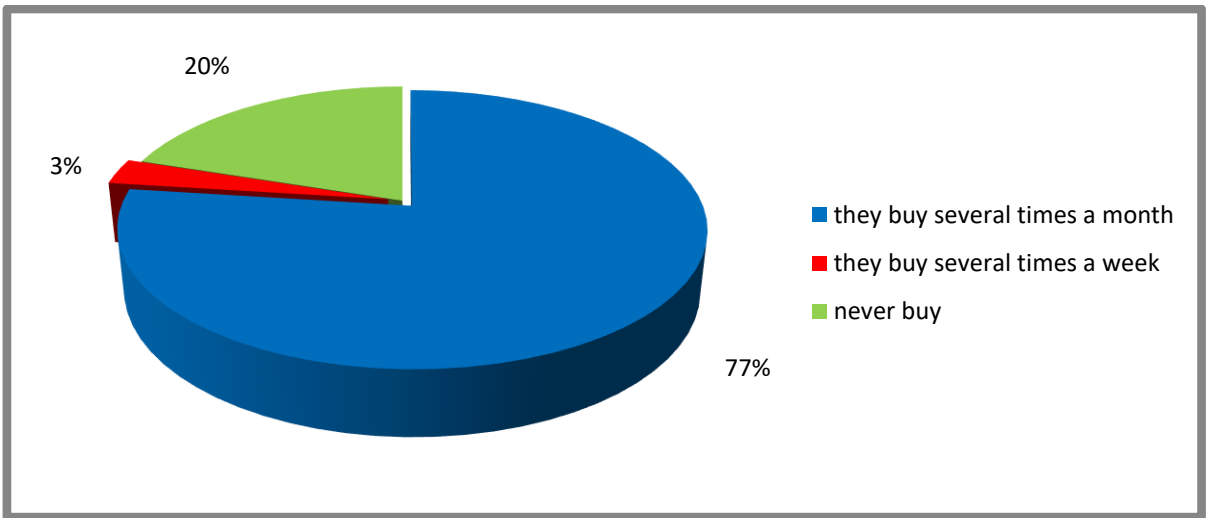

**Picture 2. Area of use of rapeseed and linseed oils**

Studies have shown that refined deodorized rapeseed and linseed oil are preferred by 80%, and refined non-deodorized - by 14% (Pic. 3).



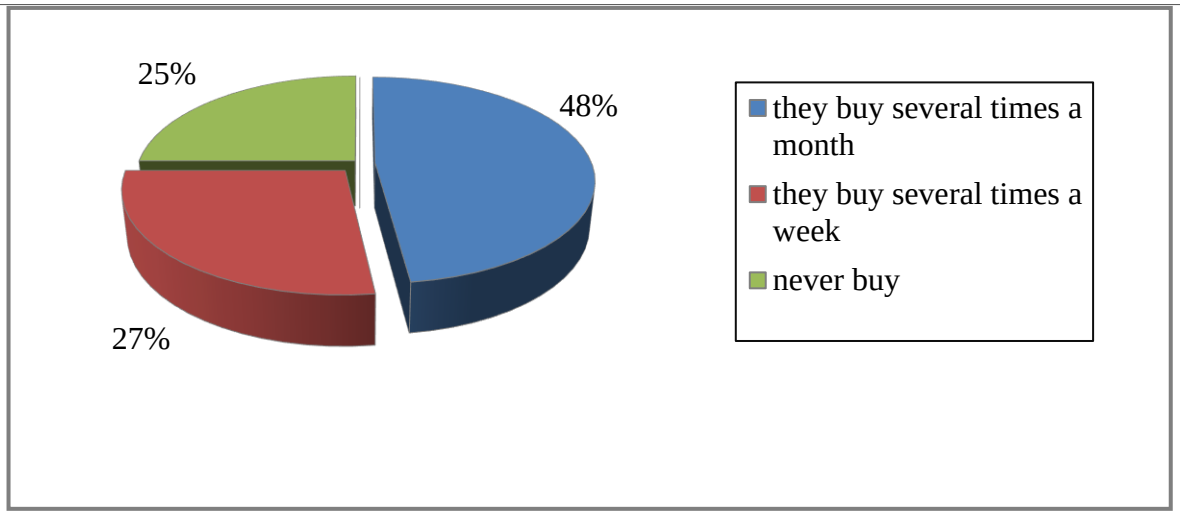

**Picture 3. Consumer preferences on the degree of purification of rapeseed and linseed oils**

To the question «How often do you buy rapeseed oil?» the majority of respondents (77.1%) replied that they purchase this category of products several times a month; 2.7% of respondents - several times a week, 20.2% do not buy this category of goods at all (Pic.4).




**Picture 4. Structure of rapeseed oil consumption**

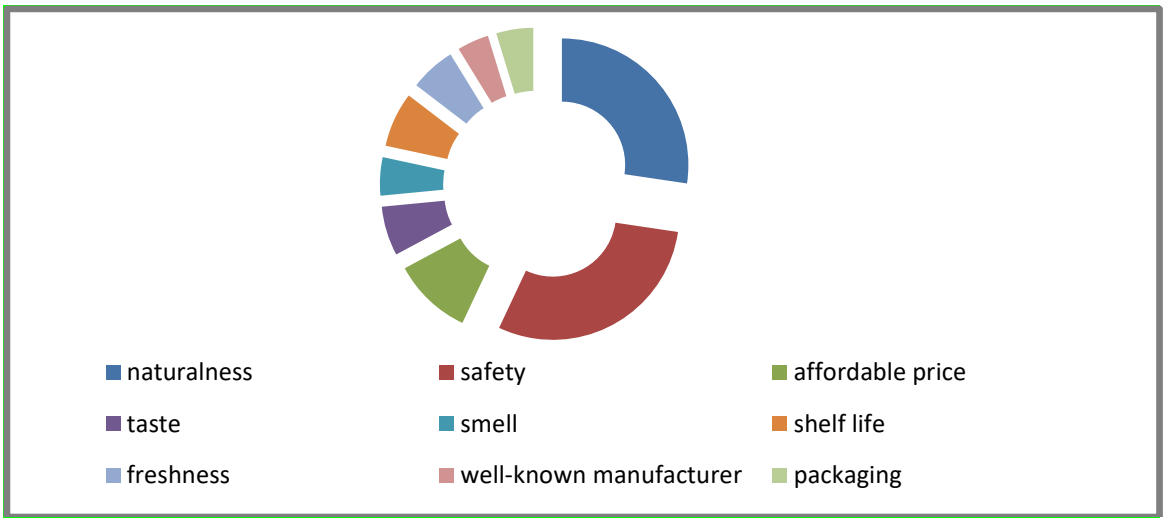
The results of the study of linseed oil are as follows: 47.6% of respondents chose the best option for buying linseed oil – "several times a month", 27.3% prefer to purchase these products several times a week and 25.1% do not buy linseed oil at all (Pic.5).




**Picture 5. The structure of consumption of linseed oil**

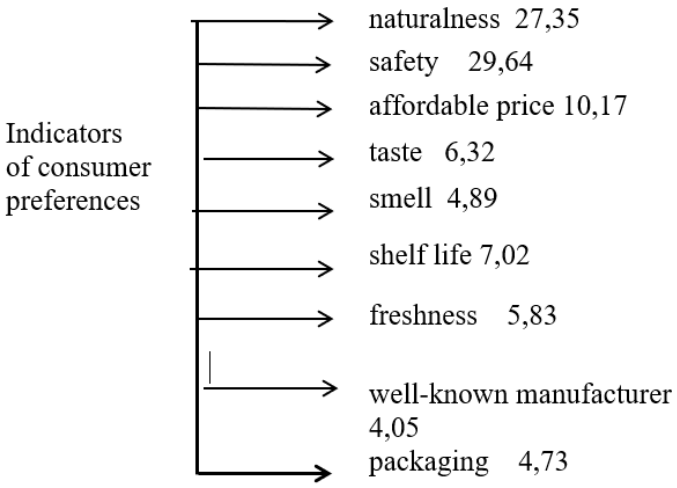
At the next stage of research, the nomenclature of consumer properties of rapeseed oil was identified, expressed in the «language of consumers», the ranking of the identified nomenclature was carried out and the weighting coefficients (relative) were determined. The results of determining the weighting coefficients of consumer preference indicators are presented in Figure 6.

As can be seen from Figure 6, the most important indicators of the consumer properties of sour cream are two indicators: naturalness (relative. = 27.35%) and security (29.64%). The indicators of average importance include the remaining indicators of consumer preferences (affordable price, taste, smell, shelf life, freshness, well-known manufacturer, packaging), which account for slightly more than half of the total value of the weighting coefficients of consumer preferences (56.99%) (Pic. 6).



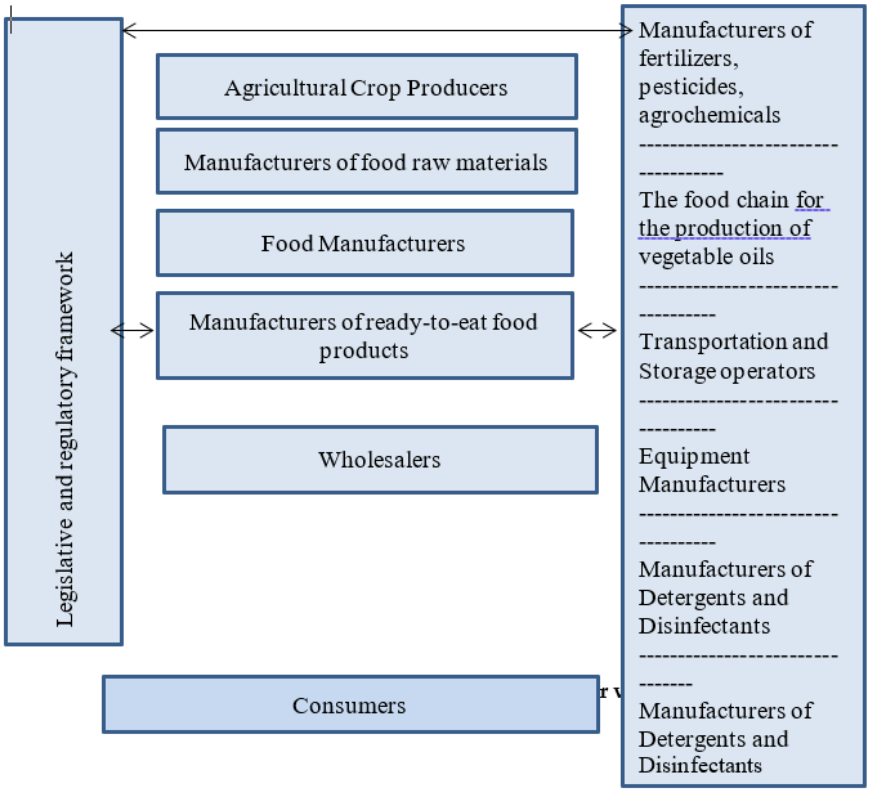

**Picture 6. Weighting coefficients of consumer properties of rapeseed oil**

The obtained results allow us to form a part of the properties tree – a tree of indicators of consumer preferences for the quality of rapeseed oil (Pic. 7).




**Picture 7. A tree of indicators of consumer preferences for the quality of rapeseed oil with weighting coefficients**

We have scientifically substantiated the basic structure of a multilevel hierarchical quality management system of vegetable oil. The safety and quality of the product are created in stages at each level of the system (Pic. 8).




**Picture 8. Safety and quality assurance system for vegetable oils**

Analysis of GOST 18848-2019 «Vegetable oil. Organoleptic and physico-chemical indicators «Terms and definitions» showed that the presented terms affect only terminology related to the quality and safety indicators of vegetable oils.

The developed document contains terms and definitions of the stages of rapeseed oil production,

intermediate and by-products of the production process.

A comparative analysis of the terms adopted in the domestic practice of vegetable oil production with terms standardized abroad shows that direct use of international terminology in some cases is impossible.

The authors have developed a label layout. The layout is a scan of a package or part of it, or a label containing illustrations, text, signs and barcodes, the requirements for which must be met based on the collected data. The work consisted of several stages. Experts – representatives of trade organizations of the city of Nur-Sultan were invited to this work. It is established that at all stages of the label layout development process, problems and inconsistencies of the object with the specified criteria and parameters should be identified and predicted. In order to establish the absolute and relative importance of each of the considered stages of the process, a matrix diagram was constructed.

It has been established that labeling that does not have the necessary degree of reliability can lead to undesirable consequences as a result of incorrect product selection by the consumer. To determine the level of consequences for the consumer, the authors applied a methodology (Rozhina N.V., 2011), including a list of possible inconsistencies in labeling, as well as a scale for assessing the significance of consequences for the consumer (Table 1).

**Table 1. Scale for determining the significance of the consequences for the consumer**

| Characteristics of the consequences for the consumer | Characteristics of the consequences for the consumer | Evaluation |
|---|---|---|
| No consequences | There will be no consequences | 1 |
| Weak | Dissatisfaction with consumer expectations | 2 |
| Moderate | Dissatisfaction with the needs of the consumer | 3 |
| Dangerous | Causing harm to the consumer's health | 4 |

Based on the study and analysis of legislative and regulatory-technical documentation, as well as the results of 245 samples of labeling of consumer containers of vegetable oil, the labeling elements presented in the form of a tree diagram are established (pic.9).

To systematize the identification features of vegetable oils, the authors analyzed the basic concepts, concepts of production processes and indicators of vegetable oils included in the Technical Regulations of the Customs Union for fat and oil products (TR CU 024/2011), and also studied the regulatory and technical documentation of the industry.

The authors provide a list of signs for all identified groups of signs. It is established that the signs attributed to the group, including technological features of the production of vegetable oils, correspond to the information reflected in the labeling elements «product name», «information on the composition of the product», «information on storage conditions»; a group of signs, including information on the physico-chemical parameters of the product - in the labeling elements «information about nutritional value», «mass fraction of fat» (including «the mass fraction of fat in the dry matter of the product», the mass fraction of milk fat in the fat phase of the product); a group including microbiological identification features determines whether the product belongs to the group of fermented milk products (dairy and dairy components) and fermented products (dairy components and milk-containing products, including heat-treated), taking into account the content in them microorganisms, thereby determining the name of the product. A number of unmarked identification features have been identified, which are used in the assessment and confirmation of conformity or are classification, allowing the product to be attributed to a specific grouping (for example, the mass fraction of protein in skimmed milk solids, the fermentation process, etc.), or clarifying (for example, information about organoleptic signs when forming the product

name)

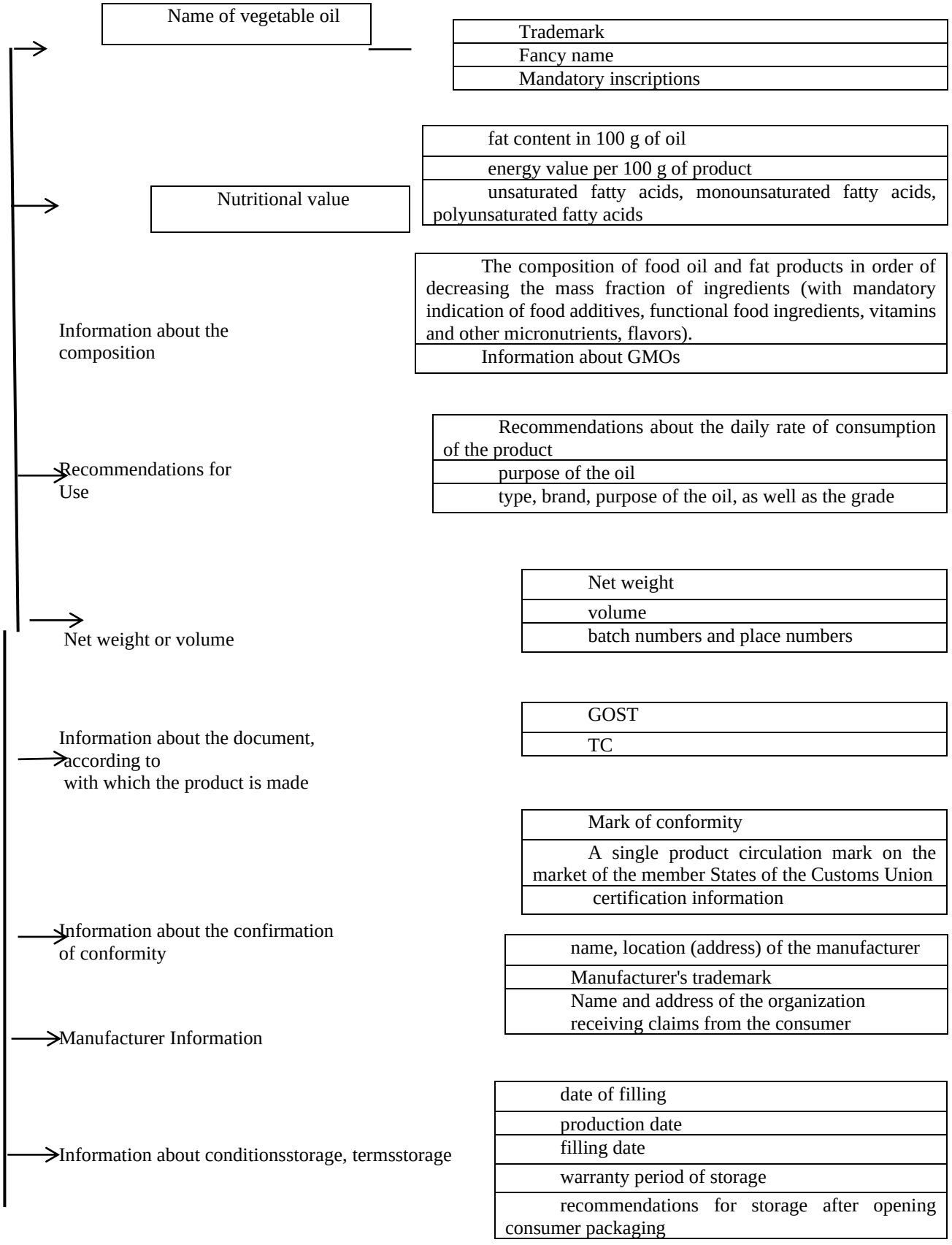

Name of vegetable oil
Trademark
Fancy name
Mandatory inscriptions
Nutritional value
fat content in 100 g of oil
energy value per 100 g of product
unsaturated fatty acids, monounsaturated fatty acids, polyunsaturated fatty acids
Information about the composition
The composition of food oil and fat products in order of decreasing the mass fraction of ingredients (with mandatory indication of food additives, functional food ingredients, vitamins and other micronutrients, flavors).
Information about GMOs
Recommendations for Use
Recommendations about the daily rate of consumption of the product
purpose of the oil
type, brand, purpose of the oil, as well as the grade
Net weight or volume
Net weight
volume
batch numbers and place numbers
Information about the document, according to with which the product is made
GOST
TC
Information about the confirmation of conformity
Mark of conformity
A single product circulation mark on the market of the member States of the Customs Union
certification information
Manufacturer Information
name, location (address) of the manufacturer
Manufacturer's trademark
Name and address of the organization receiving claims from the consumer
Information about conditionsstorage, termsstorage
date of filling
production date
filling date
warranty period of storage
recommendations for storage after opening consumer packaging

Table 2 presents the results of an expert assessment of determining the significance of aspects of labeling vegetable oils**.**

**Table 2. The significance of the consequences of errors in labeling elements for the consumer**

| The level of significance of the consequences for the consumer | Ev aluation | Name of the marking element |
|---|---|---|
| No consequences | 1 | 1. Information about the document according to which the product is manufactured<br>2. Information about the manufacturer |
| Weak | 2 | 1. Net weight (or volume)<br>2. Nutritional value |
| Moderate | 3 | 1. Name of vegetable oil<br>2. Information on conformity assessment |
| Dangerous | 4 | 1. Information about storage conditions, production date and expiration date<br>2. Information about the composition<br>3. Recommendations for use |

The above results were used by the authors as the basis for the draft national standard «Traceability in the production chain of vegetable oils». When developing a standard, it is necessary to consider the requirements of technical regulations, production features, product characteristics, and consumer expectations. As you know, the complexity of the traceability system varies depending on the properties of the products and the goals set.

The proposed document implements the following principle:

- protection of consumer rights through the development and operation of a methodological tool for designing information for consumers based on process and system approaches, which will increase consumer guarantees regarding the purchase of high-quality and safe vegetable oil that meets legislative requirements and consumer requirements.

When developing the standard, the following factors were considered:

- technical limitations specific to the organization and products (for example, the nature of raw materials, batch size, collection and transportation procedures, processing and packaging methods);
- the economic effect of the costs of using such a system.

The standard establishes the principles and basic requirements for the development and implementation of a traceability system for vegetable oils in their production chain. The standard will be intended for use by any organization working at any stage of the production of vegetable oils. The application of the developed standard should be flexible enough to allow organizations producing vegetable oils to achieve their goals. The traceability system should document the history of the product and/or its position in the vegetable oil production chain. This standard will facilitate the search because caused non-compliance with the requirements and will allow, if necessary, to cancel or recall products. The standard can also improve the proper use and reliability of the information, and the efficiency and productivity of the organization's activities.

The traceability system at enterprises has been developed based on the following data: objectives; regulatory and policy requirements related to traceability; products and/or ingredients; place in the vegetable oil production chain; material flow; information requirements; procedures; documentation; coordination of the vegetable oil production chain.

According to the requirements of the standard, information about the movement of materials (products) within the traceability system must be linked to the origin of materials, the history of

technological processing, and the distribution of vegetable oils. The analysis of the organization's traceability system should be carried out at appropriate intervals or when changes are made to goals and/or products or processes. On the basis of such an analysis, appropriate corrective or preventive actions are taken, which makes it possible to establish a process of continuous improvement. According to the standard, this analysis should contain, among other things, the following data:

- traceability of test results;
- traceability of audit results;
- changes made to products or processes;
- traceability information provided by other organizations of the vegetable oil production chain;
- corrective actions regarding traceability;
- customer reviews, including complaints about traceability;
- new or amended technical regulations affecting traceability;
- new statistical methods of evaluation.

## Discussion

Studies of consumer preferences have shown (Fig. 1-6) that most respondents surveyed in the city of Nur-Sultan want vegetable oils to be natural and safe. Most respondents (94%) prefer to purchase domestic products, in their opinion, the products of local manufacturers are of higher quality, short shelf life, and safe to use.

As the respondents noted, the falsification of vegetable oils is common, and the re-sorting of vegetable oils is also widespread. Highly refined vegetable oils are very often replaced by crude and even technical types of oils. High-quality adulteration of rapeseed and linseed oils can be achieved in the following ways: violation of production technology; violation of the formulation; violation of purification technology.

As the survey results showed, quantitative falsification of vegetable oils is very common when the net weight of the container with vegetable oil is less than what is written on the package itself. Consumers note that many packages with vegetable oil indicate that it does not contain cholesterol. But all types of vegetable oil have never contained cholesterol, since this substance is synthesized only by animal organisms. This information misleads the ordinary consumer and is just an advertisement.

The analysis of legal, regulatory, and methodological documents showed the following. According to this Technical Regulation of the Customs Union for Fat and oil products (TR CU 024/2011), the identification of vegetable oils is carried out by one and (or) several of the following methods: by name, visual method, organoleptic method, analytical method. As the analysis of the Technical Regulations has shown, the problems of identification of vegetable oils in this document have not been completely solved. Due consideration of this issue should be carried out within the framework of separate documents, which are related to the quality and safety of vegetable oils, and their falsification.

Let's turn to the interstate standard GOST 18848-2019 «Vegetable oils. Organoleptic and physicochemical parameters. Terms and definitions». This standard defines the terms and definitions of the basic concepts in the field of indicators of vegetable oils. According to this document, the complex Physico-chemical indicators for most vegetable oils include a fatty acid composition of vegetable oil, the density of vegetable oil, a refractive index of vegetable oil, solid fat content [solid triacylglycerols], a melting point of vegetable oil, solidification temperature of vegetable oil, titer [solidification temperature of fatty acids] of vegetable oil, flash point vegetable oil, the ignition temperature of vegetable oil, the mass fraction of moisture in vegetable oil, the mass fraction of moisture and volatile substances in vegetable oil, the mass fraction of non-fat impurities in vegetable oil, vegetable oil sludge by volume, the total ash content in vegetable oil, the mass fraction of phosphorus-containing substances in vegetable oil, color number, acid number, peroxide number, etc.

The analysis of GOST 18848-2019 showed that it is necessary to update the terms, if necessary, replace them with new ones that meet the requirements. Currently, many compositions of vegetable oils with a balanced composition of fatty acids have been developed, and therefore the authors recommend making changes to the standard in terms of terminology and metrological support.

Interstate standard GOST 32190-2013 «Vegetable oils. Acceptance rules and sampling methods» establishes acceptance rules, methods and means of sampling unpacked and prepackaged vegetable oils.

Modern world trends in the field of healthy nutrition («organic», «bio») are aimed at the consumption of natural vegetable oils, as close as possible to nature and with a minimum degree of chemical and thermal effects. Indicators of oxidation of vegetable oils in most countries, including the USA and the European Union, are indicators of the quality of vegetable oils and are set individually for each type of oil, depending on the growing conditions of oil plants and methods of subsequent processing.

The interstate standard GOST 33441-2015 applies to vegetable oils and establishes a near-infrared spectroscopy method for simultaneous rapid determination of the following quality and safety indicators: acid number; peroxide number; anisidine number; mass fraction of phosphorus-containing substances; mass fraction of erucic acid (for vegetable oils from cruciferous seeds); mass fraction of transisomers of fatty acids [18].

Interstate standard GOST 5477-2015 «Vegetable oils. Chromaticity determination methods» establishes two methods for determining the chromaticity of unrefined and refined vegetable oils:

- on an iodine scale in the range from 1 to 100 mg of iodine for all oils except cotton;
- on the Lovibond scale in conventional units for all oils, including cotton.

Currently, the main criterion for assessing the biological and nutritional value, as well as detecting adulteration of vegetable oils, is the fatty acid composition of their triglycerides. In the vast majority of cases, it is characterized by the predominance of some fatty acids and a small content or absence of others, which is the basis for the group classification of oils by iodine number. In recent decades, there has been a clear trend towards their replacement by less labor-intensive modern physico-chemical instrumental express methods. Currently, chromatographic and optical methods are the most common of the instrumental methods of quality control and detection of possible adulteration of vegetable oils.

As an example, we will give the interstate standard GOST 30623-2018 «Vegetable oils and products with a mixed composition of the fat phase. The method of detecting falsification». This standard establishes a method for detecting adulteration of vegetable oils and products with a mixed composition of the fat phase containing oils and fats of non-dairy origin and milk fat (spreads and ghee mixtures). The conformity of the investigated vegetable oil to the claimed name is established by comparing the fatty acid composition determined because of measurement with the fatty acid composition of the vegetable oil of the corresponding name.

Thus, the quality and safety control of vegetable oils is carried out by various standard methods, among which there are both chemical and instrument (for example, gas-liquid chromatography) [17-26].

However, the existing variety of instrumental methods for identifying vegetable oils does not solve the identification problem, since the adaptation of existing methods is required in relation to the control of toxic additives, various mixtures of vegetable oils, and the authenticity of products.

When setting certain types of vegetable oils for production, the absence of established standards makes it difficult to: determine its group affiliation and identification name; select criteria and indicators of product safety, determine the risks of the production process and further confirm compliance. It is not excluded that the consumer may be misled about the nature, origin and composition of vegetable oils.

As the analysis showed, there is no unified approach to the presentation of the identification procedure for vegetable oils in the considered regulatory documents. In the reviewed regulatory documents, there is no clear requirement to confirm its composition and structure.

When developing a traceability and identification system for vegetable oils, it is necessary to take into account the following.

According to TR CU 024/2011, the quality indicators of vegetable oils after contact with steel may

change, since the chemical elements that make up the steel are oxidation catalysts and can lead to oxidative damage [16].

Other possible causes of the appearance or presence of a sharp odor in oils should not be excluded, namely:

- the possibility of adding poorly purified extraction oil with a large amount of residual solvent;
- the probability that the oil consists of a mixture of vegetable oils with a high content of unsaturated fatty acids, especially linolenic, the presence of which is characteristic of the group of drying vegetable oils (linseed, etc.) [15].

As the research results have shown, in accordance with the legislation in the field of consumer protection, products that do not have relevant information about the product and do not correspond to the information provided cannot be in circulation.

Such products are recognized as substandard and/or dangerous to the consumer and are subject to rejection. According to the control and supervision authorities, one of the reasons for the rejection of products is a violation of the labeling rules.

Information obtained as a result of product identification and traceability often helps to identify opportunities for improving the quality of products in an organization.

Firstly, it is necessary to identify any hazards in the production process that may lead to the release into circulation of vegetable oils that do not meet the requirements of the current regulatory and technical documentation (technical regulations, standards). Secondly, to identify critical control points in the production process in which control is needed to prevent or eliminate hazards. Thirdly, to set the limit values of indicators determined and controlled at critical control points. Fourth, monitor the indicators controlled at critical control points. Fifth, to establish the procedure for actions in case of deviation from the established safety indicators [11].

Thus, the basis of the proposed traceability system is a fund of normative and methodological documents, which represents the identification methodology, in particular, methods for testing indicators of vegetable oils, sampling, etc.

It is necessary to develop standards regulating many aspects important for ensuring the identification of vegetable oils. In particular, terminology, sampling for testing, requirements for test reports, etc.).

## CONCLUSION

1. Marketing research has shown that rapeseed and linseed oils are in demand in the consumer market of Kazakhstan. When buying rapeseed and linseed oil, consumers focus mainly on the naturalness and safety of the product, prefer domestic vegetable oils. Refined deodorized oil, which is used mainly for salad dressing and baking, is in great demand among them.

2. The levels of significance of the consequences for the consumer of violations in the labeling of consumer packaging are scientifically substantiated on the basis of an expert assessment. It has been established that inconsistencies in the labeling elements of vegetable oil are critical for the consumer: «information on the composition of the product", "information on storage conditions, production date and shelf life», «nutritional value».

3. A schematic diagram of the quality management of vegetable oils has been developed. A draft of the national standard «Traceability in the production chain of vegetable oils» has been developed.

4. A system of external and internal documents has been formed that are mandatory for use in the design of marking elements. A model of the process "Designing and developing information for the consumer" has been developed.

Based on the above, the basis of regulatory quality assurance and safety of rapeseed and linseed oils should be based on measures that can be conditionally divided into 3 large groups. The first group of

measures is related to the creation of new national and interstate standards for rapeseed and linseed oils. The second group of activities is related to the development of new methods for the identification of vegetable oils. The third group of tasks concerns the creation of reproducible and standardized reference measures suitable for tuning, calibration and verification of instruments for measuring the oxidation rate of vegetable oils.

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**Рапс және зығыр майларының тотығуына әсер ететін сапалық көрсеткіштер**

**Аңдатпа.** Жоғары сапалы және қауіпсіз өсімдік майларын өндіру маңызды ұлттық экономикалық міндет болып табылады.

Мақалада рапс және зығыр майларының сапасы мен қауіпсіздігін арттырудың қолданбалы аспектілеріне талдау жасалды. Рапс және зығыр майларының сапасы мен қауіпсіздігіне әсер ететін факторлар талданады. Нұр-сұлтан қаласында рапс және зығыр майларының тұтынушылық артықшылықтарына зерттеулер жүргізілді. Талдау нәтижелері тұтынушы Өсімдік майларының сапасы мен қауіпсіздігін қалайтындығын көрсетті.

Майлы шикізаттың құрамы мен технологиялық қасиеттеріне көптеген факторлар әсер

ететіндіктен, өндірістік процесті реттеу және Өсімдік майларының сапасы мен қауіпсіздігін жақсарту үшін майлы шикізаттың сапасы оның негізінде өндірілген дайын өнімнің сипаттамаларына қаншалықты әсер ететіндігі туралы ақпарат болуы керек.

Майлы шикізаттың параметрлерін іріктеуге жеке тәсілді қолдана отырып, Өсімдік майларының әрбір өндірістік циклі үшін нәтижелер мен процестердің қадағалануын қамтамасыз етуге, сондай-ақ нормативтік құжаттаманың және КО ТР 024/2011 талаптарына сәйкес өндірістік бақылау бағдарламасын тиімді орындауға болады.

Мақалада өсімдік майларына арналған қолданыстағы нормативтік-техникалық құжаттаманы жетілдіру бойынша қадамдар жасалды. Өсімдік майларын қадағалау жүйесіне негізделген тәсілді қолдану ұсынылды. Осы ұстанымдардан рапс және зығыр майларының тотығуына әсер ететін сапа көрсеткіштерін өлшеудің кейбір негізгі ерекшеліктері мен аспектілері қарастырылады, "өсімдік майларын өндіру тізбегіндегі бақылау" ұлттық стандартын құру негізделген. Өсімдік майларын өңдеу, сақтау, тасымалдау және сату процестері арасындағы байланысты зерттеуге және анықтауға мүмкіндік беретін жүйелі тәсілге байланысты.

**Кілт сөздер:** рапс майы, зығыр майы, сапасы, қауіпсіздігі, қадағалануы, тұтынушы

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**Качественные показатели, влияющие на окисление рапсового и льняного масел**

**Аннотация.** Производство качественных и безопасных растительных масел является важной народнохозяйственной задачей.

В данной работе проведен анализ прикладных аспектов повышения качества и безопасности рапсового и льняного масел. Проанализированы факторы, влияющие на качество и безопасность рапсового и льняного масел. Проведены исследования потребительских предпочтений в отношении рапсового и льняного масел в г. Нур-Султан. Результаты анализа показали, что потребитель отдает предпочтение качеству и безопасности растительных масел.

Поскольку на состав и технологические свойства масличного сырья оказывают влияние многие факторы, то для регулирования производственного процесса и улучшения качества и безопасности растительных масел необходимо располагать сведениями, в какой степени качество масличного сырья влияет на характеристики готового продукта, выработанного на его основе.

Применяя индивидуальный подход к подбору параметров масличного сырья, можно обеспечить прослеживаемость результатов и процессов для каждого производственного цикла растительных масел, а также эффективно выполнить программу производственного контроля в соответствии с требованиями нормативной документации и ТР ТС 024/2011.

В статье предприняты шаги по совершенствованию действующей нормативно-технической документации на растительные масла. Предложено использовать подход, основанный на системе прослеживаемости растительных масел. С этих позиций рассмотрены некоторые ключевые особенности и аспекты измерений качественных показателей, влияющих на окисление рапсового и льняного масел, обосновано создание национального стандарта «Прослеживаемость в цепочке производства растительных масел». Методология и методы исследования обусловлены системным подходом, позволяющим изучать и выявлять взаимосвязь между процессами переработки, хранения, транспортирования и реализации растительных масел.

**Ключевые слова:** Рапсовое масло, льняное масло, качество, безопасность, прослеживаемость, потребитель

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