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# INNOVATIVE APPROACHES TO DEVELOPING FUNCTIONAL FOOD ADDITIVES FROM MEDICINAL PLANTS

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# INNOVATIVE APPROACHES TO DEVELOPING FUNCTIONAL FOOD ADDITIVES FROM MEDICINAL PLANTS

**MONOGRAPH**

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N.Kh.Tukhtaboev, D.A.Shodiev, G.K.Najmitdinova, M.A.Abduvalieva. Innovative approaches to developing functional food additives from medicinal plants. Monograph. Global Book Publishing Services (GBPS) USA, 2024, 135 p.

In the monograph, preparation of biologically active food additives for functional nutrition based on local varieties of the medicinal amaranth plant and other medicinal plants, in this regard, extracting leaves, inflorescences, and seeds from amaranth varieties as the main products, squeezing oil from the seeds tasks of extraction, drying of other residues and preparation of these components for conversion into food additives are determined.

The monograph is intended for professors and teachers of higher educational institutions in the field of food technology, students, scientific workers, independent researchers, and all interested parties.

The monograph was reviewed by the Scientific Council of Fergana Polytechnic Institute and recommended for publication.

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# ABBREVIATIONS

BAA-biologically active additive
BAS-biologically active substance
BAFA - biologically active food additive
AS - aligned system
NG FEA - nomenclature of goods of foreign economic activity
ST-state standard
O‘zDST - Uzbek State Standard
TC – technical condition
UzTR - technical reglament of Uzbekistan
TI-technical instruction
SanRN - sanitary rules and norms
ECG-electrocardiogram
SF - State Pharmacopoeia
PET-polyethylenterephthalate
GCH-MS - gas chromatography-mass spectrometry
XRD-X-ray diffraction
m-meter
mm-millimetres
μm - micrometer
*l* - litre
ml-milliliter
g-gramme
kg-kilograms
t-tonne
eV - electronvolt
min - minute

# INTRODUCTION

In our republic, improved technologies for deep processing of agricultural products, obtaining semi-finished and finished food products from them, and obtaining necessary preparations for the food, pharmaceutical, and medical industries from their secondary materials have been created. The action strategy for the further development of the Republic of Uzbekistan, "deepening structural changes and consistent development of agricultural production, further strengthening the country's food security, expanding the production of environmentally friendly products, significantly increasing the export potential of the agricultural sector" tasks are defined. In this regard, among other things, scientific research aimed at creating technologies for the production of import-substitute products from locally grown medicinal plants is of great importance [1].

Decree of the President of the Republic of Uzbekistan dated January 6, 2017 No. PQ-2716 "On additional measures to develop the organization of storage and deep processing facilities for fruit and vegetable products in 2017-2018", No. PQ-3573 of February 28, 2018 "On deep processing of fruits and vegetables, obtaining export-substitute nutritional ingredients from secondary raw materials", No. PF-4947 of February 7, 2017 "On the Republic of Uzbekistan This dissertation research serves to a certain extent the implementation of the tasks defined in the decrees and decisions of the "Strategy of Actions for further development" and other regulatory legal documents related to this activity. In addition, to rapidly develop the cultivation of medicinal plants and the establishment of greenhouse farms in the Republic, to further increase the export potential of the sector and to increase the level of employment and income of the population, to establish a single organizational system that provides a mechanism for creating new jobs, especially in rural areas. and the decisions made in order to develop the cultivation of medicinal plants based on innovative technologies, to expand the production of useful

products as a result of their complex processing, also represent the importance of scientific research in this field [2,3].

At the same time, insufficient attention is paid to the cultivation of new, productive and competitive medicinal plants on the basis of innovative technologies, the provision of quality information-consulting services is not established at the level of demand, and cooperative relations are complete. Due to the lack of formation, the existing opportunities in the field are not used effectively, one of the current issues.

In order to further develop this sector in the republic, expand the scope of scientific research, increase the volume of production of high-quality industrial and exportable products based on the use of advanced and modern resource-saving technologies, and widely introduce mechanisms of state support for medicinal products. Work is being carried out to establish wide use of foreign technologies, achievements in science and production, innovations in plant processing, introduction of new innovative technologies and development of service industries [2].

At the same time, cooperatives established with the participation of processing enterprises and exporting organizations are based on mutual cooperation with the growers of medicinal plants, on the basis of cooperative activities, sorting, processing, storage, packaging and export of the grown products. It is considered necessary to introduce an efficient system of administration [3].

The Ministry of Innovative Development of the Republic of Uzbekistan and the Ministry of Agriculture will form fundamental and practical research and innovative scientific and technical projects on medicinal plants for 2020-2024 and ensure their implementation on the basis of grant competitions. a number of tasks have been given.

"Uzstandart" agency is tasked with increasing the production of products that meet the requirements of internationally recognized standards and accelerating the certification of medicinal plants, including amaranth products,

based on the requirements of these standards. It is known that synthetic additives are widely used as additives in the food industry today. This is due to the availability of cheap methods of production of synthetic food additives. However, it is no secret that synthetic food additives have a negative effect on the human body. Taking this into account, the task of creating inexpensive and cost-effective, safe for human health, ecologically clean, new, natural, biologically active food additives and their production on an industrial scale is an urgent problem. It is important to create new types of food supplements based on medicinal plants and put them into production, replacing synthetic supplements and having a positive effect on people's health.

In the following years, the tasks of developing the food industry and ensuring socio-economic development in our country are gaining more and more urgent importance.

The importance of satisfying the population's demand for ecologically clean food products, and studying food products, and biologically active food additives on a scientific basis has created the need to conduct scientific research in this field. Today, planting, cultivation and processing of non-traditional medicinal plants, introduced to local conditions, and production of biologically active food supplements based on them are being implemented [4].

Despite the fact that the chemical composition, biologically active substances, and pharmacological properties of most of the traditional medicinal plants in Uzbekistan have been widely studied, medicinal components have been extracted from the residual parts, and together with this, in recent years, they have been added to the list of these medicinal plants. "the practice of preparing biologically active food supplements from the wastes generated during the processing of non-traditional medicinal plants, which are more effective, have higher biological and nutritional value, are adapted to local conditions, and are being introduced" la not launched [5].

After sufficient extraction of the biologically active components of some medicinal plants, certain amounts of these components are preserved in the

remaining parts, and many medicinal plants have other types of components that have nutritional value together with such components, pharmaceuticals provide an opportunity to additionally obtain nutrients with different biological and chemical value from components considered as waste products for industry. This, along with bringing economic benefits, is also important in introducing a healthy diet and maintaining the health of the population.

Decision No. PQ-3968 of the President of the Republic of Uzbekistan dated October 12, 2018 "On measures to regulate the field of folk medicine in the Republic of Uzbekistan", Decision of the President of the Republic of Uzbekistan adopted on April 10, 2020 "O' Decision No. PQ-4668 "On additional measures to develop folk medicine in the Republic of Uzbekistan", "On the development strategy of New Uzbekistan for 2022-2026" dated January 28, 2022 These researches serve to a certain extent the implementation of the tasks defined in the Decree No. PF-4947 and other legal documents [6,7].

## CHAPTER I. COMPONENTS OF NEW BIOACTIVE FOOD SUPPLEMENTS CHEMICAL COMPOSITION AND PHARMACEUTICAL PROPERTIES

### § 1.1. Chemical composition and medicinal properties of new varieties of amaranth (*Amaranthus hypochondriacus L.*) introduced to local conditions in Uzbekistan.

577 of the 4230 species of plants in our country have been found to be medicinal plants. The amaranth plant, which belongs to the "Gultojikhoroz" class, has been known for a long time in our country as a unique medicinal plant. There is information about the widespread use of amaranth in the treatment of wounds and ulcers, bad breath and other diseases.

The word amaranth is derived from the ancient Russian Slavic words "mara (amrita) - death", and "a - denial" and means "denial of death" or "eternity". In Greek, "αμάρανθος" is formed by adding the prefix "a - negation" and the words "maraíno - to wither" and "anthos - flower", literally meaning "flower that does not fade". (dried amaranth keeps its shape for 3-4 months). In ancient Slavic medicine, amaranth was used as an anti-ageing agent. Central American peoples - Incas and Aztecs, ancient Etruscans and Hellenes also considered it a sign of eternal life [23, 88-91 p.].

Machin (gultojikhoroz) (Russian "shchiritsa, barkhatnik, aksamitnik, petushinye grebeshki, koshachiy khvost, lisiy khvost", Latin "amaránthus", Greek "amáranthos") is a widespread, annual herbaceous plant with small flowers united in spike-shaped inflorescences, belonging to the family "Amaranths" (Amaranthaceae). The grain is small - 1,800 grains weigh 1 gram, the body grows up to 2-4 meters and yields in 3.5 months. It gives good honey during flowering.

The original homeland of amaranth is South America, and it is known in history that it was used as a cultivated plant by the local population 8 thousand years ago.

Amaranth later spread around the world to North America, India and Asian countries, reaching China. Currently, it is widely popular as a cereal and vegetable plant among the mountain people of India, Pakistan, Nepal and China. This plant, which has been cultivated in European countries, such as Russia and Ukraine, is widely used in medicine, cooking, cosmetology, industry, agriculture and other sectors of the national economy. It is also grown as an ornamental plant in some countries for its colourful flowers and leaves. It has 65 varieties and more than 900 species.

To date, 19 varieties of amaranth have been introduced in local conditions, and the varieties "Uzbekistan-M", "Andijan", "Marhamat", "Ulug'nor" based on the Kharkovsky-1, Helios, Ultra and Lera varieties of amaranth were created by natural selection. was created, recognized as a breeding achievement, a patent was ordered under these names, and the relevant patents were issued (see Fig. 1.1-1.4). Possibilities of amaranth cultivation on degraded lands with high salinity and ultimately the dynamics of decreasing soil salinity are being tested in practice [23, 51-54].

**Figure 1.1. The Uzbekistan-M variety gives 5-6 tons of seeds and 270 tons of blue mass from 1 hectare of cultivated area.**

**Figure 1.2. Merhamat variety gives 4-5 tons of seeds and 200 tons of blue mass from 1 hectare of cultivated area**

**Figure 1.3. The excellent variety gives 4-5 tons of seeds and 200 tons of blue mass from 1 hectare of cultivated area**

**Figure 1.4. Andijan variety gives 2-3 tons of seeds and 100 tons of blue mass from 1 hectare of cultivated area**

The fact that the decrease in the level of salinity of the earth creates enough opportunities for the cultivation of other technical plants also shows the economic efficiency of this plant [55, 66-67 b].

The healing properties of amaranth are widely promoted in foreign medicine. Although the first study of certain properties of some types of amaranth in Uzbekistan was carried out by K.S.Safarov, I.R.Askarov, and N.X. Tokhtaboev since the 90s of the last century, its chemical composition, important aspects in pharmaceuticals and medicine have not been thoroughly studied [ 8-10].

Amaranth oil in the biosynthesis of cholesterol in medicine; in cleaning the body from radionuclides, and heavy metal salts; infectious diseases, herpes, psoriasis, vitiligo, neurodermatitis, eczema, atopic dermatitis, gastrointestinal ulcers, diabetes, liver disease, genitourinary colds, atherosclerosis, anaemia,

avitaminosis, angina pectoris, hypertension, oncological and cardiovascular diseases widely used in solving problems. It dramatically increases immunity, it is an unparalleled tool in the fight against anaemia.

Amaranth seeds are a source of oil and squalene. Squalene, which is needed for the pharmaceutical industry, is imported from the liver of sharks and whales, and it is clear to science that these substances are present in large quantities (8%) in amaranth oil, and that this oil contains phytosterols and other substances that have medicinal properties necessary for human health. After that, attention to amaranth oil increased dramatically. Amaranth oil contains 77% of unsaturated fatty acids, 50% of which are linoleic and linolenic acids. Vitamin YE in the form of tocopherols in oil has an antioxidant effect and has the property of reducing the amount of cholesterol in the blood. The oil also contains rutin and vitamin R, and has antimicrobial and fungicidal properties [11-13].

Currently, amaranth oil is used for oncological and cardiovascular problems, ischemic diseases, cleansing the body of radionuclides, heavy metal salts, infectious diseases, herpes, psoriasis, vitiligo, neurodermatitis, eczema, atypical dermatitis, gastrointestinal ulcers, diabetes, liver disease. , genitourinary colds, atherosclerosis, anaemia, avitaminosis, stenocardia, hypertension, etc. and is widely used as a means of dramatically increasing immunity. Among vegetable and animal fats, amaranth oil has a high quality, it has 2 times more advantages than chakanda (lat. Hippóphae) oil in all its parameters, and according to this quality, it is useful in the complex treatment of radiation sickness [56- 61].

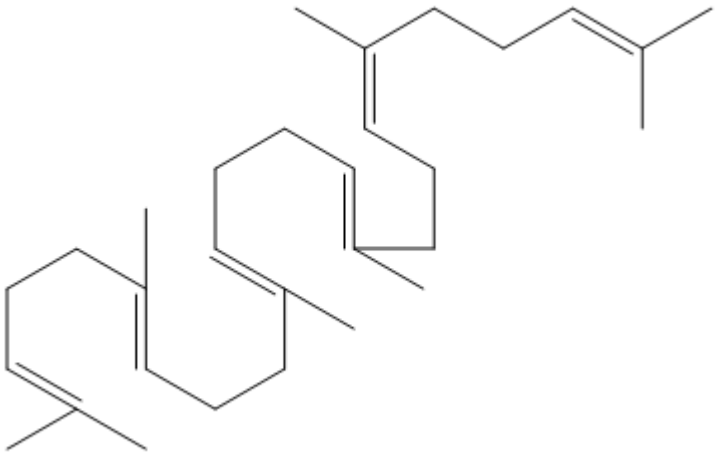
The preliminary results of amaranth plant breeding in Andijan showed that the spikes were stronger than in European countries such as Poland, Ukraine, and Russia. This ensures that productivity will be even higher in Uzbekistan.

It is not wrong to say that the presence of squalene in amaranth oil is one of the most important discoveries of our time. This substance, which is of

special importance in medicine, was isolated for the first time in 1916 by the Japanese scientist Mitsumaro Sujimoto from the liver of a shark living at the bottom of the sea (lat. Squalus - shark). It turns out that squalene is essential for sharks to survive in hypoxia (an environment with very little oxygen) deep enough in the sea.

Later, it was discovered that it can be found in some plants (olive, cotton, flax, amaranth, argan), wheat bran oil, many plant and animal tissues, and several microorganisms. Naturally occurring squalene exists in the trans-isomer state.

Squalene (2,6,10,15,19,23-hexamethyltetracose-2,6,10,14,18,22-hexaene) is a natural hydrocarbon C30H50, a triterpene belonging to the carotene group.



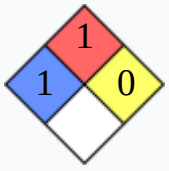
squalene

*Physical and chemical properties.* Squalene is a colourless, viscous liquid. Easily soluble in petroleum, diethyl ether, and acetone. It is insoluble in acetic acid and ethanol. Insoluble in water (see Table 1.1).

When hydrogenated by the addition of hydrogen halides, it gives crystalline products that form squalane.

**Table 1.1. Physicochemical indicators of squalene**

| Physical properties |
|---|

| | |
|---|---|
| Molar masssi | 410.73 g/mol |
| Density | 0.8562 g/cm³ |
| Thermal properties | |
| liquefaction temperature | -75 °C |
| to boil temperature | 242 °C (4 mm.sym.us.) |
| Chemical properties | |
| Comparisonrotation | 1.4961° |
| Classification | |
| CAS list number | 111-02-4 |
| PubChem | 638072 |
| EINECSlist number | 203-826-1 |
| SMILES | CC(=CCCC(=CCCC(=CCCC=C(CCC=C(CCC=C(C)C)C)C)C)C)C |
| InChI | InChI=1S/C30H50/c1-25(2)15-11-19-29(7)23-13-21-27(5)17-9-10-18-28(6)22-14-24- 30(8)20-12-16-26(3)4/h15-18,23-24H,9-14,19-22H2,1-8H3/b27-17+,28-18+,29-23+ ,30-24+ InChIKeyYYGNTYWPHWGJRM-AAJYLUCBSA-N |
| RTECS | XB6010000 |
| Chebi | 15440 |
| ChemSpider | 553635 |
| Safety | |
| NFPA 704 |   |

*Obtainable.* Squalene is extracted from the unsaponifiable fraction of fats by the action of hydrochloric acid in the medium of acetone or diethyl ether.

Chemical synthesis – it is obtained from the interaction of 1,4-bromobutane and trans-geranylacetone according to the Wittig reaction. From the mixture of isomers, trans-squalene is isolated in the form of an adduct with thiourea.

*Biosynthesis.* In the process of biosynthesis, mevalonic acid is converted into farnesylpyrophosphate, which in the presence of thiamine forms squalene under the action of squalene synthetase.

*Biological role.* Squalene is an intermediate in the biological synthesis of steroids, including cholesterol (via lanosterol), and participates in metabolism [62].

In 1931, Dr. Claure, a professor at the University of Zurich and a Nobel laureate, discovered that this biological compound consisting of a natural unsaturated hydrocarbon lacks 12 hydrogen atoms for a stable state, so this unsaturated hydrocarbon tries to pull these atoms from any compound. Since water is the most abundant in the body, squalene interacts with water, absorbs hydrogens from it creates free oxygen, and provides oxygen saturation of tissues and organs. As a result, it rejuvenates the cells of the body, eliminates free radicals, prevents the appearance and spread of oncological tumours, dramatically increases the stability of the immune system, and plays an important role in restoring human health. Among the many properties of squalene, it should be mentioned that it is a derivative of vitamin A, and in the synthesis of cholesterol it turns into its biochemical analogue 7-dehydrocholesterol, and this substance exhibits radioprotective properties under the influence of sunlight and forms vitamin D. does. In addition, vitamin A is better absorbed when dissolved in squalene. Since squalene is a natural component of the human body's sebaceous glands, it has the ability to be easily absorbed by the body and accelerates the entry of beneficial substances contained in cosmetics into the body. For humans, squalene is necessary as an anticarcinogenic, antimicrobial and fungicidal agent, and oxygen deficiency causes tissue damage, ageing of the body, and the appearance and development of tumours. It is squalene that is necessary as a solution to this problem.

Squalene can be used for the prevention of onco- and cardiac diseases in the preparation of steroid hormonal preparations, in cosmetics. Squalene, which is needed for the pharmaceutical industry, is imported from the liver of sharks

and whales, and these substances are present in large quantities in amaranth oil (in amaranth-8%, in olive oil-0.7%), and this oil has medicinal properties necessary for human health. When the presence of phytosterols and other substances became clear to science, attention to amaranth oil increased dramatically. Amaranth oil is higher in unsaturated fatty acids than saturated fatty acids. Vitamin YE in the form of tocopherols in oil has an antioxidant effect and has the property of reducing the amount of cholesterol in the blood. The oil also contains rutin and vitamin R and has antimicrobial and fungicidal properties.

Currently, amaranth oil is used in the biosynthesis of cholesterol, oncological and cardiovascular problems, ischemic diseases, cleansing the body of radionuclides, heavy metal salts, infectious diseases, herpes, psoriasis, vitiligo, neurodermatitis, eczema, atopic dermatitis, gastrointestinal ulcers, diabetes. It is widely used in diabetes, liver disease, genitourinary colds, atherosclerosis, anaemia, avitaminosis, stenocardia, hypertension, and as a means of dramatically increasing immunity.

Wheat flour is 40-50 times more expensive than wheat flour on the world market. A small amount of amaranth flour is added to make delicious and healthy bread products. These products are a solution to several problems, such as increasing immunity and eliminating anaemia.

It is known that flour and leaves made from amaranth grain are of good quality and have useful nutritional value, amaranth oil is rich in iron, phosphorus, potassium, vitamins $V_1$, $V_2$, YE and D group, phospholipids, phytosterols [63-69].

The amaranth plant is one of the most urgent issues that our government is paying special attention to today, increasing the efficiency and productivity of animal husbandry, poultry, and fishing, and ultimately providing the population of Uzbekistan, whose number is increasing, with cheap, high-quality meat, milk, eggs, fish, etc. it is also of particular importance in terms of providing food products. Following the decision of the Cabinet of Ministers of the Republic of

Uzbekistan dated April 27, 2018, No. VMQ-312 "On measures to increase the quantity and quality of fodder for livestock needs", "... 280 fattening complexes have been established, 354,000 tons of granulated and extruded modern fodder production facilities are planned to fully meet consumer demand for fodder...".

New technologies of intensive animal husbandry make it possible to dramatically increase the number of cattle even in very narrow areas, under different storage conditions and using feed produced on an industrial scale. In such conditions, the main factor ensuring the health status of animals is high-quality feed.

Improving the feed production system, improving the composition of the feed base, researching new feed resources and feed production technologies are urgent issues in meeting the biological needs of animals for high-quality feed.

One of the promising ways to improve the total value of feed rations is the inclusion of various methods of preparation for feeding, in particular, concentrated feeds prepared by extrusion, which increase the satiety of the animal organism by ensuring full digestion of feed.

In the conditions of Uzbekistan, due to problems such as the scarcity of irrigated land, agricultural areas, and salinity of large areas, effective use of cultivated areas for fodder production is of great importance. Research on solving problems in this regard has shown that the introduction of agricultural crops, which have shown their respective positive qualities in world-scale practices and are considered non-traditional for our country, can give the expected results. We can grow amaranth and quinoa from such plants in our salty lands. Amaranth, which is known for its excellent properties, has been able to show itself as a widespread agricultural crop in many countries today, with high feed and feed value.

High productivity in terms of blue mass, unique biochemical composition of seeds and topsoil (high and balanced content of proteins, vitamins and biologically active substances), balance and proportion (resistance to salinity and dehydration) It caused the definition of the plant by the UN experts:

"Amaranth will be one of the main agricultural crops of the planet in the 21st century and will help solve the growing food problem."

According to its biochemical composition, amaranth is a valuable plant for obtaining high-quality fodder. Depending on the growth phase, in amaranth blue mass (calculated relative to absolute dry mass): crude protein 15.6-16.75%, fats 2.4-2.8%, coarse fibres 16, 0-21.7%, calcium 2.1-2.6%, phosphorus 0.2-0.21%, carotene up to 200 mg/kg. For comparison: in the milking-hardening phase of corn grains, the blue mass is 2 times less than that of amaranth, i.e. 7.5-8% protein [70].

It is urgent to develop technologies using amaranth to obtain high-protein functional feed, which is 7-10 times more profitable than traditional feed production.

In the conditions of chemicalization of fodder production, the presence of various supplements such as mineral supplements, vitamins and other vital nutrients is required in animal rations. Despite the presence of small amounts of mineral substances in the animal body, they actively participate in the processes of metabolism and help to increase livestock productivity.

In the farms of our republic, alfalfa hay, corn silage, concentrated fodder and corn husks are used as the main fodder for livestock. The diet based on these foods, in turn, cannot cover all micro- and macroelements (calcium, phosphorus, potassium, sodium, copper, cobalt, manganese, zinc, molybdenum, iodine, fluorine, etc.).

At the same time, bentonite clay added to animal silage contains iron, potassium, calcium, sodium, magnesium, manganese, boron, copper, strontium, nickel, barium and other elements necessary for the animal organism, i.e. animal keeps the same elements that are specially added to the diet. Bentonite clays can be used in the production of soft feeds and additives for agricultural animals (cattle, sheep, poultry, rabbits) and urea concentrates.

Preparation of balanced, easily digestible feed without imported additives, fully meeting current requirements based on a mixture of amaranth, quinoa,

Eichhornia and other non-traditional plants granulated plant flour with bentonite mineral flour for livestock and poultry. technology development is underway.

In this regard, the following tasks are planned: development of technology for making high-protein "Amaranth+maize" silage; Creating a method of obtaining high-protein fodder pellets in the combination of "amaranth+maize+eichhornia"; development of technology for preparation of granulated mixed - fodder by adding secondary product of amaranth seeds processing; creating a method of obtaining extruded fodder from amaranth and other plant grains; creation of methods of adding bentonite salt to feed; determination of fat content, total protein content, vitamin, amino acid, macro- and microelements, carbohydrates, polysaccharide content and nutritional value assessment of all selected fodder products; formation of ITX projects for developed products in accordance with the requirements of the State Standards system of the Republic of Uzbekistan.

In animal husbandry, amaranth's green mass and pulp is a high-energy quality protein-vitamin feed, which is especially necessary for breeding cattle. In poultry farming, it is a nutritious, vitamin-rich food, which has been found to have a significant effect on increasing the number of eggs. In addition, it is an invaluable raw material for cosmetology.

Amaranth is a useful fodder for pets and poultry. If 25% of amaranth blue mass is added to their feed, lambs and calves grow 1.5-2 times faster, nutria and rabbits 2-3 times faster, and the milk yield and fat content of cows increases dramatically. Piglets fed with amaranth have been tested in practice to gain 60 kg of live weight in 4 months.

The high level of vitamin C and carotene in amaranth is an important factor in the health of animals and poultry.

Amaranth attracts the attention of agricultural workers, and practitioners-researchers due to its rich protein content, high yield, many vitamins and mineral salts. It is considered a leading raw material not only for food and fodder but also as an invaluable medicinal plant.

Its trunk, leaves and grain husk are used as valuable fodder in livestock farming. The large number of useful unique elements and the record level of protein in the composition ensure rapid and healthy growth of lambs, calves and chicks, sharply increase the fattening process of animals, and increase the amount of cow's milk and the level of fat in it. Amaranth is well-ensiled together with corn, which solves the problem of fodder throughout the year. The abundance of sugar in corn pulp and protein in amaranth makes silage more nutritious.

Another noteworthy point is that after extracting the oil from the seeds of this plant, the prospect of obtaining pectin substances as a high-quality biologically active additive from the remaining waste is very high.

Several studies are being carried out on the extraction of oil and squalenes, pectin substances in amaranth varieties grown in Uzbekistan.

Amaranth is an effective stimulator in the technology of obtaining biogas, it accelerates the process of fermentation of organic mass and increases the amount of biogas. The amount of biogas obtained from silage is 3 times more efficient than that of cattle manure.

Although it is known that biogas from organic matter are obtained voluntarily, the effectiveness of some of them in this field is the basis of scientific research. The process of obtaining biogas is very complicated, and its amount is intrinsically dependent on the composition of the substrate. Biogas catalysts have been thoroughly studied by the scientific group of A. Arbuzov Kazan Institute of Fine Chemical Technologies in order to dramatically increase biogas production. They took as a basis the green mass of the amaranth plant and the drug Malofen, which ensures rapid plant growth [71].

Cattle-fed amaranth have been observed to develop gas in their stomachs. It is this phenomenon that gives hope that there is a possibility of getting gas from amaranth. The results of scientific research entered the science system in a new direction - studying the possibilities of obtaining biogas from amaranth green mass or using it as a stimulant in this process. Amaranth supplementation

has been shown to increase the amount of methane in off-gas by 10 or more times. Amaranth porridge (jom) is a valuable substance that has been found to increase gas production.

Due to such unique properties of amaranth, it is boldly entering the agricultural sector of Uzbekistan as a new promising cultural and economically effective plant.

Since 2013, scientists from Andijan began to study this unique medicinal plant in detail by order of the Science and Technology Development Coordination Committee under the Cabinet of Ministers. Various varieties of amaranth available in Uzbekistan and imported from abroad were tested and the most efficient ones were selected. Research conducted in cooperation with the scientists of the Institute of Bioorganic Chemistry of the Republic of Uzbekistan and the Institute of Plant Substances Chemistry proved that amaranth grown in the conditions of Uzbekistan is richer in useful elements.

Imported from Germany, "AEN Engineering GmbH & Co. KG" company's special cold pressing equipment extracted oil from locally grown amaranth grains and found that the oil contained high levels of squalene and several other beneficial substances. Preliminary studies have shown that the amount of squalene in Uzbekistan amaranth oil is 8-10 times higher than that of shark liver. The oil was found to contain 12% squalene and a number of other useful substances listed above. Most interestingly, it was found that the amount of squalene enriched in kunja reached 42%, and S.D.Gusakova, professor of the Institute of Plant Substances of the Russian Federation AS, considered this a discovery [69].

Amaranth oil grown in Andijan was tested by gas chromatography and it was found to be rich in Omega-3 and Omega-6 unsaturated fatty acids. This determines the prospects for the use of locally produced amaranth oil as a unique medicinal substance in medicine.

The Lera variety of amaranth, grown in the Ulug'nor district, is growing and yielding crops in saline lands where other plants do not grow and are giving

farmers the opportunity to make a profit. Amaranth, which yields up to 7 tons of grain per hectare in fertile soil, has yielded 2-3 tons of grain per hectare in these areas, and the economic effect is self-evident considering that the price of 1 kg of grain in the world market is 1 US dollar. In addition, silage made from 200-250 tons of green mass obtained from each hectare of land is high-vitamin fodder for livestock. 1 litre of oil, which is 2-2.5% by grain mass, is priced at 200 US dollars in Russia, and 700-800 US dollars (cold-pressed oil) in Russia. The kunjara remaining after the extraction of this oil is considered a raw material for the production of medicinal food products (halva, pastries, bread, etc.) [72,73].

Amaranth leaf is used as a tea and food due to its anti-inflammatory and immune-boosting properties. If we make mini bod from grain and eat it with a little honey, we will get rid of many diseases. There is a possibility to export this product as a medicinal product in special packaging. If bread is prepared by mixing it with 1/10 of ordinary wheat flour, it becomes a medicinal type and does not harden for a long time.

It is not difficult to calculate the economic value of amaranth cultivation, in fact, in addition to the huge amount of silage (200 tons) obtained from one hectare, 6-8% of amaranth oil is obtained from 60 centners of seeds. So, it is enough to consider that 1 litre of this oil, which can be obtained from 1 ton per hectare, is valued at 300 US dollars.

The cultivation of amaranth in Uzbekistan, and its wide use in various fields of national economy and medicine is a promising direction and one of the needs of today. From the ecological importance of this plant, there is a prospect of being involved in the health of our soil, which is losing its quality more and more, and even in solving the energy problem.

Amaranth plant grows well in saline soil with NaCl concentration up to 10 mM and gives a high yield. Amaranth planted for 2-3 years in a saline environment makes the soil suitable for planting wheat. This plant, which tolerates hot temperatures of 45-50 degrees, activates microorganisms that

enrich the soil with nitrogen. A strong root system improves the microporous state of the soil and restores the humus state at a certain depth as an inexpensive sideral fertilizer. As a phytomediator, amaranth also performs the task of cleaning the soil from heavy metals, radionuclides and pesticides.

The economic importance of amaranth in rural and national economies is incomparable. Currently, the prospects of exporting amaranth flour, leaves, roots, and seeds together with amaranth oil as valuable vitamin medicinal products are being studied.

Amaranth has amazing properties as a miracle plant [74-85]:

– Amaranth is among the plants with high efficiency in S4 photosynthesis;

– The high content of mineral nitrogen, which ensures rapid plant growth, ensures that amaranth gives up to 300 tons of green mass per hectare;

– Amaranth has a low transpiration coefficient, so it is drought-resistant and can live in a saline environment;

– The seeds of 10 amaranth plants are enough to plant 1 ha of land because one plant produces up to 300,000 seeds;

– Energy expenditure for the cultivation of a unit of amaranth biomass by a person is the least (0.8 kcal for soybeans, 0.1-0.2 kcal for wheat, less than 0.1 kcal for amaranth). This factor indicates the low cost of amaranth cultivation;

– All vegetative organs of this plant (seed, leaf, trunk, root) are useful for humans;

– Amaranth grain has 13-17 per cent protein, which is higher than all cereals. 2-3 tons of protein can be obtained per hectare during the 100-day vegetation period;

– Amaranth is the only plant with the highest quality protein, oil and carbohydrates. It is a grain-ear, fodder, vegetable, technical, sidereal and decorative cultural plant;

– Amaranth protein is 2-3 times higher than wheat and corn in terms of amino acids and lysine;

– The presence of squalene, tocotrienols and omega-3,6,9 in amaranth grain is useful in the treatment of many diseases in medicine;

– Amaranth oil is widely used in the treatment of cardiovascular diseases and effective reduction of cholesterol levels;

– Amaranth does not contain gluten;

– Amaranth consists of high-grade plant tissue;

– You can make healthy mini-popcorn from amaranth grain.

## § 1.2. Chemical composition and medicinal properties of peppermint (Mentha piperita L.).

Mint (scented mint, black mint - Mentha piperita L.) is one of the oldest medicinal plants in the world. Its healing properties were noted by the inhabitants of Ancient Greece and Rome, Russia. With its medicinal properties, mint has found its place in human daily life. In Uzbekistan, many medicinal plants are cultivated by farms specializing in the cultivation of medicinal plants and by local residents. Today, due to its rapid spread, it can be found in many fields.

*Chemical composition and calorie content per 100 grams*

Energy value: storage of proteins, fats and carbohydrates.

The energy value of 100 grams of mint is 70 kcal due to the large amount of carbohydrates in it. Mint consists mainly of water (78.65 g) and carbohydrates (6.89 g). There are almost no fats in this plant (0.94 g). Protein content - 3.75 g. Mint contains 8 g of dietary fibre and 1.76 g of ash.

*Vitamins.*

This plant is rich in vitamins: ascorbic acid (C) is 31.82 mg, which stabilizes the activity of the immune system. Peppermint contains 1.71 mg of niacin (B3), 0.34 mg of pantothenic acid (B5), and 0.27 mg of riboflavin (B2), which help improve colour sensitivity and night vision. gives skin a lack of

vitamin B2 in the body; and mucous membranes; causes deterioration of the general condition of vision.

Beta-carotene (A) - in the amount of 0.21 mg, contributes to the normal development of the body, maintains the health of the skin and eyes, and increases immunity.

The amount of pyridoxine (B6) is 0.13 mg. The amount of folic acid (B9) is 0.11 mg, which improves the metabolism of nucleic and amino acids. The consequence of its insufficient amount in daily consumption is the cessation of cell division and growth. Its deficiency during pregnancy causes premature birth, hypotrophy, birth defects and deficiencies in child development.

Thiamine (B1) – 0.08 mg.

*Microelements.*

The amount of iron (Fe) is 5.08 mg, its deficiency causes a feeling of fatigue in the body. Manganese (Mn) – 1,176 mg participates in the formation of bone and connective tissue. Its deficiency can cause growth retardation. Copper (Cu) – 329 μg, its deficiency leads to disorders of the cardiovascular system and the formation of the skeleton. Zinc (Zn) - 1.11 mg.

*Macronutrients.*

Potassium (K) – 569 mg. Calcium (Ca) – 243 mg, its deficiency leads to demineralization of bones. Magnesium (Mg) - 80 mg, lack of magnesium in the body can lead to heart disease. Sodium (Na) - 31 mg. Phosphorus (P) - 73 mg.

*Amino acids that are not synthesized in the body.*

Non-exchangeable amino acids: arginine - 0.173 g; valine - 0.187 g; histidine - 0.075 g; isoleucine - 0.154 g; leucine - 0.281 g; lysine - 0.161 g; methionine - 0.053 g; threonine - 0.154 g; tryptophan - 0.058 g; phenylalanine - 0.191 g.

Exchangeable amino acids: alanine - 0.195 g; aspartic acid - 0.443 g; glycine - 0.18 g; glutamic acid - 0.403 g; proline - 0.154 g; serine - 0.146 g; tyrosine - 0.113 g; cysteine - 0.041 g.

*Saturated fatty acids.*

Saturated fatty acids (0.246 g): myristin - 0.006 g; palmitin - 0.176 g; stearin - 0.025 g.

Monounsaturated fatty acids (0.033 g): palmitolein – 0.002 g; olein (omega-9) – 0.029 g.

Polyunsaturated fatty acids (0.508 g): linoleic – 0.069 g; linolenic - 0.435 g; omega-3 fatty acids - 0.435 g; omega-6 fatty acids - 0.069 g.

The presence of essential oil in mint (up to 3% in leaves, 4-6% in flowers) attracts lovers of unusual and pleasant smells. Basically, this essential oil consists of menthol (up to 65%) [86].

*Preparation of raw materials and their quality.* Peppermint leaves, essential oils and menthol are used in medicine. For pharmacies, the leaves of the plant are harvested by means of special tools when 50-75% of the flowers are in bloom. Varieties that retain high essential oils are harvested in August-September. Drying of plant leaves is carried out in special dryers at temperatures not higher than 30-35ºC. According to the state pharmacopoeia, the following requirements are set for bitter mint leaves: humidity from 14%; ash from 14%; The amount of ash soluble in 10% hydrochloric acid is from 6%; blackened leaves should not exceed 5%.

Requirements for trimmed and ground raw materials: parts larger than 10 mm from 10%; Parts passing through a 0.5 mm sieve should not exceed 8%. The amount of essential oils should not be less than 1% for both cases.

The leaves of the plant are stored in warehouses in 30-50 kg bags.

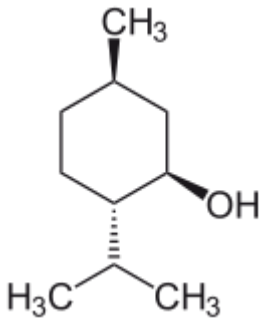
*Medicinal use and chemical composition.* The amount of essential oils contained in mint leaves is 3% in the southern regions, 2-2.5% in the northern regions; and the amount of menthol in essential oil is 50-55%. The essential oil of the plant contains menthol, menthone, methylacetate, mentafuran, seneol, phytoncides, tannins, vitamins, carotenes, trace elements and other biogenic substances.

Essential oils are used in the perfumery, food industry, and production of alcoholic products.

In addition to essential oils, the leaves of the plant are rich in carotene, organic acids and other compounds. Fragrant teas and tinctures are prepared from the leaves of the plant, which dilate and invigorate blood vessels.

Moderate sedative, antianginal, carminative, antihypoxic, choleretic, antiseptic, analgesic, anti-nausea effect. The therapeutic effect mainly depends on the components of the essential oil, the most abundant of which is menthol (60%), which is used as a pain reliever in neuralgia, myalgia, arthralgia, and other drugs. - used as a vasodilator and sedative. Menthol is part of validol and valocardin drugs.

The active components of peppermint stimulate cold-sensing receptors, nerves and blood vessels, causing blood vessels to dilate, which helps reduce pain.



menthol

When taken orally (under the tongue), menthol activates cold receptors of the mucous membrane of the oral cavity, which relieves pain, regulates vascular permeability and tension, and plays an important role in the modulation of various mediator systems, enkephalins, endorphins, ensures the formation and release of dynorphins and peptides into the blood. As a result, reflex expansion of the heart, brain, and pulmonary vessels occurs. Menthol stimulates the respiratory centre and stops nausea.

*Instructions for use of peppermint.* A tincture made from mint leaves regulates blood pressure, normalizes intestinal fermentation processes and intestinal peristalsis, has an antispasmodic effect on the smooth muscles of the

gastrointestinal tract and urinary tract, and lightly stimulates the secretion of the digestive glands.

The essential oils contained in it have an antiseptic effect and destroy spore-forming bacteria, for example, Staphylococcus aureus, and because of this strong antiseptic effect, it is widely used in various fields of medicine and even in cooking.

Menthol, together with flavonoids of mint leaves, has an expectorant effect, and isovaleric acid esters have a sedative effect, so mint is added to herbal preparations for the treatment of cholecystitis, hepatitis and gallstone diseases.

Menthol, β-betapinene, limonene, cineol, tannins and ursolic acid have antimicrobial, antimicrobial effects and help to restore the functions of the vibrating epithelium of the upper respiratory tract. Expectorant, mucolytic and moderate antihypoxic effects are preserved when inhaled with peppermint oil.

Due to its essential oils, peppermint is added to pastes, soaked in thread and even toothpaste, and is widely used in dermatology and cosmetology.

Excitability of the nervous system, neurosis, mild sleep disturbance; NSD with cardialgia, angina pectoris, tachycardia and arterial hypertension; dyskinesia and spasm conditions in the digestive system, fermentopathy, dysbacteriosis, flatulence, cholecystitis, gallstone diseases; infectious and inflammatory diseases of the oral cavity and upper respiratory tract; sea and air sickness, toxicosis; arthralgia, myalgia, neuralgia, rheumatism, bruises; for damage to the mucous membrane of the oral cavity and lips, toothache, dryness of the lips, mint is used directly and as a part of combined preparations.

It is forbidden to use peppermint in case of low blood pressure because it helps to expand blood vessels and further decrease the pressure, regular use of peppermint consumption leads to serious consequences;

Due to the property of expanding blood vessels, it cannot be used in varicose diseases;

No one is protected from allergic reactions, in some cases medicinal plants, including mint, have been observed to cause allergies.

Although mint is beneficial for women's health, it can cause a decrease in libido in men.

Since peppermint has sedative properties, it is not recommended to use it in situations that require attention

*Dosage regimen.* Mint remedies can be drunk, and used as inhalations, external rinses, and washes. The dosage of peppermint preparations, the frequency of use and the duration of treatment are determined individually depending on the instructions and the dosage form.

*To leave the pain behind.* Peppermint tincture helps to get rid of any pain. Gargling the mouth and throat with drops will help to reduce the pain a little. The analgesic effect is due to a combination of freezing effect and local blood circulation control. Reduces symptoms of flatulence and intestinal pain in the digestive system. Relieves nausea, heart palpitations, stomach pain, and cystitis pain. Peppermint decoction relieves nervous tension and is recommended for neurosis, hysteria, overexertion, depression and chronic stress. Women with painful periods are advised to drink mint tincture. During pregnancy, mint helps to normalize the emotional background due to its sedative effect, and helps to relieve pregnancy with anti-cold, anti-nausea properties during pregnancy. It is recommended to use mint remedies after consulting a doctor.

In cosmetology, peppermint tincture relieves skin problems. The tincture is poured into an ice mould, and rubbing the face with ice cubes every morning keeps facial tension, and eliminates and prevents various rashes.

Mint is very useful in the treatment of skin diseases of various etiologies: eczema, atopic dermatitis, neurodermatitis, hives, etc.

*Special instructions.*

Peppermint preparations for external use should not be applied to damaged skin and should not be splashed into the eyes.

*Adverse effects.* Allergic reactions are possible. Menthol can cause bronchospasm and reflex suffocation when inhaled in children.

In rare cases, when taking menthol drugs under the tongue, slight nausea, tearing, and dizziness can be observed.

When applied externally to the skin, hyperemia, irritation, and itching are possible, and in rare cases, rashes may appear.

*Instructions against use.* In case of hypersensitivity to mint components, stop using the tool.

*Use during pregnancy and breastfeeding.* During pregnancy and breastfeeding, if the intended benefit for the mother poses a potential risk to the fetus or baby, it should be used after consulting a doctor.

*Use in children.* It can be used in children in recommended dosages and dosage forms depending on their age. When using specific medicinal forms of peppermint in children of different ages, it is necessary to strictly follow the contraindications for peppermint preparations.

*Interaction with other drugs.* Oral peppermint preparations potentiate the effects of central nervous system depressants and hypotensive drugs that affect the central nervous system, which requires proper dosing [87,87].

## § 1.3. Chemical composition of chamomile (Matricaria chamomilla L.) petals and their use in modern medicine

*Chemical composition.* Chamomile (Matricaria chamomilla L.) flowers and inflorescences contain up to 1% of essential oil and biologically active components - hamazulene, anthemic acid and glycosides, which provide the main medicinal properties. Quercetin provides anti-inflammatory properties, and caprylic acid fights fungal diseases.

Contains potassium (K) – 41.8 μg/g, calcium (Ca) – 8.3 μg/g, magnesium (Mg) – 3.1 μg/g, iron (Fe) – 0.3 μg/g, copper (Cu) – 0.78 μg/g, zinc (Zn) – 0.8 μg/g, chromium (Cr) – 0.09 μg/g, aluminium (Al) – 0.27 μg/g, barium (Ba ) –

0.2, vanadium – 0.08 (V), selenium – 7.2 (Se) μg/g, nickel (Ni) – 0.24 μg/g, strontium (Sr) – 0.12 μg/g, lead (Pb) – 0.074 μg/g, iodine (J) – 0.07 μg/g, boron (B) – 38.8 μg/g, ash – in amounts up to 10.57% occurs.

*In medicine, dried and fresh chamomile is used:*

Chamomile is one of the most widely used medicinal plants. For medicinal purposes, tinctures and extracts of chamomile flower baskets and essential oils obtained from it are used. Chamomile flowers are collected from June to the end of summer, it is during this period that a lot of essential oil is collected in chamomile.

Chamomile decoctions and tinctures are used as anti-inflammatory, hemostatic, analgesic, mild antibacterial, sedative, antispasmodic, astringent and expectorant. Teas and tinctures are used for insomnia, intestinal pains, flatulence, diarrhoea, liver and biliary tract diseases, and also as a diaphoretic. Chamomile tincture is used to wash hair. Chamomile extract stimulates the secretion of gastric juice and bile and also has a positive effect on the central nervous system.

In official medicine, chamomile preparations are used to treat diseases of the digestive system and liver, mucous membranes of the mouth and throat, and inflammatory diseases of the upper respiratory tract. In the pharmaceutical industry, chamomile is used in the production of various herbal preparations, romazulan, rekutan, rotokan and other drugs.

Chamomile essential oil has a calming, disinfecting and diaphoretic effect, stimulates the central nervous system, reduces gas, relieves pain and relieves colds, thereby improving digestive function. regulates. If a stomach ulcer is detected, regular drinking of chamomile tincture for several months with the doctor's advice can help heal the ulcer and reduce its complications and symptoms. It is this anti-inflammatory property that allows it to be used for the treatment of inflammations in the gastrointestinal tract, including the intestines. It is recommended to use chamomile tinctures and decoctions in the order

prescribed by the doctor in case of painful menstruation in women and gynaecological problems such as uterine bleeding.

Chamomile extract is the basis of creams and many cosmetic products used in cosmetology. It is rinsed in chamomile tincture to make the hair golden. It is used in the production of baby care products (soaps, creams, oils and lotions), toothpaste, lipsticks, tanning products, shampoos and balms. Chamomile decoction makes the skin soft and velvety, while chamomile extract has emollient, moisturizing, anti-allergic anti-inflammatory and wound-healing properties.

Chamomile essential oil is used as a sedative in aromatherapy. Due to its high cost, this product is often adulterated, including replacing it with Roman chamomile oil [89].

*Medicinal properties.* Chamomile is medicinal, but it should not be consumed in excess. Otherwise, it can cause central nervous system tension, restlessness, lethargy, fatigue and even headache. Chamomile is not recommended for people prone to diarrhoea and those suffering from diarrhoea. Chamomile is used as an effective remedy for colds due to its warming and warming properties, which reduce and eliminate colds. Chamomile infusions and decoctions are also recommended for those who have a lot of gas in their intestines or have severe intestinal pain. The property of ensuring the secretion of gastric juices in relatively natural and very mild conditions undoubtedly improves digestion. In addition, chamomile absorbs and removes many toxins and slags from the body. Chamomile can be used without other drugs in severe intestinal diseases. Tea made from chamomile flowers improves the functioning of the bile ducts and causes bile to be released from the gallbladder effectively. It is also an effective remedy for liver and kidney diseases, and endocrine system diseases.

For the nervous system and the heart, there are many chamomile-based preparations designed to treat the nervous system or stop bleeding. This does not mean that chamomile should be used only by seriously ill patients, but also for

healthy people, chamomile helps to relieve stress and tension, normalize sleep and calm down. So, when under stress, there is no need to resort to any kind of medication, a person can drink chamomile regularly in the form of tea to feel much better. Chamomile can be used for heart problems, including arrhythmia. In this case, it is allowed to consume chamomile remedies only if the doctor gives permission. In general, it not only has a good effect on the heart but also calms the nervous system, thereby reducing anxiety and improving heart function.

*Side effects.* There are very few contraindications for medicinal chamomile. But in several cases, it is better to use it carefully. In particular, it cannot be used when there is a lack of hydrochloric acid during gastritis. In addition, chamomile remedies may not work directly in individual cases. In any case, despite its healing properties, it should not be consumed excessively, strictly defined doses should be used. Excess may cause cough, headache, dizziness, increased menstrual cramps or nausea. Chamomile is given to breastfeeding women only with the permission of a doctor.

### § 1.4 Chemical composition of safflower leaves and flowers and their beneficial properties

Safflower (safflower - Carthamus tinctorius L.) is a plant whose beneficial properties have been known to man for more than a thousand years. Since ancient times, the plant has received the scientific name "dyer's safflower" because it has been used for dyeing various materials. Other names for this flower such as "American daffodil" or "wild thistle" can also be found in the literature. Safflower is also widely used in the medical and chemical industries.

Safflower is an annual plant belonging to the marigold family. Safflower leaves are large, toothed, branch-like, hard, oblong-ovate, and there is a network of protruding veins on the lower surface of the leaf. The flowers are red-orange. The ball consists of one oval-shaped basket. The fruit is a smooth white seed

with a slightly raised rib. Safflower blooms from early June to mid-summer, and the fruits ripen until autumn.

Safflower was originally found only in Ethiopia and Afghanistan. Then it spread widely in India and China, where it was cultured very quickly. They knew about the plant in ancient Egypt. Today, this plant can be found wild in Southern Europe, North Caucasus, Turkestan and southern regions of Russia. It grows in Ukraine in Poltava, Kherson, Kharkiv regions and Crimea.

Safflower flowers were used by the ancient Egyptians to dye embalming cloth. In ancient India, safflower oil was highly valued. In China, the medicinal properties of this plant were used to treat heart diseases.

Currently, the safflower plant is widely cultivated in Spain, India, the USA, China, Uzbekistan, and Egypt. An oil with a number of valuable properties is obtained from the seeds of this plant. It can be consumed, it is similar to sunflower oil in terms of quality and in terms of some of its properties, it has been proven to reduce the amount of free cholesterol in the blood, and it is also used in the production of margarine, in cosmetology to regulate the level of moisture in the skin. , used to moisturize and soften skin and hair.

Safflower flowers are the source of all shades of yellow and gold dyes, including food dyes.

Recently, Canadian geneticists made new developments in the synthesis of insulin, they used safflower in their research, inserted several necessary genes into the genetic system of this plant, and in the process of chemical transformations managed to obtain one of the types of insulin. insulin produced by the pancreas. Production of such insulin is economically profitable and promising.

Flower baskets and seeds of safflower are used for medicinal purposes [90].

Safflower prefers a warm climate and needs a lot of sunlight. Safflower is commonly sold as part of a variety of herbal preparations or teas, which can be purchased at pharmacies or herbal stores.

*Description*

- orange or golden;
- mild, bitter-sweet taste;
- floral scent

**Table 1.2. Nutritional value and calories, per 100 g**

| Proteins | Oils | Carbohydrates | Calories |
|---|---|---|---|
| 16 g | 38 g | 34 g | 517 Kcal |

*Chemical composition.*Pigments found in safflower flowers: cardamom (red), and cartamine (yellow). In addition to them, flowers contain glycosides and polyacetylenic hydrocarbons. The seed oil consists of oleic, palmitic, myristic and other unsaturated fatty acids. The seeds also contain lignan alcohol. It also contains glycosides, sodium Na, potassium K, calcium Ca, iron Fe, magnesium Mg, and vitamins A, D, B12, B6 and C. Its nutritional value and calorie content are very acceptable for the human body (see Table 1.2).

*Useful features*

- is a mild laxative;
- has a diuretic effect;
- the herb has a driving effect;
- calms the nervous system;
- increases tone;
- prevents colds;
- normalizes the menstrual cycle;
- lowers the level of cholesterol in the blood;
- effective emetic;
- has an antibacterial effect;
- lowers blood pressure.

*Harmful and side effects*

Care should be taken when treating with safflower remedies, and preparations based on safflower, because this plant does not interact well with certain drugs, especially anticoagulant drugs, and is not recommended for use in the following conditions:

- pregnancy;
- decreased blood clotting, and heavy menstrual periods.

*Tinctures and decoctions*

A decoction of safflower flowers is also called safflower tea. This tea helps to improve the functioning of the gastrointestinal tract, as well as to restore the functioning of the liver and kidneys. To prepare a tincture, take ¼ teaspoon of dry, crushed flowers and pour a glass of water over it. Such tea should be brewed under the lid for half an hour. It is recommended to drink safflower tea once a day, before going to bed.

It is very beneficial to drink safflower tea made from its petals and drunk at night. During the day, you can drink several glasses of such a healing drink, which has an antiseptic effect. Tea helps to cleanse the kidneys and liver and makes you sweat. If such tea is consumed from time to time, it is possible to achieve a wonderful cosmetic effect, that is, the skin becomes healthy, and its colour becomes clearer and brighter. Safflower is included in sunscreens and lotions.

*Culinary use*

- oil and plant flowers are used in cooking;
- safflower is an excellent alternative to saffron;
- in the east, its petals are used to dye products yellow or golden;
- meat, poultry and fish dishes are seasoned with dried safflower leaves;
- safflower goes well with legumes and cereals;
- Add safflower petals to black, green, flower or herbal teas.

*Medicinal properties of safflower*

Local official medicine allows the use of safflower only as a biologically active food additive. Safflower is listed as a medicinal plant in the British Herbal Pharmacopoeia. It is also used in traditional medicine in Tibet. It is widely used as a uterine contraction agent in atonic postpartum haemorrhage. It has contraceptive and antiseptic properties.

Safflower is used to treat various forms of wounds and burns, pyoderma and blistering rashes. In Chinese medicine, safflower flowers are also widely used in gynaecological diseases, such as metro- and endometritis, amenorrhea, and endocervix. A decoction of flowers has an expectorant and laxative effect. In treatment, the blood is cleaned with a decoction. It is applied to painful joints.

Pharmaceutical laboratories of various manufacturers were able to see the prospect of the plant in the production of new effective drugs a long time ago. Traditional medicine has always used wild saffron in its field as an effective agent with analgesic, antipyretic and anti-toxic properties.

The healing properties of safflower are well-known and widely used in Chinese medicine. Here, safflower helps to relieve pain during menstruation, stops blood loss after childbirth, and has a preventive effect on osteoporosis. The use of safflower causes contraction of the uterine muscles, which stops bleeding from the uterus and has a laxative effect on the intestines. This characteristic of safflower prevents its use during pregnancy.

For elderly people with problems related to the heart and blood vessels, tea made from safflower leaves helps to restore health.

Antioxidant, pain-relieving, anti-inflammatory properties have been discovered in safflower for a long time. Laboratory tests have proven the effective effect of the plant on diabetes, high blood pressure and bleeding. Preparations made based on safflower reduce the level of platelets and normalize the amount of cholesterol in the blood. It is enough to drink safflower tea for a month and a half for cholesterol to return to normal in a patient with atherosclerosis.

Safflower is used in folk medicine to treat and prevent various diseases, including:

- heart and blood vessel diseases;
- dysmenorrhea;
- amenorrhea;
- endometriosis;
- ischemic heart disease;
- Pnevmoniya;
- hepatitis;
- gastritis;
- rheumatism;
- skin damage;
- intestinal inflammation;
- stomach ulcer.

*Side effects.*

Safflower should not be taken with some medicines. Patients taking regular medications should be careful when taking safflower. It cannot be used together with anticoagulants.

In the studies conducted in China on the therapeutic effect of taking safflower, the drug's hormonal effect was determined. Safflower treatment has helped many patients undergoing infertility treatment.

Plants and flowers that prepare decoction help a lot with rheumatism, arthritis and metabolic disorders.

Research on the medicinal properties of safflower is carried out by different manufacturers in their own laboratory centres, so not everyone publishes information about their research. However according to the general recommendations regarding the daily dose, 10 g of petals should be poured with half a litre of boiled water, let rest for a while, and eat it 3 times a day [91].

*Folk recipes.*

To relieve psoriasis, safflower water is prepared. The recipe is very simple: pour 4 litres of clean water into a saucepan, boil it and add a teaspoon of dried safflower flowers to it and boil it for another 4-5 minutes; cooled and filtered. You should drink at least 4 glasses of safflower water a day. It is stored in the refrigerator for several days.

A tincture of safflower is prepared to relieve exacerbation of chronic gastritis. For this, 2 tablespoons of dried, crushed flowers and a glass of boiling water are poured into a thermos. After an hour of rest, swim. Drink 1 tablespoon 3-4 times after meals.

Cosmetics containing safflower flowers or oil are characterized by a wide range of effects [92]:

- moisturizes and nourishes the skin;
- improves blood circulation and thus gives the skin a healthy tone;
- has an antioxidant effect;
- treats minor inflammations;
- effective in skin ageing;
- heals microcracks;
- fights skin diseases;
- smooths and shines the hair;
- prevent hair loss.

## § 1.5. Sunflower oil (Helianthus annuus L.) and its chemical composition

The energy value of sunflower oil is 899 kcal, and it does not contain carbohydrates or proteins. This energy value depends only on fatty substances [93].

The nutritional value and chemical composition of sunflower oil are presented in the following table (calories, proteins, fats, carbohydrates, vitamins and minerals), in %, relative to 100 g of nutritional content (see table 1.3).

**Table 1.3. Nutritional value and chemical composition of sunflower oil**

| Nutrient | Amount | Norm** | % 100 g compared to the norm | % 100 kcal compared to the norm | 100% is the norm |
|---|---|---|---|---|---|
| Calories | 899 kCal | 1684 kCal | 53.4% | 5.9% | 187 g |
| Oils | 99.9 g | 56 g | 178.4% | 19.8% | 56 g |
| Water | 0.1 g | 2273 g | | | 2273000 g |
| Vitamins | | | | | |
| Vitamin V4, choline | 0.2 mg | 500 mg | | | 250000 g |
| Vitamin YE, α-tocopherol | 44.1 mg | 15 mg | 293.3% | 32.6% | 34 g |
| Vitamin K, phylloquinone | 5.4 μg | 120 μg | 4.5% | 0.5% | 2222 g |
| Macroelements | | | | | |
| Phosphorus, P | 2 mg | 800 mg | 0.3% | | 40000 g |
| Sterols | | | | | |
| β-sitosterol | 200 mg | ~ | | | |
| Saturated fatty acids | | | | | |
| Saturated fatty acids | 11.3 g | max 18.7 g | | | |
| 16:0 Palmitin | 6.2 g | | | | |
| 18:0 Stearin | 4.1 g | | | | |
| 20:0 Arahin | 0.3 g | | | | |
| 22:0 Begenat | 0.7 g | | | | |
| Monounsaturated fatty acids | 23.8 g | min 16.8 g | 141.7% | 15.8% | |
| 18:1 Oleic acid (omega-9) | 23.7 g | | | | |
| Polyunsaturated fatty acids | 65 g | From 11.2 to 20.6 g | 315.5% | 35.1% | |
| 18:2 Linoleic acid | 59.8 g | ~ | | | |
| Omega-6 fatty acids | 59.8 g | From 4.7 to 16.8 g | 356% | 39.6% | |

100 g of sunflower oil contains 178.4% of the daily value of fats. Among the fat-soluble vitamins, vitamin E is 44.1 mg, vitamin K is 5.4 μg, and vitamin B4 is 0.2 mg.

Many nutritional products do not cover the complete set of vitamins and minerals. Therefore, it is desirable to have various products in the daily diet to meet the body's need for vitamins and minerals.

*Useful properties of sunflower oil*

Vitamin E in sunflower oil is 293.3%, it is important in our life as a stabilizer of universal cell membranes, because it has antioxidant properties and is essential for the functioning of gonads, and heart muscles. This substance activates haemoglobin, protects cells from premature ageing, and increases the tolerance level of capillaries. If this vitamin deficiency occurs, hemolysis of erythrocytes and neuralgic disorders are observed [94].

Sunflower oil is an oil obtained from different oil varieties of sunflower, the largest producers of which in the world are Russia and Ukraine [95].

Sunflower oil is a semi-solid vegetable oil. At room temperature, a thin layer forms a soft adhesive film under the influence of atmospheric oxygen. Semi-solid oils include sunflower, soybean, camellia, safflower, poppy and other vegetable oils [96].

From saturated fatty acids in sunflower oil: myristic acid - 1%, palmitic acid - 6-9%, stearic acid - 1.6-4.6%, arachidonic acid - 0.7-0.9%; from unsaturated fatty acids: oleic acid - 24-40%, linoleic acid - 46-72%, linolenic acid - 1%. Triglycerides are 80-90% ricinoleic acid derivatives [97].

The average molecular weight of fatty acids is 275-286. Of the unsaturated fatty acids in sunflower oil, omega-3 is only 1% [98], while omega-6 is present in significant amounts.

Phosphorus sequestering substances, tocopherol, waxes, moisture, volatile substances, non-oil additives, oil colour index value, clarity, peroxide number, flash temperature, as well as a variety of extraction and sunflower seed content of sunflower oil depends on the processing methods of raw materials.

For example, the amount of α-tocopherol (vitamin E), an important antioxidant, can vary from 46 to 60 mg% (per 100 g of oil) in pressed, unrefined oil [99]. The solvent is removed from the extracted oil with hot steam at a

temperature of 180-230 °C, and this process can significantly reduce the amount of α-tocopherol in it. However, despite this, in comparison with other oil plants, the amount of α-tocopherol in unrefined sunflower oil has one of the highest values. For example, the amount of all tocopherols in olive oil produced by different technologies does not exceed 5 mg% [100].

The composition of sunflower oil is determined by the technical regulation GOST R 52465-2005 (Chapter 5 (inaccessible link)), and since 2015, the quality indicators of the oil are determined by the technical regulation EAC TR TS 024/2011 for oil-oil products and determined by GOST 1129-2013.

Like all vegetable products, sunflower oil does not contain cholesterol (this is sometimes emphasized by manufacturers for advertising purposes). Cholesterol is a component of animal cell membranes, and plant cells contain its analogue - phytosterol, which is found in very small amounts in sunflower oil.

Raw sunflower oil has a pleasant smell and taste. Density at 10 °C is 920-927 kg/m3, solidification temperature is in the range of -16 to -19 °C, flash temperature in a closed crucible is not lower than –180 °C, smoke formation temperature is 232 °C (107 when untreated), kinematic viscosity 60.6·10−6 m2/s at 20 °C, Newtonian fluid it's not (Debornumber is around 0.5).Number of iodine119-136, hydroxyl number2-10.6.

Unrefined sunflower oil comes in two types:

- pressed (cold press)
- extraction

These oils are produced in oil extraction plants.

Sunflower oil is consumed in two forms. The first is refined and deodorized oil intended for frying, and the second is intended for salads.

Depending on the degree of purification, this product is divided into unrefined and refined oils.

During production, unrefined oil is only filtered, which eliminates mechanical impurities and preserves biologically valuable components. This

type of oil is the most useful, it will have a darker colour. The shelf life of unrefined sunflower oil is short.

Refined (refined) oil goes through several stages of processing: hydration, neutralization, deodorization and freezing. After long processing, heavy metals, pesticides, free fatty acids and other substances are removed from its composition.

Unrefined oil contains a large amount of vitamin E, as well as phosphorous substances. However, this type of oil is not suitable for frying, because it has a specific smell when heated, which often affects the taste of the food. Therefore, it is better to use odourless oils specially designed for frying.

Regardless of what kind of animal fat it is, during the frying process, it has harmful properties and carcinogens are formed in it. The reason for this is the presence of saturated fatty acids in animal fat. Sunflower oil contains a large amount of unsaturated acids, so even when heated, it does not pose a threat to human health.

The complex of vitamins in the composition serves to reduce the amount of harmful cholesterol in the blood and strengthen the nervous system and immunity. Improves gastrointestinal function and metabolism. Prevents cardiovascular diseases, and eliminates atherosclerosis, and liver diseases.

Due to the presence of a large amount of unsaturated acids in the composition, it is highly oxidizable and can deteriorate quickly if storage conditions are not provided. When unrefined oil is heated, harmful substances are formed in its composition. Sunflower oil is a high-calorie product, so if consumed in excess, it does more harm than good [101].

## § 1.6. Chemical composition and properties of components (sugar, starch, calcium stearate, vitamin D3).

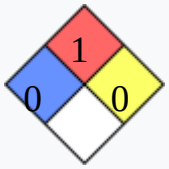
**Sugar.**

Sugar (Sucrose – C12H22O11). Industrially, it is a product obtained from sugar cane and sugar beet (it contains up to 28% of dry mass). Two monosaccharides belonging to the group of oligosaccharides (a-glucose and b-fructose) formed a disaccharide. A common disaccharide in nature. It is found in the composition of fruits, berries, and plant juices (apple, maple, melon, watermelon, watermelon, carrot, etc.). 110-120 million tons are produced per year. Mainly used in the food industry.

*Physical properties.* In its pure state, it is colourless and has a monoclinic crystal structure. When liquefied sugar cools, a clear amorphous mass - caramel is formed. Sugar is highly soluble in water. 179 g of sugar dissolves in 100 g of water at 0ºC and 487 g at 100ºC. 0.9 g dissolves in ethanol at 20ºC, very slightly soluble in methanol. It is completely insoluble in diethyl ether. The density at 15ºC is 1.5879 g/cm$^3$, and the specific gravity is 66.53 for the D-line of sodium (water, 35 g/100 g, 20ºC). The melting point is 186ºC (see Table 1.4).

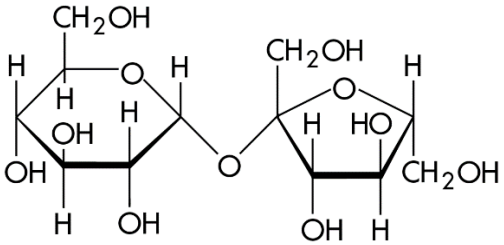
**Table 1.4. General properties of sugar**

| | |
|---|---|
| Systematic nomenclature | (2R,3R,4S,5S,6R)-2-[(2S,3S,4S,5R)-3,4-dihydroxy-2,5-bis(hydroxymethyl)oxolan-2-yl]oxy-6-( hydroxymethyl)oxane-3,4,5-triol |
| Abbreviation name | α-D-glucopyranosyl-(1,2)-β-D-fructofuranoside |
| Traditional name | Sugar, white sugar, cane sugar, cane sugar |
| Formulas | C12H22O11 |
| Physical properties | |
| Status | Solid, crystalline |
| Molar mass | 342.2965 ± 0.0144 g/mol |
| Density | 1.587 g/cm³ |
| Thermal properties | |
| Temperature | |
| •liquefaction | 186 °C |
| • fragmentation | 367 ± 1 °F[1]i 320 ± 1 °F |
| Vapor pressure | 0 ± 1 mm wire. st. |

| Solubility | |
|---|---|
| • in water | 211.5 g/100 ml |
| Classification | |
| CAS | 57-50-1 |
| PubChem | 5988 |
| EINECS | 200-334-9 |
| SMILES | OC1C(OC(CO)C(O)C1O)OC2(CO)OC(CO)C(O)C2O |
| InChI | InChI=1S/C12H22O11/c13-1-4-6(16)8(18)9(19)11(21-4)23-12(3-15)10(20)7(17)5(2- 14)22-12/h4-11,13-20H,1-3H2/t4-,5-,6-,7-,8+,9-,10+,11-,12+/m1/s1<br>CZMRCDWAGMRECN-UGDNZRGBSA-N |
| RTECS | WN6500000 |
| Chebi | 17992 |
| ChemSpider | 5768 |
| Dangerousness | |
| NFPA 704 |  |
| Standard conditions (25 °C, 100 kPa) | |

*Chemical properties*. It does not have reductive properties - it does not react with Tollens, Feling, and Benedict reagents. The chain form does not open, so it does not exhibit aldehyde and ketone properties. Due to the presence of a hydroxyl group in the composition, metals react easily with alkali. When copper (II)-hydroxide is added to a solution of sugar in water, a bright blue copper sucrose solution is formed. Due to the absence of an aldehyde group, it does not react with an ammoniacal solution of silver (I)-oxide. When heated with copper (II) oxide, it does not form red copper (I) oxide. Maltose and lactose are isomers of sugar with the formula C12H22O11.

The chemical composition of sugar is the same and consists of 99.75% sucrose. Sugar is quickly digested and provides the body with carbohydrates.



sucrose

Boiling an aqueous solution of sugar with a few drops of hydrochloric or sulfuric acid and neutralizing the acid with alkali and then boiling produces aldehyde group molecules that reduce copper(II)-hydroxide to copper(I)-oxide. This indicates that sugar forms glucose and fructose in catalytic hydrolysis.

*Biochemical role.*

In recent years, scientists from several countries have linked the increase in certain diseases, including cardiovascular diseases and tooth decay, to excessive consumption of sugar. Therefore, it is recommended to replace sugar with other foods or to reduce its amount in the diet. In fact, in the last hundred years, the consumption of sugar in developed countries has increased several times. In the 70s of the 20th century, its amount was 110-140 grams per person per day. Sugar is an important source of glucose, a necessary product for the functioning of the brain, muscles, etc. To reduce its consumption, extensive research is being conducted on sugar substitutes in the daily diet.

Sugar is primarily a food product, and its calories are too high to match its nutritional value. If a lot of sugar is consumed, the amount of protein, vitamins and minerals in the daily diet will decrease.

After the sugar enters the intestine, it is quickly broken down into glucose and fructose by the action of α-glucosidase of the small intestine, which is absorbed into the blood. α-glucosidase inhibitors such as acarbose oppose the breakdown and absorption of sugars and other carbohydrates, particularly starch. This property of inhibitors is used in the treatment of type 2 diabetes.

Excessive consumption of high-calorie sugar causes fat metabolism disorders, obesity, and increased cholesterol in the blood. Consuming too much

sugar at once causes blood glucose levels to rise and the pancreas to produce too much insulin. This situation helps to accumulate glucose in the liver, and muscles in the form of glycogen and partially turn it into fat. As a result, the concentration of sugar in the blood decreases, and the person feels hungry. This effect of sugar leads to overeating and obesity. In addition, regular and excessive consumption of sugar complicates the work of the pancreas and causes the development of diabetes. Therefore, healthy people who do not engage in physical activity and sports are recommended to consume no more than 50-100 g of sugar per day (including sweets, food, candy, confectionery, jam, compote etc.). However, it is not recommended to exclude sugar from the daily diet, and it is not allowed to replace it with saccharin, xylitol, sorbitol, or fructose without consulting a doctor.

Currently, the consumption of relatively large amounts of sugar is necessary for people engaged in heavy physical work, especially for athletes (more than 100 g per day). As you get older, you should reduce your sugar intake.

Sugar has the property of retaining water in the body, so in a therapeutic diet, especially when the internal organs are swollen, its amount in the daily diet should be moderate (see Table 1.5) [100].

**Table 1.5.Some food- the approximate amount of sugar in food**

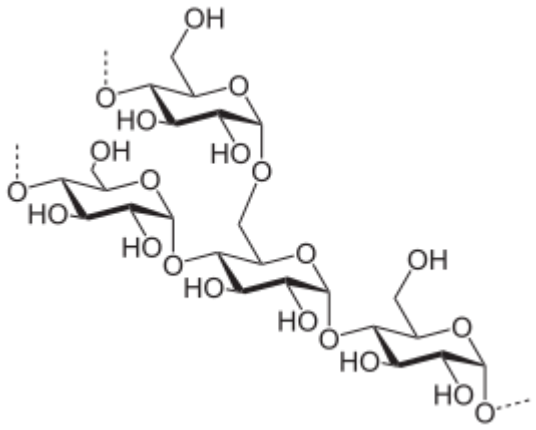
| Products | Unit of measure | Weight, in grams | Sugar content, in grams |
|---|---|---|---|
| Sugar | 1 tbsp | 9 | 9 |
| Refined | 1 pc | 7 | 7 |
| Povidlo | 1 tbsp | 15 | 10 |
| Jam | 1 tbsp | 15 | 11 |
| Cake | 1 pc | 75 | 34 |
| Cooking | 1 box | 185 | 50 |

| | | | |
|---|---|---|---|
| Ice cream | 1 start | 75 | 12 |
| Compote | 1 cup | 175 | 39 |
| Fruit juice (nectar) | 1 cup | 175 | 26 |
| Fruit juice | 1 cup | 175 | 16 |

In some diseases (diabetes, obesity) it is necessary to reduce the consumption of sugar to a minimum level or completely stop it. In this case, sugar substitutes: sorbitol and xylitol are used as sweeteners; saccharin is used only in the production of alcoholic beverages and confectionery intended for patients with diabetes. Sorbitol is twice as sweet as sugar. Sorbitol is recommended for diabetic and obese patients. Xylitol is also recommended for such patients; it is twice as sweet as sugar and sweeter than sorbitol. In addition, xylitol also has a bitter taste and is a laxative.

**Starch.**

Starch $(C_6H_{10}O_5)n$ –n-monomer was glucose amylose and amylopectin of polysaccharides is a mixture. Starch synthesized by various plants in chloroplasts (light during photosynthesis under the influence) slightly differ in the structure of grains, the degree of polymerization of molecules, the structure of polymer chains and their physical and chemical properties.




starch

*Physical properties.*

Tasteless white amorphous powder, insoluble in cold water. It is visible under the microscope without individual grains; When starch powder is compressed, it produces a characteristic sound caused by the friction of the particles (see Table 1.6).

*Chemical properties.*

It swells (dissolves) in hot water, colloids the solution forms a paste. Acids as catalysts (diluted $H_2SO4$ etc.) slowly in added water hydrolyzed decreasing molecular mass "soluble starch", dextrins are formed and the cycle continues until complete glucose.

**Table 1.6. Physico-chemical properties of starch**

| General properties | |
|---|---|
| Chemical formula | (C6H10O5)n |
| Physical properties | |
| External appearance | A hard, white powder |
| Molarmass | 162×ng/mol |
| Density | 1.5 g/cm³ |
| Thermal properties | |
| Temperature | |
| • sublimation | 410 °C |
| •flare up | 410 °C |
| Vapor pressure | 0 ± 1 mm |
| Classification | |
| CAS | 9005-25-8 |
| EINECS | 232-679-6 |
| RTECS | GM5090000 |
| Chebi | 28017 |
| Standard conditions(25 °C, 100 kPa) | |

Starch molecules vary in size. Starch is a mixture of linear and branched macromolecules.

Enzymes under the influence or when heated with acids undergo hydrolysis:

$(C6H10O5)n + nH2O \rightarrow nC6H12O6$

Qualitative reactions:

Iodine when reacting with a blue compound is formed. This reaction was discovered in 1814 by Jean-Jacques Colen and Henri-Francois Goethe de Clobri [102].

Starch, unlike glucose, silver mirror reaction does not give;

Sucroselikecopper (II)-hydroxide does not return;

*Biosynthesis*.

During photosynthesis, part of the glucose produced in green plants is converted into starch:

$6CO_2 + 6H_2O \rightarrow C6H12O6 + 6O_2$ (general view)

$nC6H12O6$ (glucose) $\rightarrow (C6H10O_5)n + nH_2O$

In general, this process can be described as follows:

$6nCO_2 + 5nH_2O \rightarrow (C6H10O_5)n + 6nO_2$.

Starch is stored in root nodules, fruits, and seeds of plants as a reserve food source. 24% in potato tubers, wheat in cereals - 64%, in rice- 75%, in corn - up to 70% starch.

*Starch modification*.

Starch in the industry to glucose cycle (sugaring process) is carried out by boiling it in dilute sulfuric acid for several hours (catalytic effect of sulfuric acid on the sugaring of starch in 1811K.S.Kirchhofdiscovered by). Sulfuric acid from the resulting solution to losechalkis added, insoluble in it calcium sulfate is formed, it is easily separated from the solution by filtering it. The solution is evaporated and sweet and dark starch molasses is obtained. In addition to glucose, molasses contains a large amount of other products of hydrolysis.

Molasses is used for the preparation of confectionery products and for various technical purposes.

If pure glucose is to be obtained, the boiling of starch is continued until complete conversion to glucose is achieved. After neutralization and filtration, the resulting solution is boiled until glucose crystals begin to form.

Also, currently, starch hydrolysis is enzymatically carried out by-amylase dextrins of different lengths are formed and glucose is obtained by hydrolyzing them with glucoamylase.

When dry starch is heated to 200-250 °C, it is partially decomposed and lower than starch polysaccharides mixture (dextrinetc.) is obtained. The physical change allows to obtain starch that retains moisture well, which has a positive effect on the quality of the final product.

*Nutritional value.*

Starch in the digestive system of humans and animals is hydrolysed and turns into glucose, which is absorbed by the body. Intermediate products of starch hydrolysis dextrins.

Starch food supplements the thickening of many foods, jelly, sauces and lajusused for preparation.

Starch is the most common in the human dietis a carbohydrate and many basic nutrients in foods there is. The main sources of starch in the world are cereal crops: rice, wheat, corn; and different root nodules, including potatoes, also called cassava[103].

Most other starchy plants grow only in certain climates, such as rye, barley, buckwheat, corn, millet, blackberry, banana, chestnut, white corn, sweet potato, bread tree, yams, taro, chilim, arrowroot, until arrack, canna, colocasia, Japaneseaspueraria, malanga, nodular acid, heel, sago and many legumes - beans, chickpeas, mosh, shelled peas, peas.

Common foods that contain starch include bread, pour, noodles, pasta, grain, porridge, jelly various bakery bread, and tortillas.

Fooddigestive enzymes crystal starch is a little more difficult to break down. Raw starchduodenumandthinIntestinal indigestion and bacterial decomposition in the large intestine will happen. Amyloses are more difficult to digest than amylopectin. At the same time, even indigestible starch also plays its physiological role: the slow processing of such starch in the intestine to hyperglycemia does not lead to (an increase in the concentration of glucose in the blood, this diabetes important for patients with), colon epithelium creates organic acids, which are the main source of energy for, increases and supports the immunity of the intestinal tract, the body's defence against colds [104].To increase the digestibility of starch, it is thermally processed. Therefore, before people started using fire, protein unlike cereals, grains and other starchy foods was not the most important source of energy for the body. Heat treatment has changed this situation, but energy from fast-absorbing carbohydrate foods is in our time metabolic syndromes, including obesity, and sugary diabetes became one of the factors of development.

Adding sugar that competes for water in baking, such as making a cake of starch can reduce coagulation and gelatinization, which improves the texture of starch and prevents "gumming".

*Industrial use.*

In the world, starch is used the most in the paper industry, amounting to millions of metric tons every year [105].

Food in the food industry starch glucose, molassesyesethanolto produced in the textile industry and used for fabric processing and as a filler in the paper industry. In addition, starch is included in most sausages, mayonnaise, ketchup and other products.

Modified starch wallpaper glue is the main component.

It is a drug in the pharmaceutical industry in tablet forms used as a filler, some medicinal capsules, dextrans (dextrins) are a series of infusion solutions for intravenous administration (hemolysis, polyglucin,rheopolyglucinetc.) are used for preparation.

Starch with iodineamyloidinThe so-called adduct is used as an antiseptic and in the treatment of iodine deficiency.

*Use in household life.*

In everyday life, clothes are used for starching collars, robes, etc. Starch glue wallpaper paste, pape-mache preparation used for sometimes starch is a drying powder is used.

*Biological properties.*

PhotosynthesisStarch, one of its products, is widely distributed in nature. For plants, it is a storehouse of nutrients and is mainly found in fruits, seeds and roots. Starch for the human body, with sucrose, of carbohydratesis one of the most important components of food products as a main source. Enzymes in the human body under the influence of starch to glucose are hydrolyzed, and it is oxidized to carbon dioxide and water in the cells and provide the energy necessary for the functioning of the living organism.

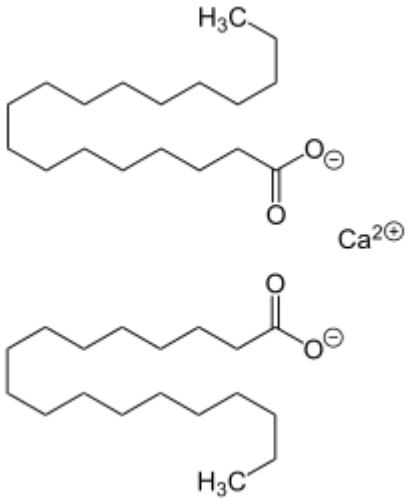
A solution of starch in waterNewtonian fluid does not have the property

*Clay starch.*

Sludge starch is a by-product in the production of the first type of starch: the part that collects in the settling tank or at the top of the mixing bowls. Contains 90-95% starch, processed into starch.

**Calcium stearate.**

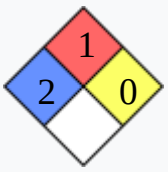
Calcium stearate - calcium salt of stearic acid Ca(C17H35COO)2, chemical compound, colourless (white) substance, insoluble in water (see Table 1.7).



calcium stearate

**Table 1.7. General properties of calcium stearate**

| | |
|---|---|
| General information | |
| Systematic to be named | Calcium stearate |
| Traditional naming | Calcium stearate |
| Chemical formulas | CaC36H70O4 |
| Rational formula | Ca(C17H35COO)2 |
| Physical properties | |
| External appearance | Finely dispersed colourless (white) substance, powder, granules |
| Molar masssi | 607.02 g/mol |
| Density | 1.08 g/cm³ |
| Thermal properties | |
| Temperature | |
| •liquefaction | 180 °C |
| Solubility | |
| • in water | 0.00415 g/100 ml |
| Classification | |
| Reg. number CAS | 1592-23-0 |
| PubChem | 15324 |
| Reg. number EINECS | 216-472-8 |
| SMILES | [Ca+2].[O-]C(=O)CCCCCCCCCCCCCCCCC.[O-]C(=O)CCCCCCCCCCCCCCCCC |

| | |
|---|---|
| InChI | InChI=1S/2C18H36O2.Ca/c2*1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18(19)20; /h2*2-17H2,1H3,(H,19,20);/q;;+2/p-2<br>CJZGTCYPCWQAJB-UHFFFAOYSA-L |
| RTECS | WI3000000 |
| Chebi | CHEMBL2106092 |
| ChemSpider | 14587 |
| Dangerousness | |
| NFPA 704 |  |
| Standard conditions (25 °C, 100 kPa) | |

*Obtainable.*

It is obtained by reacting stearic acid with calcium oxide or hydroxide in equimolar proportions. The process is carried out in the solid phase, with intensive stirring at normal atmospheric pressure, without heating, in the presence of CaX-type zeolite added in the amount of 6.7-16%.

Sodium stearate and calcium are obtained from the exchange reaction of chloride.

$CaCl_2 + 2C17H35COONa \rightarrow Ca(C17H35COO)_2\downarrow + 2NaCl$

In hard water soap when sedis also formed:

$Ca(HCO3)2 + 2C17H35COOH \rightarrow Ca(C17H35COO)2\downarrow + 2CO2\uparrow + H2O$

*Physical properties.*

Calcium stearate forms a colourless (white) substance. Not toxic. It leaves the human body quickly. Resistant to high temperatures. Gives a synergistic effect with lead stabilizers. It does not dissolve in water. Soluble in toluene, benzene, ethanol and other organic solvents, and oils.

*Usage.*

In the medical and food industry, it is used in the production of biologically active additives, confectionery products, and the tabletting of

medicines and vitamins, YE470 nutritional supplement is used in the production of containers that come into contact with food because it is non-toxic;

It is used as an auxiliary component in the preparation of packaging materials for food products, pharmaceuticals, and medicines. It creates conditions for the intensive progress of several chemical reactions in the production of medicines, improves the interaction of various components during the mixing process, and ensures the formation of a stable uniform consistency.

- Lubricants such as Solidolthickener. Limited use due to lower thermostability;
- Polyvinyl chloride stabilizer and internal lubricant for it;
- In addition to waterproofing materials;
- Stabilizer/lubricant agent in the production of polyolefin compounds, coloured and white super concentrates of polymers;
- Assistant in paints and varnishessiccative and opacification additive;
- Reducing salinity, contamination and decay of facade materials;
- In increasing the mobility of the mixture of concretes and plasters;
- Cement and for fabric shydrophobizer;
- Lubricant in bulk forms;
- For cosmetic preparations emulsifiers;
- Plasticizer in pencil production;
- Catalyst in chemical synthesis;
- An auxiliary component in medicinal preparations.

*Contraindications.*

Side effects are observed when used in parallel with other drugs. It cannot be consumed together with alcoholic beverages and energy drinks. In the gastrointestinal system, it can be decomposed by exposure to hydrochloric acid in the stomach.

**Vitamin D3.**

*Description of the drug*- vitamin D3

*Active substance:* cholecalciferol(cholecalciferol)

*Pharmaceutical form.*

Vitamin D3 - oil solution for drinking, 20000 MB/ml: in vials of 10 ml, 15 ml, 20 ml, 25 ml, 30 ml or 50 ml.

*Release form, packaging and composition of the drug.*

A clear, slightly yellowish solution for drinking

Excipients: up to 1 ml of medium-chain triglycerides.

Cholecalciferol substance contains dl-α-tocopherol acetate. 1 ml of the drug contains 0.05 mg of dl-α-tocopherol acetate.

Packaging:

- 20 ml - dark glass bottles (1) - cardboard packages.
- 25 ml - dark glass bottles (1) - cardboard packages.
- 30 ml - dark glass bottles (1) - cardboard packages.
- 50 ml - dark glass bottles (1) - cardboard packages.
- 10 ml – glass bottles with dropper caps (1) or screw caps with dropper caps. - cardboard packages.
- 15 ml – glass vials with a dropper cap (1) or screw caps with a dropper cap. - cardboard packages.
- 30 ml - glass bottles with a dropper cap (1) or screw caps with a dropper cap. - cardboard packages.
- 50 ml - glass bottles with dropper caps (1) or screw caps with dropper caps. - cardboard packages.

*Clinical-pharmacological group:* A drug that regulates calcium and phosphorus metabolism.

*Pharmacotherapeutic group:* Vitamin-calcium-phosphorus metabolism regulator

*Pharmacological effect.*

A drug that treats vitamin D3 deficiency. Participates in the regulation of calcium-phosphorus exchange, enhances the absorption of calcium and phosphates in the intestine (due to the increase in the permeability of the cell and

mitochondrial membranes of the intestinal epithelium) and their reabsorption in the renal tubules; promotes bone mineralization, bone skeleton and teeth formation in children, enhances the ossification process, is necessary for the normal functioning of the thyroid gland.

*Pharmacokinetics.*

It is rapidly absorbed (in the distal part of the small intestine) and enters the lymphatic system, the liver and the general circulatory system. In the blood, it binds to α-2-globulins and partially to albumins. Accumulates in the liver, bones, skeletal muscles, kidneys, adrenal glands, myocardium, and adipose tissue. The time to reach Cmax in tissues is 4-5 hours, then the concentration of cholecalciferol decreases slightly, remaining at a constant level for a long time. In the form of polar metabolites, it is mainly localized in the membranes of cells, microsomes, mitochondria and nuclei. Passes through the placental barrier, and comes out with breast milk. Stored in the liver. It is metabolized in the liver and kidneys: in the liver, it is converted into an inactive metabolite calcifediol (25-dihydro cholecalciferol), in the kidneys it is converted from calcifediol into an active metabolite calcitriol (1,25-dihydroxycholecalciferol) and an inactive metabolite 25-dihydroxycholecalciferol. It undergoes intestinal-hepatic recirculation.

Vitamin D3 and its metabolites are excreted with bile, in small amounts - through the kidneys.

*Instructions for vitamin D3.*

- prevention and treatment of rickets;
- prevention of vitamin D3 deficiency in high-risk groups (malabsorption, chronic diseases of the small intestine, biliary cirrhosis of the liver, the condition after resection of the stomach and/or small intestine);
- maintenance therapy of osteoporosis (of various origins);
- treatment of osteomalacia (in patients over 45 years old against the background of mineral metabolism disorders, long-term immobilization in injuries, limiting the consumption of milk and dairy products);

- treatment of hypoparathyroidism and pseudohypoparathyroidism.

**Adverse effects**

Allergic reactions, hypercalcemia, hypercalciuria, loss of appetite, polyuria, constipation, flatulence, nausea, abdominal pain, headache, myalgia, arthralgia, increased blood pressure, arrhythmia, and impaired renal function. disorder, an increased process in tuberculosis.

**Instructions against use**

- hypercalcemia;
- D3 hypervitaminosis;
- renal osteodystrophy with hyperphosphatemia;
- calcium nephrolithiasis;
- hypersensitivity (including thyrotoxicosis).

Atherosclerosis, heart failure, kidney failure, pulmonary tuberculosis (active form), sarcoidosis or other granulomatosis, hyperphosphatemia, phosphate nephrolithiasis, organic heart disease, acute and chronic diseases of the liver and kidneys, gastrointestinal diseases and duodenal diseases of the colon, diseases of the pancreas. should be used with caution during pregnancy, lactation, and hypothyroidism.

**Use during pregnancy and lactation**

Chronic overdose during long-term use of the drug in high doses during pregnancy (hypercalcemia, entry of metabolites of vitamin D3 through the placenta) can cause defects in the physical and mental development of the fetus, special forms of aortic stenosis.

Vitamin D3 and its metabolites are excreted in breast milk.

**Use in children**

*Prevention of rickets:* healthy children are prescribed 1 drop (about 625 MB) of vitamin D3 per day from the second week of life. Premature babies are prescribed 2 drops of vitamin D3 (about 1250 MB) per day from the 2nd week of life. It is recommended to use the drug in the first and second year of life, especially in winter.

**Special instructions**

Vitamin D3 should be used with regular careful medical control of calcium concentration in blood and urine (especially when prescribed together with thiazide diuretics).

When using for preventive purposes, it is necessary to keep in mind the possibility of overdose in children (do not prescribe more than 400,000-600,000 MB per year). Long-term use in high doses leads to chronic vitamin D3 hypervitaminosis.

It should be remembered that the sensitivity to vitamin D3 in different patients is individual, and in some patients even taking therapeutic doses can lead to hypervitaminosis.

The sensitivity of newborns to vitamin D3 varies, some of them may even be sensitive to very low doses. Children who take vitamin D3 for a long time have an increased risk of discolouration.

A balanced diet is necessary to prevent D3 hypovitaminosis.

Breastfed babies born to dark-skinned and/or mothers who don't get enough sun exposure are at increased risk of vitamin D3 deficiency.

With age, the need for vitamin D3 may increase due to a decrease in the absorption of vitamin D3, a decrease in the ability of the skin to synthesize provitamin D3, a decrease in insolation time, and kidney failure.

Because there may be phases of normal sensitivity to vitamin D3 in pseudohypoparathyroidism, the dose of the drug should be adjusted.

*Effects on the ability to drive vehicles and machinery.*

There is no information on the effect of the drug on the ability to drive vehicles and mechanisms.

**Overdose**

*Symptoms of vitamin D3 hypervitaminosis:*

- fairy (due to hypercalcemia) - constipation or diarrhoea, dryness of the mucous membrane of the oral cavity, headache, thirst, pollakiuria, nocturia,

polyuria, anorexia, metallic taste in the mouth, eyes nausea, vomiting, unusual fatigue, general weakness, adynamia, hypercalcemia, dehydration;

- evening - bone pain, cloudy urine (appearance of hyaline cylinders in urine, proteinuria, leukocyturia), increased blood pressure, itching, increased photosensitivity of the eyes, hyperemia of the conjunctiva, arrhythmia, drowsiness, myalgia, vision nausea, vomiting, pancreatitis, gastralgia, weight loss, rarely - psychosis (mental changes) and mood changes.

- *Symptoms of chronic intoxication (when taken for several weeks or months at a dose of 20,000-60,000 MB per day, 2000-4000 MB per day for children):*

- calcinosis of soft tissues, kidneys, lungs, blood vessels, arterial hypertension, kidney and chronic heart failure (these effects often occur when hypercalcemia is combined with hyperphosphatemia), and growth arrest in children (1800 per day long-term use at a dose of MB).

*Treatment:* stop the use of the drug, diet with low calcium content, drink plenty of fluids, and prescribe glucocorticosteroids, in severe cases, intravenously administer furosemide, electrolytes, calcitonin, 0.9% solution of sodium chloride, hemodialysis should be carried out. No specific antidote is known.

In order to prevent an overdose, it is recommended to control the concentration of calcium in the blood in most cases.

**Drug interactions**

Thiazide diuretics increase the risk of hypercalcemia.

In hypervitaminosis, D3, the risk of arrhythmia may increase due to the increased effect of cardiac glycosides and the development of hypercalcemia (monitoring of calcium concentration in the blood, electrocardiograms, as well as correction of the dose of cardiac glycosides is recommended).

Under the influence of barbiturates (including phenobarbital), phenytoin and primidone, the need for cholecalciferol can significantly increase (increases the rate of metabolism). Against the background of simultaneous use of antacids

containing aluminium and magnesium, long-term therapy increases their concentration in the blood and the risk of intoxication (especially in chronic kidney failure). Calcitonin, bisphosphonates, plicamycin, gallium nitrate and glucocorticosteroids reduce the effect of the drug. Cholestyramine, colestipol and mineral oils reduce the absorption of fat-soluble vitamins in the gastrointestinal tract and require an increase in their dosage. Accelerates the absorption of phosphorus-sparing drugs and increases the risk of hyperphosphatemia. When used simultaneously with sodium fluoride, the interval between doses should be at least 2 hours; and with oral forms of tetracycline, the interval should be at least 3 hours. Simultaneous use with other analogues of vitamin D3 increases the risk of developing hypervitaminosis. Concomitant use of benzodiazepines increases the risk of hypercalcemia. Isoniazid and rifamycin reduce the effect of the drug due to an increase in the rate of biotransformation. Does not interact with food [106].

**Storage conditions for the drug D3.**

The drug is stored in a place protected from light at a temperature from 15 °C to 25 °C. Keep out of reach of children.

**Shelf life of the drug**

Validity period - 5 years.

**Conclusions on chapter I**

The new varieties of amaranth (Amaranthus hypochondriacus L.), introduced to local conditions in Uzbekistan, have increased medicinal and nutritional properties due to the fact that they differ in the richness of their chemical composition compared to foreign varieties grown and introduced abroad. Amaranth seeds are a source of oil and squalene. Oil in medicine for cleaning the body from radionuclides, heavy metal salts; infectious diseases, herpes, psoriasis, vitiligo, neurodermatitis, eczema, atopic dermatitis, gastrointestinal ulcers, diabetes, liver disease, genitourinary colds, atherosclerosis, anaemia, avitaminosis, angina pectoris, hypertension, oncological and cardiovascular diseases widely used in solving problems. It

dramatically increases immunity, an unparalleled tool in the fight against anaemia. Contains rutin and vitamin R, and has antimicrobial and fungicidal properties. The number of sunny days and high annual temperatures in our country have caused an increase in the amount of necessary biologically active substances in the plant and its components.

The chemical composition and medicinal properties of peppermint (Mentha piperita L.) are unique, and the leaves are rich in carotene, organic acids and other compounds in addition to essential oils.

It has moderate sedative, antianginal, carminative, antihypoxic, choleretic, antiseptic, analgesic, and anti-nausea effects.

The chemical composition of chamomile (Matricaria chamomilla L.) petals and their use in modern medicine are related to the use of its decoctions and tinctures as anti-inflammatory, hemostatic, analgesic, mild antibacterial, sedative, antispasmodic, astringent and antipyretic agents. 'liq. Teas and tinctures are used for insomnia, intestinal pains, flatulence, diarrhoea, liver and biliary tract diseases, and also as a diaphoretic. Chamomile tincture is used to wash hair. Chamomile extract stimulates the secretion of gastric juice and bile and also has a positive effect on the central nervous system.

The chemical composition of the leaves and flowers of safflower (Carthamus tinctorius L.) and their beneficial properties are that it has a mild laxative, diuretic and choleretic effect, calm the nervous system, increase tone, prevent colds, normalize the menstrual cycle, is related to lowering blood cholesterol level, being an effective emetic agent, antibacterial effect, lowering blood pressure.

Sunflower oil (Helianthus annuus L.) is one of the most common edible oils, a product that has its place in human life, its chemical composition is rich in substances that are very useful for humans, including vitamin E - 293.3 %, it has antioxidant properties and is essential in the functioning of gonads, heart muscles, and is important in our life as a stabilizer of universal cell membranes.

In conclusion, it can be said that amaranth, peppermint, chamomile, safflower, and sunflower oil, which are the components of new biologically active food additives, each has sufficient specific biological activity, and auxiliary substances: sugar, starch, calcium stearate, a supplement of vitamin D3chemical composition and properties do not change the chemical composition of these components and do not affect their biological activity, the level of danger for the human body belongs to the 4th class at the lowest level.

## CHAPTER II. EVALUATION OF EFFICACY OF NEW BIOACTIVE FOOD ADDITIVES

### § 2.1. Effectiveness of "BIODARMON" a biologically active food supplement

The physiological effect of biologically active supplements (BAA) is to fill gaps in nutrition, improve the absorption of nutrients, activate the body's internal reserves and reduce the risk of developing many diseases by introducing substances or complexes of substances with specific biological activity into the body. is seen in improving the quality of life. During the research, the goal of selecting a biologically active supplement useful for a person at a certain stage of prevention and treatment was achieved.

"BIODARMON" biologically active food supplement includes ground amaranth seed powder, mint, safflower leaves and flowers.

Amaranth and its products are rich in vitamins, trace elements and other useful substances, which are perfectly absorbed by the body. The main, most important element of amaranth seed flour is that it does not contain gluten. Gluten is a plant protein found in grain plants (wheat, rye, oats, barley) and consists of gliadin and glutenin. Patients with celiac disease or gluten enteropathy should be very careful when eating products containing gluten. In this disease, gluten destroys the hairs of the mucous membrane of the small intestine. According to various sources, gluten intolerance is observed in 0.5-1% of the world's population. However, 10-20% of the population in different countries think they have this condition. It has been scientifically proven that gluten slows down the brain.

Many studies have shown that amaranth has an anabolic effect. In particular, many experiments involving animals were conducted to reveal this property of the plant.

For example, small amounts of green, fresh amaranth leaves were added to the daily diet of young rabbits and nutria. Leaves are included in the fattening

diets of animals, making up a quarter of all food. As a result, the daily weight gain of rabbits and nutria increased at least one and a half times. In addition, the animals recovered from existing diseases and became resistant to various diseases [23,41,77].

Peppermint preparations have a sedative, expectorant, antiseptic and pain-relieving effect, as well as reflex coronary expansion. Due to the local excitatory effect, peripheral neuroreceptors of the skin and mucous membranes increase capillary blood circulation and intestinal motility. Regular consumption leads to the healing of wounds and improvement of the general condition. Diuretic properties. There are also weak hypotensive properties, but this is not very important. In folk medicine, mint leaves are used together with other medicinal plants to reduce the acidity of the stomach, sometimes for headaches, palpitations and sleep disorders. Peppermint is an invaluable tool for relieving painful menstruation. Mint is also used for male infertility, impotence, and increased sexual arousal. The German National Health Service recommends the use of peppermint in stomach, intestinal and gall bladder disorders [107].

Safflower (mahsar) is a famous medicinal plant. Its extracts and oils are widely used in the production of medicines. In folk medicine, mahsar was used as a laxative, pain reliever and antipyretic. Mahsar has antioxidant, analgesic, anti-cold and anti-diabetic effects [108].

Biologically active substances of "BIODARMON" plant components - flavonoids, tannins, oils, essential oils, sugars, vitamins and microelements are important factors for activating biochemical processes in the body and normalizing metabolic processes, metabolism and functioning of vital organs and systems.

**Time and place of clinical trial.**

Clinical studies on the effectiveness of "BIODARMON" UAE "Med House Clinic" (Chairman of the Commission, chief doctor Turdikulova OA, head of department Rozimova NK) from February 10, 2019, to March 12, 2019, held in the period of

**The purpose of the study.**

Evaluation of the effectiveness of the biologically active food supplement "BIODARMON", approval of recommendations for use, instructions, contraindications, and identification of side effects, dated 30.2016 of the Cabinet of Ministers of the Republic of Uzbekistan It was carried out in accordance with the decision No. 131 of April "On the approval of the Regulation on the procedure for passing the authorization procedure in the sanitary-epidemiological service system of the Republic of Uzbekistan".

The following are offered for research: - "BIODARMON" biological supplement based on crushed amaranth seed powder, mint, safflower flowers and leaves, created taking into account the specific characteristics of the national diet, filling the deficiency of the most important vitamins and minerals example of an active food additive. Suitable for long-term preventive and therapeutic use.

**A brief description of the UAE presented for research, its characteristics and applications:**

**Contents:**

Ground amaranth seeds powder - 55 g, mint - 2 g, safflower leaves - 2 g, safflower flowers - 1 g.

**Release form: in the form of powder.**

**Method of application:** The powder is drunk twice a day - in the morning and in the evening 30 minutes before meals or one hour after meals, half a teaspoon (3 g) with at least 50-100 ml of boiled and cooled water. Salty, peppery, spicy foods and carbonated drinks are not consumed during the period of powder consumption.

**Active substances:** B vitamins, D, folic acid, pantothenic acid, etc.; minerals - zinc, phosphorus, calcium, potassium, magnesium, manganese, iron, sodium, etc.; pectins and cellulose; biologically active substances - squalene, plant hormones, phospholipids; amino acids - lysine, tryptophan, arginine, methionine and phenylalanine. Proteins, fats, carbohydrates.

**Instructions for use:**

A source of biologically active substances and micronutrients to maintain the activity of the central nervous system helps to saturate the blood with oxygen. UAE contributes to the normalization of the digestive tract, improves appetite and digestion, supports the functions of the liver and gall bladder, improves bowel function and reduces flatulence and spasms.

**Circumstances that cannot be used:** individual exposure to components. Not a medicine.

**Additional effects:** If side effects occur, stop using and consult a doctor.

**Storage conditions:** Store in a dry place at room temperature.

**Expiry date:**2 years.

**Packaging form:** Vo bottles approved for use by the Ministry of Health of the Republic of Uzbekistan in accordance with current regulations.

**Research materials.**

10 men and women aged 22 to 56 participated in the research program. 3 out of 10 people with similar complaints and manifestations of diseases were designated as a control group.

The study lasted 30 days.

**Research methods.** The research was carried out by the Ministry of Health of the Republic of Uzbekistan on 06.04.2014. approved, "Methodological recommendations for testing the effectiveness of biologically active food additives for food" edited by MM Roziyeva were used [109].

During the inspection, the following research control methods were implemented:

- General blood analysis.
- General urinalysis.
- Electrocardiogram (diagram 1).
- Questionnaire survey of patients.

As a criterion for the effectiveness of the biologically active food additive, the dynamics of the severity of complaints was obtained according to the results

of laboratory and functional studies and a questionnaire survey conducted in the experimental control group [110-113].

During the study of the effect of the biologically active food supplement, the complaints of the patients were monitored, and the general health of the patients and the results of laboratory and functional studies were evaluated. As a result of the use of biologically active food supplements, fatigue, nervousness, reduced swelling and improvement of general mood, increased endurance, normalization of blood pressure, and reduction of complaints were noted in patients. Side effects were not noted during studies conducted on patients. Patients in the control group did not receive biologically active food supplement therapy (see Figure 2.1).

**UAE therapy:** The following indicators of the biologically active additive were confirmed during the research process using the biologically active food additive "BIODARMON":

- relieves fatigue;
- leaves a headache;
- increases tone;
- increases immunity;
- restores the natural colour of hair;
- has a rejuvenating effect on the body;
- helps in the treatment of impotence and frigidity;
- and simply acts as an excellent preventive against many diseases.

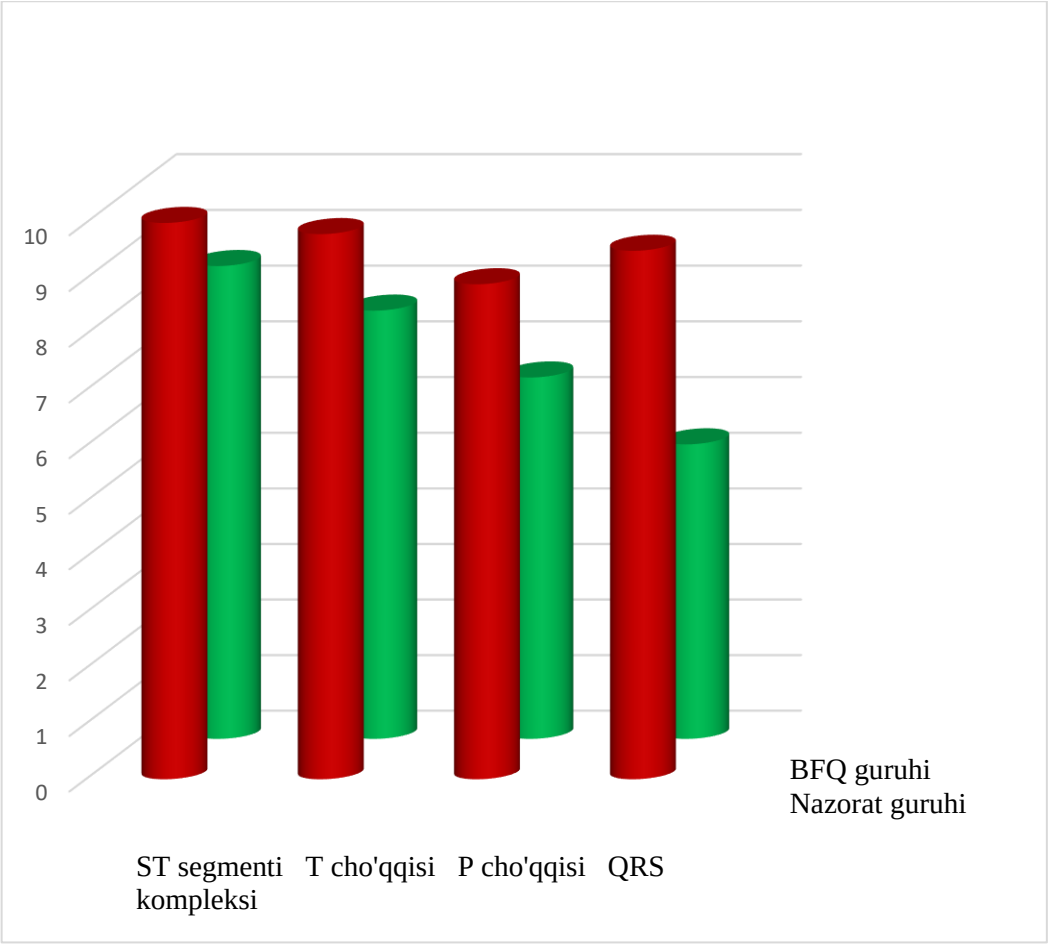



**Figure 2.1. The result of clinical trials of "BIODARMON" UAE**

The ST segment and the T peak reflect the repolarization of the ventricular myocardium, the P peak reflects the process of depolarization of the pre-cardiac myocardium, and the QRS complex reflects the processes of ventricular depolarization.

The ST segment is the segment of the ECG curve between the end of the QRS complex and the beginning of the T peak, which corresponds to the period of the cardiac cycle that is completely covered by the excitation of both ventricles. The ST segment begins at point J (ST junction).

T peak - reflects myocardial repolarization, and shows relaxation of ventricular myocardium.

Peak P - reflects the process of depolarization of the right and left atria. Usually, the averaged atrial depolarization vector (vector P) in the frontal plane is located almost parallel to the II axis of the standard deviation and is projected onto the positive parts of the II, aVF, I and III axes of deviation.

QRS complex - ventricular depolarization, consists of Q, R and S peaks. QT interval is the time between the beginning of ventricular depolarization and the end of their repolarization. The RR interval is the time interval between two complexes.

## § 2.2. Effectiveness of "BIOMOJIZA" a biologically active food supplement

Available food sources do not always fully satisfy the body's needs. Lack of vitamins and minerals leads to serious diseases, some of these diseases even end in death. Such cases were observed, as a result of which entire families, entire villages and small towns were affected by a severe, rapidly developing disease, the increased weakening of the organism was accompanied by acute neuralgia, oedema, and circulatory failure and led to death.

To date, 13 vitamins and 10 vitamin-like substances are widely used in medicine. For the full functioning of the systems of the human body, it is necessary to prevent the deficiency of all micronutrients. For this purpose, it is recommended to take vitamin and mineral complexes that ensure a balanced intake of components in amounts that do not exceed the permissible level of daily intake. Vitamins of group B, which play a major role in maintaining the normal functioning of the nervous system and the level of intelligence, are essential vitamins that should be in the daily diet of every person. The body of a person living in the city is tired of stress and malnutrition. Throughout history, people have used plants extensively to treat illness, reduce fever, and heal wounds.

Biologically active supplements are compositions of natural biologically active substances intended for direct consumption with food, used as a source for optimizing various types of metabolism, normalizing or improving the functional state of organs and tissues, and reducing the risk of diseases. is considered [65].

"BIOMOJIZA" biologically active food supplement includes the following: amaranth oil - amaranth and products derived from it are rich in vitamins, trace elements and other useful substances and are well absorbed by the body. However, the main, most important element of amaranth is squalene. Originally, squalene was extracted from the liver of deep-dwelling whales and sharks. Along with its many miraculous properties, along with the use of amaranth in the daily diet, since it was discovered that it contains a large amount of squalene, this plant has become the focus of attention and has served as a source for many studies [ 23].

Many studies have shown that amaranth has an anabolic effect. In particular, many experiments involving animals were conducted to reveal this property of the plant.

For example, small amounts of green, fresh amaranth leaves were added to the daily diet of young rabbits and nutria. Leaves are included in the fattening diets of animals, making up a quarter of all food. As a result, the daily weight gain of rabbits and nutria increased at least one and a half times. In addition, the animals got rid of existing diseases and became resistant to various diseases.

Amaranth oil contains a large amount of very useful substances:

- carotene;
- vitamin C;
- folates;
- tocopherol.

It is these substances that have an antioxidant effect. As a result of clinical and laboratory studies conducted by scientists, this oil has wound healing, antitumor and radioprotective effects.

The main fatty acids in amaranth oil: are palmitic (19.1-23.4% of the total amount of fatty acids), olein (18.7-38.9% of the total amount of fatty acids) and linoleum (the total amount of fatty acids - 36.7-55.9%) acids [8-11].

Thus, when the human body is damaged by small doses of ionizing radiation or in conditions where the body is poisoned with fluorides, the use of

amaranth oil allows the normalization of some processes that occur in the work of the heart and liver. In addition, in this case, amaranth oil has a stabilizing effect on erythrocyte membranes.

Some researchers have studied how amaranth oil affects the activity of tissue thromboplastin. Thus, the obtained data showed that amaranth oil used in outpatient settings is an excellent preventive measure to prevent the formation of blood clots in people suffering from various diseases of the cardiovascular system.

It is more difficult to obtain such data in clinical research conditions because there is no way to determine the actual activity of thromboplastin. However, the data obtained from the use of the oil in ambulatory conditions and the analysis of the conducted experiments allow us to think about the positive effect of amaranth oil in clinical conditions.

The actual effect of amaranth oil on tissue thromboplastin itself, as well as on other factors and parameters of thrombus coagulation, requires a more detailed study.

Such studies create conditions for determining and justifying the possibility of using amaranth oil in combination with other drugs in therapy.

Some researchers who have studied this matter in depth state that amaranth oil is significantly superior to chakanda (oblepixa) oil in terms of its effectiveness [56].

Amaranth seeds have long been used in traditional medicine in several Asian countries, but in Great Britain, they are officially recommended for oral administration as a diuretic and astringent [77].

It has been observed that if you use a tincture prepared by mixing equal proportions of the following plants, you can cleanse and rejuvenate the body from several harmful substances, including salts of heavy metals, pesticides, etc.:

- amaranth;
- kizilpoycha (Zeroboy);

- chamomile flowers;
- birch buds.

Three tablespoons of the mixture are added to a litre of boiled water and placed in a water bath for ten minutes. The resulting tincture should be drunk half an hour before meals during the day.

With regular use of amaranth oil as a medicinal product, cholesterol levels can be significantly reduced. Also, the effect of amaranth oil on human health and its general condition was studied in patients with heart ischemia. A total of 125 patients, divided into several groups, participated in the research, and a diet with a different amount of squalene was selected for each group:

- 100 milligrams per day;
- 200 milligrams per day;
- other groups up to 600 milligrams per day.

According to the results of the study, it was found that consuming 600 milligrams of squalene per day has a very good effect on the immune system and endurance of a person. And the antioxidant effect began to be observed when consuming 200 to 400 milligrams of squalene per day.

Some physiotherapists recommend taking baths with the following content every day to enhance the growth of children:

- amaranth - 200 g;
- mountain basil (jambil) - 500 g;
- medicinal cow's tail - 500 g.

The mixture is boiled in 3 litres of water, mixed with 10-20 litres of warm water, poured over the child's head for 15-30 minutes and washed.

The active substances of "BIOMOJIZA" biologically active supplement (BAA) - fats, essential oils, sugars, vitamins and microelements are important factors for activating biochemical processes in the body and normalizing metabolic processes, metabolism and functioning of vital organs and systems [41 ].

**Time and place of clinical trial.**

Clinical studies on the effectiveness of "BIOMOJIZA" UAE at the "Med House Clinic" treatment and prevention facility (Chairman of the Commission, chief doctor Turdikulova OA, head of the department Rozimova NK) from February 10, 2019, to be held until March 12 of the year.

**The purpose of the study.**Evaluation of the effectiveness of biologically active food supplement "BIOMOJIZA", approval of recommendations for use, indications, contraindications, side effects determination of the Cabinet of Ministers of the Republic of Uzbekistan, 2016 It was carried out in accordance with the decision No. 131 dated April 30 "On the approval of the Regulation on the procedure for transitioning from the authorization procedures in the sanitary-epidemiological service system of the Republic of Uzbekistan".

The following is presented for research: - a sample of biologically active food supplement "BIOMO'JIZA" based on amaranth oil, created taking into account the specific characteristics of the national diet, filling the deficiency of the most important vitamins and minerals. Suitable for long-term preventive and therapeutic use.

**A brief description of the biologically active food supplement submitted for research, its properties and application:**

**Contents:**

Amaranth seed oil - 20 ml, sunflower oil - 5 ml.

**Release form:** in oil form.

Method of administration: Oral – one measuring spoon 5 ml in the package. Twice a day. 20-30 minutes before meals.

**Active ingredients:**omega-3, omega-b, omega-9 oils, as well as palmitic, stearic saturated fatty acids; B1, B2, B3 (vit. PP), B4, B5, D, E (choline), P vitamins; calcium, potassium, iron, sodium, magnesium, copper, zinc, phosphorus macro- and microelements; serotonin; phospholipids, squalene (up to 8%).

**Instructions for use:**

A source of biologically active substances and micronutrients to maintain the activity of the central nervous system helps to saturate the blood with oxygen.

Contraindications: individual exposure to components. Not a medicine.

**Additional effects:** If side effects occur, stop using and consult a doctor.

**Storage conditions:** Store in a dry place at room temperature.

**Expiry date:**2 years.

**Packaging form:** It is packed in bottles from 25 ml to 1 litre or imported bottles in accordance with the current regulatory documents approved for use by the Ministry of Health of the Republic of Uzbekistan.

**Research materials** 10 men and women aged 22 to 56 participated in the research program. 3 out of 10 people with similar complaints and manifestations of diseases were designated as a control group.

The study lasted 30 days.

**Research methods.** The research was carried out by the Ministry of Health of the Republic of Uzbekistan on 06.04.2014. approved, "Methodological recommendations for testing the effectiveness of biologically active food additives for food" edited by MM Roziyeva were used [109].

During the inspection, the following research control methods were implemented:

- General blood analysis.
- General urinalysis.
- Electrocardiogram (diagram 2).
- Questionnaire survey of patients.

As a criterion for the effectiveness of the biologically active food additive, the dynamics of the severity of complaints was obtained according to the results of laboratory and functional studies and a questionnaire survey conducted in the experimental control group [110-113].

During the study of the effect of the biologically active food supplement, the complaints of the patients were monitored, and the general health of the

patients and the results of laboratory and functional studies were evaluated. As a result of the use of biologically active food supplements, fatigue, nervousness, reduced swelling and improvement of general mood, increased endurance, normalization of blood pressure, and reduction of complaints were noted in patients. Side effects were not noted during studies conducted on patients. Patients in the control group did not receive biologically active food supplement therapy (see Figure 2.2).

**UAE therapy:** The following indicators of the biologically active additive were confirmed during the research process using the biologically active food additive "BIOMOJIZA":

- relieves fatigue;
- leaves a headache;
- increases tone;
- increases immunity;
- restores the natural colour of hair;
- has a rejuvenating effect on the body;
- helps in the treatment of impotence and frigidity;
- and simply acts as an excellent preventive against many diseases.

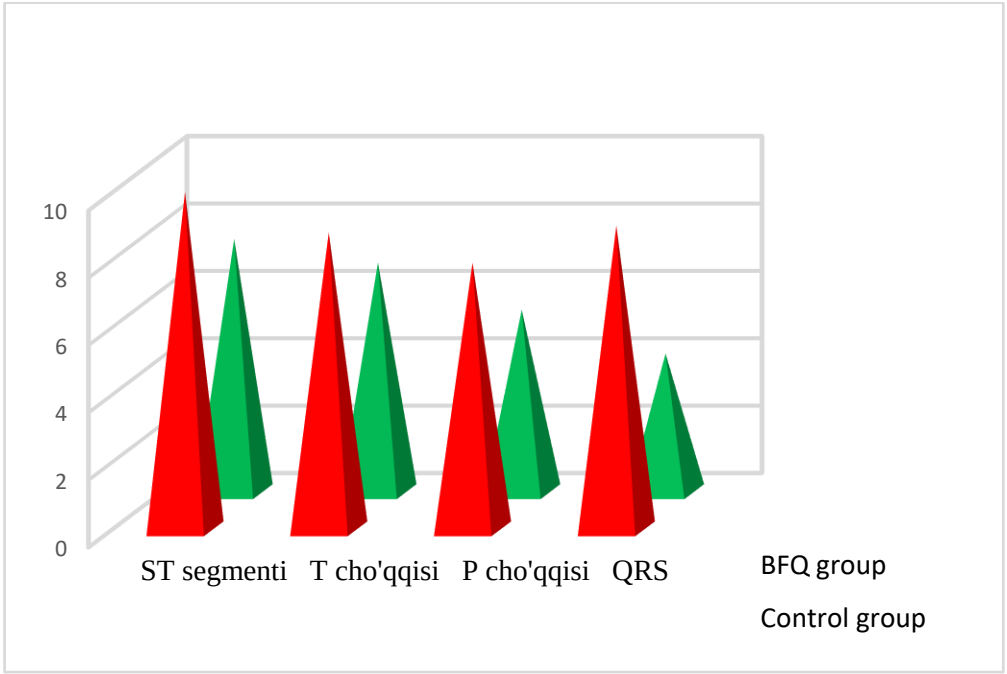



**Figure 2.2. The result of the clinical trials of "BIOMIJIZA" UAE**

Changes in the amount of squalene in the content of oils obtained from the seeds of amaranth varieties "Andijan", "Ulug'nor", "Uzbekistan", "Markhamat", which are the objects of research, were studied in the "KITECH" and "KIRLM" laboratories of the Republic of Korea. was studied. The results showed that the "Markhamat" variety of amaranth has superiority over other varieties in terms of oil content. The climatic conditions of Marhamat ensure the formation of a maximum amount of squalene in this variety, this variety was selected for "BIOMOJIZA" UAE.

To determine the composition of the oil, the analysis was carried out in two different ways: gas chromatography-mass spectrometry (GX-MS) in the form of liquid oil, and X-ray diffraction (RND) in the form of dry oil extract.

### § 2.3. Effectiveness of "BIOCHOY" biologically active food supplement

Biologically active substances of "BIOCHOY" plant components - essential oils, sugars, vitamins and microelements are important factors for activating biochemical processes in the body and normalizing metabolic processes, metabolism and functioning of vital organs and systems.

"BIOCHOY" UAE includes amaranth flowers and leaves, mint, and chamomile.

The body's needs are not always fully met from food sources. In order for the body's systems to function fully, it is necessary to prevent the lack of micronutrients. For this purpose, it is recommended to take vitamin and mineral complexes that ensure a balanced intake of components in amounts that do not exceed the permissible level of daily intake. Vitamins of group B, which play a major role in maintaining the normal functioning of the nervous system and the level of intelligence, are essential vitamins that should be in the daily diet of every person. The body of a person living in conditions of increased

urbanization is tired with stress and malnutrition. Throughout history, people have used plants extensively to treat illness, reduce fever, and heal wounds.

Biologically active supplements are compositions of natural biologically active substances intended for direct consumption with food, used as a source for optimizing various types of metabolism, normalizing or improving the functional state of organs and tissues, and reducing the risk of diseases. is considered [23].

In particular, many experiments involving animals were conducted to reveal this property of the plant.

For example, small amounts of green, fresh amaranth leaves were added to the daily diet of young rabbits and nutria. Leaves are included in the fattening diets of animals, making up a quarter of all food. As a result, the daily weight gain of rabbits and nutria increased at least one and a half times. In addition, the animals recovered from existing diseases and became resistant to various diseases [77].

Amaranth contains many useful substances: carotene, ascorbic acid, folates, and tocopherols. Their antioxidant effects have been determined by clinical and laboratory studies conducted by scientists, which may explain amaranth's wound-healing, antitumor, and radioprotective effects [41].

Thus, when the human body is damaged by small doses of ionizing radiation or in conditions where the body is poisoned with fluorides, the use of amaranth oil allows the normalization of some processes that occur in the work of the heart and liver. In addition, in this case, amaranth oil has a stabilizing effect on erythrocyte membranes.

Amaranth seeds, oil, twigs and leaves have long been used in traditional medicine in several Asian countries, and in Great Britain they are officially recommended for oral administration as a diuretic and astringent.

The use of tincture made of equal proportions of amaranth, liquorice, chamomile flowers, and birch buds has an excellent effect on rejuvenating the body, as well as cleaning it from a number of harmful substances, including salts

of heavy metals, pesticides, etc. Three tablespoons of the mixture are added to a litre of boiled water and placed in a water bath for ten minutes. The resulting tincture should be drunk half an hour before meals during the day.

Some physiotherapists recommend taking baths made of amaranth, mountain basil, and medicinal cow tail to strengthen the daily growth of young children: the mixture is boiled in 3 litres of water, mixed with 10-20 litres of warm water, poured over the child's head for 15-30 minutes and washed. [11].

Chamomile contains an essential oil consisting mainly of chamazulene, prochamazulene, monoterpenes and sesquiterpenes. Among the sesquiterpenes, the lactones matricin and matricarin are particularly important. The essential oil also includes caprylic acid, sesquiterpene hydrocarbons, and alcohols. In addition, flowers contain flavonoids, choline, carotene, coumarins, vitamin C and a number of other substances. Pharmacological properties are manifested in the form of spasmolytic (m-cholinergic effect), anti-inflammatory, antiseptic, sedative, and mild pain-relieving effects. After drinking chamomile tincture, the secretion of the digestive glands increases, and the secretion of bile improves. Under the influence of its essential oil, breathing becomes slightly deeper, the number of heart contractions increases, and cerebral vessels expand [115].

Peppermint preparations have a sedative, expectorant, antiseptic and pain-relieving effect, as well as reflex coronary expansion. Due to the local excitatory effect, peripheral neuroreceptors of the skin and mucous membranes increase capillary blood circulation and intestinal motility. Regular consumption leads to the healing of wounds and improvement of the general condition. Diuretic properties. There are also weak hypotensive properties, but this is not very important. In folk medicine, mint leaves are used together with other medicinal plants to reduce the acidity of the stomach, sometimes for headaches, palpitations and sleep disorders. Peppermint is an invaluable tool for relieving painful menstruation. Mint is also used for male infertility, impotence, and increased sexual arousal. The German National Health Service recommends the use of peppermint in stomach, intestinal and gall bladder disorders [107].

**Time and place of clinical trial.**

Clinical studies on the effectiveness of "BIOCHOY" UAE "Med House Clinic" (Chairman of the Commission, chief physician Turdikulova OA, head of department Rozimova NK) from February 10, 2019, to March 12, 2019, held in the period of

The purpose of the study. Evaluation of the effectiveness of biologically active food supplement "BIOCHOY", approval of recommendations for use, instructions, contraindications, identification of side effects of the Cabinet of Ministers of the Republic of Uzbekistan dated April 30, 2016 It was carried out in accordance with the decision No. 131 "On the approval of the Regulation on the procedure for transitioning from authorization procedures in the sanitary-epidemiological service system of the Republic of Uzbekistan".

**The following are provided for research** sample of the bioactive food supplement "BIOCHOY" based on amaranth, mint, and chamomile flowers and leaves, created taking into account the specific characteristics of national nutrition, filling the deficiency of the most important vitamins and minerals, for long-term preventive and therapeutic use fits.

**A brief description of the UAE presented for research, its characteristics and applications:**

**Contents:**

Amaranth flowers and leaves - 1 g, chamomile - 0.5 g, mint - 0.5 g.

**Release form:**2 mg are packed in filter bags.

**Method of application:** It is drunk twice a day, in the morning and in the evening, 15-20 minutes before meals or one hour after meals. One package is put in 150-200 ml of boiled and cooled water and left for 5 minutes. After using the thread, shake the bag. The tea can be drunk warm or chilled. One package is for one-time use. You can add sugar or honey to the tea.

**Active substances:** vitamins B1, B2, B3 (PP), B4, B5, D, E (choline), and P; contain calcium, potassium, iron, sodium, magnesium, copper, zinc, phosphorus macro- and microelements.

**Instructions for use:**

A source of biologically active substances and micronutrients to maintain the activity of the central nervous system helps to saturate the blood with oxygen. In particular, it is recommended as a supplement to the daily diet to increase the activity of the immune system and the body's resistance to adverse environmental factors, stimulate the body's defence forces against infections, and eliminate the development of inflammatory and cold processes.

**Circumstances that cannot be used:** individual exposure to components. Not a medicine.

**Additional effects:** If side effects occur, stop using and consult a doctor.

**Storage conditions:** Store in a dry place at room temperature.

**Expiry date:**2 years.

**The packaging form** mg filter is packed in bags and placed in a cardboard box. One box contains 100 filter packs used in accordance with current regulations or import packs approved for use by the Ministry of Health of the Republic of Uzbekistan.

**Research materials.**

10 men and women aged 22 to 56 participated in the research program. 3 out of 10 people with similar complaints and manifestations of diseases were designated as a control group.

The study lasted 30 days.

**Research methods.** The research was carried out by the Ministry of Health of the Republic of Uzbekistan on 06.04.2014. approved, "Methodological recommendations for testing the effectiveness of biologically active food additives for food" edited by MM Roziyeva were used [109].

During the inspection, the following research control methods were implemented:

- General blood analysis.
- General urinalysis.
- Electrocardiogram (diagram 3).

- Questionnaire survey of patients.

As a criterion for the effectiveness of the biologically active food additive, the dynamics of the severity of complaints was obtained according to the results of laboratory and functional studies and a questionnaire survey conducted in the experimental control group [110-113].

During the study of the effect of the biologically active food supplement, the complaints of the patients were monitored, and the general health of the patients and the results of laboratory and functional studies were evaluated. As a result of the use of biologically active food supplements, fatigue, nervousness, reduced swelling and improvement of general mood, increased endurance, normalization of blood pressure, and reduction of complaints were noted in patients. Side effects were not noted during studies conducted on patients. Patients in the control group did not receive biologically active food supplement therapy.

**UAE therapy:** The following indicators of the biologically active additive were confirmed during the research process using the biologically active food additive "BIOCHOY":

- relieves fatigue;
- leaves a headache;
- increases tone;
- increases immunity;
- restores the natural colour of hair;
- has a rejuvenating effect on the body;
- helps in the treatment of impotence and frigidity;
- and simply acts as an excellent preventive against many diseases.

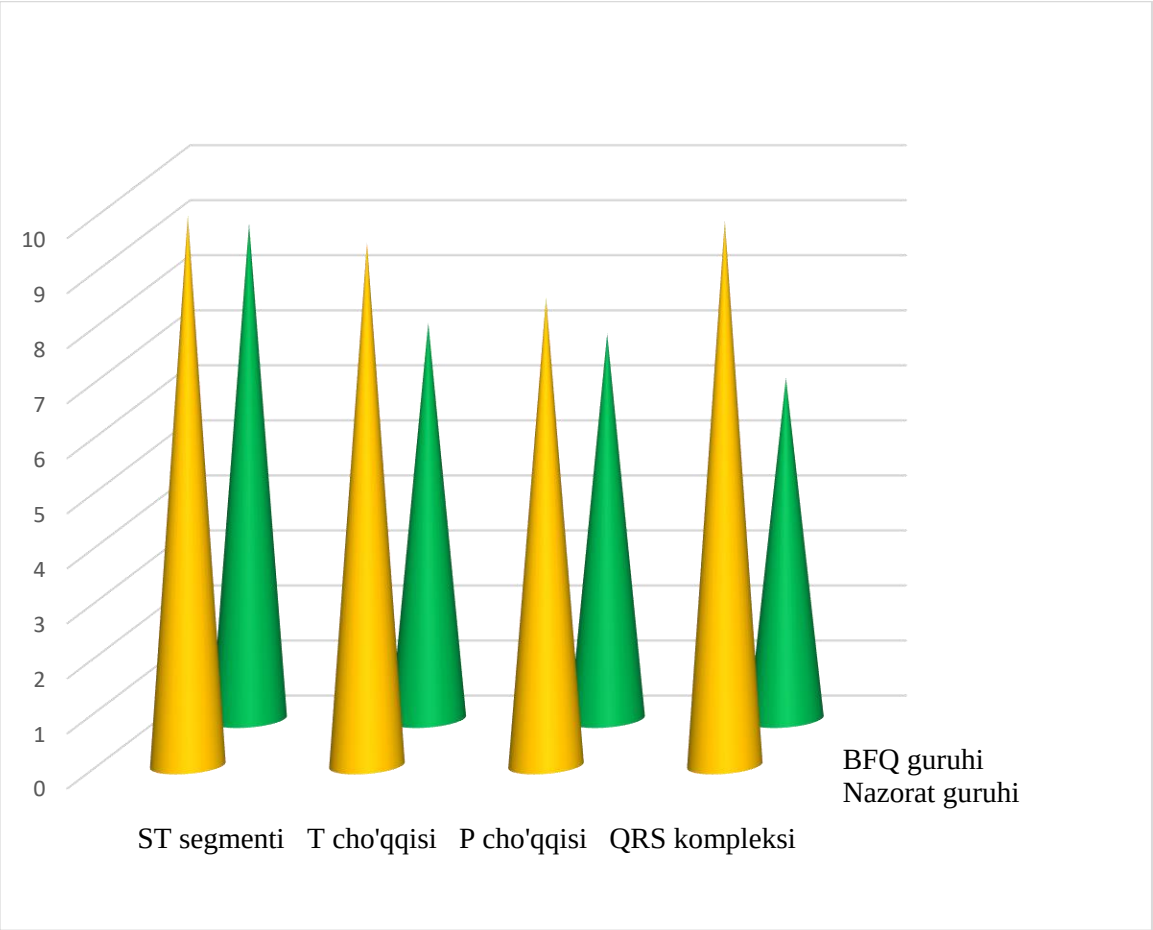



**Figure 2.4. The result of clinical trials of "BIOCHOY" UAE**

## § 2.4. Toxico-hygienic properties of biologically active supplements "BIODARMON", "BIOMO'JIZA", "BIOCHOY"

"BIODARMON", "BIOCHOY" and "BIOMO'JIZA" biologically active food supplements, developed for the first time in Uzbekistan, are made of vitamins, minerals and plant extracts. are products intended for use as a source of additives, and based on our recommendation, production by "SIFAT AGRO SERVIS" LLC in the city of Andijan was launched [23, 115, 116].

In order to check the conformity of these biologically active additives with toxicological and hygienic requirements, the relevant samples were submitted to the Republican State Sanitary and Epidemiological Control Center of the Ministry of Health of the Republic of Uzbekistan. The activity of the centre toxicology laboratory is carried out on the basis of the accreditation

certificate No. UZ.AMT.07 MAI.086, which was registered in the State Register of the National Accreditation System of the Republic of Uzbekistan and issued to the testing laboratory (centre) on February 18, 2008.

The period of the experiment: January 9 - February 11, 2019 (Head of the toxicology department and laboratory Sh.Kh. Eshmuradov, department doctor and laboratory technician Yakubova GT, department laboratory technician Shoyusupova MM)

Information about biologically active food additives:

One vial of "BIODARMON" contains amaranth seeds - 55 g, mint - 2 g, safflower (mahsar) leaf - 2 g, safflower (mahsar) flower - 1 g.

One filter pack of "BIOCHOY" contains amaranth flower and leaf - 1 g, chamomile - 0.5 g, and mint - 0.5 g.

"BIOMOJIZA" contains amaranth oil - 20 ml, sunflower oil - 5 ml, vitamin D3 - 5 μg.

Evaluation of the effectiveness of "BIODARMON", "BIOCHOY" and "BIOMO'JIZA" biologically active food supplements, approval of recommendations for use, indications, contraindications, identification of side effects It was carried out in accordance with the decision of the Cabinet of Ministers of the Republic of Uzbekistan No. 131 of April 30, 2016 "On the approval of the Regulation on the procedure for transitioning from the authorization procedures in the sanitary-epidemiological service system of the Republic of Uzbekistan".

**RESULTS OF TOXICOLOGICAL TESTS PERFORMED [110-113].**

**Understanding of hazard levels of substances**

There are the following procedures for classifying the degree of danger of substances:

**Hazard class according to the national classification**- is the conditional magnitude of the harmful effect, which is determined for various objects - chemical substances in accordance with industry regulations.

The hazard class of hazardous substances is a conditional quantity intended for the simplified classification of potentially hazardous substances

According to the degree of impact on the body, harmful substances are divided into four classes of danger:

1st class. Extremely dangerous substances;

2nd class. Hazardous substances;

3rd class. Moderately dangerous substances;

4th grade. Low-risk substances;

The hazard class of harmful substances depends on the norms and indicators. Indicators according to GOST 12.1.007-76 must comply with the following standards (see Table 2.2).

**Table 2.2. Hazard class norms according to the national standard**

| Indicator | Hazard class standards | | | |
|---|---|---|---|---|
| | I | II | III | IV |
| The permissible concentration of harmful substances in the work zone - REK (PDK), mg/m³ | <0.1 | 0.1-1.0 | 1.1-10.0 | >10.0 |
| The median lethal dose (LD50), when administered in the stomach, is 1 kg/mg | <15 | 15-150 | 151-5000 | >5000 |
| The median lethal dose (LD50), when applied to the skin, is 1 kg/mg | <100 | 100-500 | 501-2500 | >2500 |
| Average lethal dose (LD50), in air, mg/m³ | <500 | 500-5000 | 5001-50000 | >50,000 |
| The probability ratio of inhalation poisoning | >300 | 300-30 | 29-3 | <3 |
| Zone of an acute effect | <6.0 | 6.0-18.0 | 18.1-54.0 | >54.0 |
| Zone of chronic influence | >10.0 | 10.0-5.0 | 4.9-2.5 | <2.5 |

***Experimental method.*** In order to experimentally determine the toxicological properties of substances, it is necessary to evaluate the hazard class and other similar indicators. To achieve a high degree of accuracy, it is advisable to conduct toxicity studies in two or three species of animals or test cultures (strains, etc.).

*Calculation method.* Together with the complete analytical research of the object, it is also based on the database of toxicological properties of individual

substances. Due to the fact that toxicological studies on the object require high costs, in practice the calculation method is used, consciously avoiding a number of limitations [117, 118].

**Danger class according to international standards.**

**NFPA 704**- National Fire Protection Association is a trade-industry association of the United States and some countries that provides fire, electrical and construction safety. Headquartered in Quincy, Massachusetts. It was founded in 1896. Its main mission is to conduct research, training, education and implementation of standards and codes to reduce the probability of fire and other man-made disasters around the world.

Currently, "fire diamond" is used for any product, that is, the equipment, equipment, which should be used by the personnel of the emergency services as part of immediate first aid in emergency incidents involving hazardous materials. an equilateral diamond-shaped area, divided into 4 equal sections, coloured blue, red, yellow, and white, indicating the hazard level on a scale of 0 to 4, indicating procedures and precautions defines a printed instruction (see Figure 2.5).

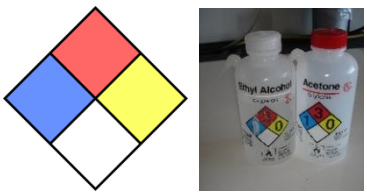



**Figure 2.5. Fire diamond - containers marked with "fire diamond" and safety indicator**

In this case, the blue colour indicates a health hazard, the red colour - a fire hazard, the yellow colour - chemical stability and the white colour for special codes for various hazards. The first three categories are rated on a scale from 0 (stable substance, safe) to 4 (lethal dangerous) (see Table 2.3).

**Table 2.3. Hazard class norms according to international standards**

| Hazardous to health (blue colour) | |
|---|---|
| 4 | Causes death or serious injury with a very short exposure (e.g., cyanide acid, tetraethyl lead, phosphine) |

| | |
|---|---|
| 3 | Short-term exposure may cause serious temporary, moderate-duration complications (e.g., potassium hydroxide, chlorine, sulfuric acid) |
| 2 | There is a possibility of temporary incapacitation or other complicating injuries as a result of non-chronic intensive or prolonged exposure (eg, ethanol, diethyl ether, chloroform). |
| 1 | Has minimal complicating damage-causing effects (e.g., benzophenone, acetone) |
| 0 | Safe for health, no precautions required (eg, lanolin, baking soda) |

| Flammable (red) | |
|---|---|
| 4 | Evaporates completely at normal atmospheric pressure and temperature or readily disperses and ignites in air (e.g. pentanes, acetylene, propane) Flash point <23 °C (73 °F) |
| 3 | Flammable liquids and solids at ambient temperatures. The flash point is between 23 °C (73 °F) and 38 °C (100 °F). (egbutanol-1,benzene,acetone) |
| 2 | It ignites as a result of slight heating or relatively high air temperature (for example, phenol, diesel fuel). Flash point between 38 °C (100 °F) and 93 °C (200 °F) |
| 1 | Must be heated to ignite (e.g. soybean oil). Flash point >93 °C (200 °F) |
| 0 | A non-flammable substance (eg water) |

| Instability/susceptibility to reaction (yellow) | |
|---|---|
| 4 | May detonate or explode at normal pressures and temperatures (e.g.nitroglycerin,start-butyllithium, hexogen) |
| 3 | As a result of external exposure, it may detonate or explode when heated in a closed place, explode with water or detonate when strongly struck. (eg potassium perchlorate, ammonium nitrate) |
| 2 | Undergoes serious chemical changes at high temperature and pressure, reacts violently with water or forms an explosive mixture (mg phosphorus, potassium, sodium) |
| 1 | Normally stable, but may become unstable at high temperature and pressure (e.g.hydrogen peroxide, sodium-hydrocarbonate) |
| 0 | Stable to open flame and unaffected by water (e.g. argon, helium) |

***White colour is special.***

White is a "special character" field and can be marked with different characters:

~~W~~: interacts with water in an unusual or dangerous manner (e.g. feel, sodium, rubidium)

OKili OXY: oxidizer (e.g. potassium perchlorate, ammonium nitrate)

SA: suffocating gas (does not aid breathing, non-toxic) (nitrogen, helium, neon, argon, krypton, xenon)

***Non-standard characters.***

*Note:* These are symbols not part of the NFPA 704 standard, but are sometimes used informally. The use of unofficial symbols may be required, permitted, or prohibited by competent authorities (such as regulators).

COR: Engraver (visual *Corrosive*); strong acid or alkali (e.g. sulfuric acid, potassium hydroxide

ACID(visual *Acid*- acid) i ALK (visual *Alkali*– alkali)

☣ / BIO: Biological hazard(eg smallpox virus)

☠ / POI/TOX: (visual *Poison*):Toxic(eg, bee venom, tetraethyl lead, barium chloride, thallium sulfate, potassium cyanide, cadmium acetate, nicotine)

☢(radiation triangle) or RA/RAD:Radioactive(eg plutonium, uranium, polonium hydride, potassium diuranate)

**CRY**or CRYO (visual *Cryogenic*): Lower temperature (e.g. liquid nitrogen)

***Determination of the average mortality rate of biologically active food additives after oral administration into the stomach***.

An experiment to determine the acute toxicity of "BIODARMON", "BIOCHOY" and "BIOMO'JIZA" biologically active food additives, that is, the average lethal dose (LD50), was conducted in white rats. The initial weight of the animals was 160-210 g.

Doses of 2000, 3000, 4000 and 5000 mg/kg of biologically active food additives in the form of tablets were injected into the stomach of white rats through an iron gavage once, and the animals were monitored for 21 days. The occurrence of symptoms of poisoning and the occurrence of death in animals were taken as the effect criteria of biologically active food additives.

According to the results of the experiment, during the control period, no changes were observed in the studied parameters of the animals, i.e. in their behavior, appearance, and attitude to food, and water, at the tested doses of biologically active food additives. and the state of death did not occur. Only the

highest dose of 5000 mg/kg was presented in the table from the studied dose of each bioactive food additive tested (see Table 2.4).

**Table 2.4. Results of the observation of the lethality of biologically active food additives at a dose of 5000 mg/kg in the stomach of animals**

| Name of biologically active food additive | Dose, mg/kg | Days of observation and the ratio of total animals to the number of dead animals | | | | | | | | Total number of dead animals |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1-day | 2-day | 3-day | 4-day | 5-day | b-day | 14-day | 21-day | |
| "BIODARMON" | 5000 | 6/0 | 6/0 | 6/0 | 6/0 | 6/0 | 6/0 | 6/0 | 6/0 | 0 |
| "BIOCHOY" | 5000 | 6/0 | 6/0 | 6/0 | 6/0 | 6/0 | 6/0 | 6/0 | 6/0 | 0 |
| "BIOMIRACLE" | 5000 | 6/0 | 6/0 | 6/0 | 6/0 | 6/0 | 6/0 | 6/0 | 6/0 | 0 |

*Summary:* The average lethal dose of "BIODARMON", "BIOCHOY" and "BIOMO'JIZA" biologically active food additives in a single injection into the stomach of a white rat is higher than 5000 mg/kg, and they are According to the state standard (GOST 12.1.007-76), it belongs to the class 4 substances with low risk.

***Results of the study of the local effect of biologically active food additives on the skin***

Guinea pigs weighing 320-360 g were selected to study the local effect of biologically active food additives "BIODARMON", "BIOCHOY" and "BIOMO'JIZA" on the skin.

First, the right and left flanks of the animals were cleaned of wool with the help of electric scissors in the size of 5x5 cm. The skin of their deboned right calf was treated with 20 mg/cm2 of the test food additive samples in their native state separately and left for 4 hours, and the left calf served as a control for comparison. After the specified time, the skin surface was washed with warm water and wiped dry.

As a criterion for the effect of biologically active food additives, attention was paid to the symptoms of redness and swelling that may occur on the skin, and their level of manifestation was evaluated in points.

Redness was determined visually, and swelling was determined by measuring skin thickness with an electronic micrometre. The observation period lasted 14 days.

The results of the experiment showed that "BIODARMON", "BIOCHOY" and "BIOMOJIZA" biologically active food supplements did not cause skin redness and swelling symptoms in the tested dose during the experimental period (see Table 2.5).

**Table 2.5. Redness and oedema level (in points) on the skin of guinea pigs under the influence of biologically active food additives**

| Name of biologically active food additive | Observed indicators | Tracking time and score | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Background | 4 hours | 1-day | 2-day | 3-day | 4-day | 5-day | b-day | 7-day | 10-day | 14-day |
| "BIODARMON" | redness | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | swelling | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| "BIOCHOY" | redness | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | swelling | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| "BIOMIRACLE" | redness | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | swelling | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*Summary:* Biologically active food additives "BIODARMON", "BIOCHOY" and "BIOMO'JIZA" did not cause local changes (redness 0 points, oedema 0 points) after a single exposure to the skin, and according to a special classification, they are inflammatory on the skin. belongs to the category of substances that do not cause exposure, that is, they do not cause local changes on the skin.

***Absorption of biologically active food additives into the body through sweat***

Skin absorption of biologically active food additives "BIODARMON", "BIOCHOY" and "BIOMO'JIZA" was also studied in guinea pigs.

During the observation period, indicators such as animal behaviour, changes in food and water needs, changes in appearance, urine colour, increased

eye discharge, heart rate, and respiratory rate were used as an effect criterion. received.

The results of the experiment show that the tested biologically active food additives did not cause changes in all the tested indicators in the experimental animals, and their behaviour did not differ from that of the animals of the control group.

*Summary:* "BIODARMON", "BIOCHOY" and "BIOMOJIZA" biologically active food additives are not absorbed into the body through the skin, no negative changes were observed, and they do not have absorption properties.

***Effects of biologically active food additives on the mucous membrane and cornea of the eye***

The effect of biologically active food additives "BIODARMON", "BIOCHOY" and "BIOMO'JIZA" on the mucous membrane and cornea of the eye was studied in 3 rabbits in each group.

2 drops of the solution were instilled into the conjunctival sac of the right eye of the animals separately, the tear-nasal canal was pressed with a finger for one minute, and the left eye served as a control (only 2 drops of water were instilled into it). The observation period lasted 14 days.

The obtained results show that the studied biologically active food additives "BIODARMON", "BIOCHOY" and "BIOMO'JIZA" contribute to the increase of discharge in the conjunctiva, eyelid, and eye of animals. and did not cause changes in the cornea (clouding of the cornea, the appearance of a damaged area on the cornea) (see Table 2.6).

**Table 2.6. Results of the evaluation of the effect of tested food additives on the mucous membrane of the eye and the cornea**

| Name of biologically active food additive | Observed indicators | Tracking time and score | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Background | 4 hours | 1-day | 2-day | 3-day | 4-day | 5-day | b-day | 7-day | 10-day | 14-day |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| "BIODARMON" | Redness of the conjunctiva | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Pancreatic swelling | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Eye separation | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Frostbite | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | The affected area of the cornea | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| "BIOCHOY" | Redness of the conjunctiva | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Pancreatic swelling | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Eye separation | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Frostbite | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | The affected area of the cornea | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| "BIOMIRACLE" | Redness of the conjunctiva | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Pancreatic swelling | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Eye separation | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Frostbite | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | The affected area of the cornea | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*Summary:* Biologically active food additives "BIODARMON", "BIOCHOY" and "BIOMO'JIZA" belong to the substances that do not damage the eye (mucous membrane and cornea) according to the level of local effect.

***Study of the cumulative nature of biologically active food additives***

Summarizing the accumulation (cumulative property) of biologically active food additives "BIODARMON", "BIOCHOY" and "BIOMOJIZA" in the body, according to its average lethality when administered to animals through the stomach the results of the experiment were used because, in the study of this property, the determined average lethal dose of the substance or the average hour of death is considered as the initial starting point. The fact that the highest tested dose of 5000 mg/kg in white rats in a previous acute gastric experiment did not cause animal death allowed us to calculate their mean lethal dose and mean time to death. did not give Therefore, the results of this experiment indicate that the tested biologically active food additives do not accumulate in the body.

*Summary:* Biologically active food additives "BIODARMON", "BIOCHOY" and "BIOMOJIZA" belong to the class of substances with functional cumulative properties.

***Study of allergenic properties of biologically active food additives***

"BIODARMON", "BIOCHOY" and "BIOMOJIZA" biologically active food additives allergenicity features tested in guinea pigs. For the experiment, each group consisted of 3 (3 groups in total), weighing 340-370 g. animals were selected. First, 0.02 ml of a 1:500 (20 μg) suspension of each of the studied biological food supplements dissolved in physiological solution was injected under the skin of the outer ear of the animals, using a tuberculin syringe, separately. Animals in the control group received the same amount of saline only. After 12 days, the skin surface of the experimental animal's right thigh, cleaned of wool, was cut with a scarifier 1-1.5 cm long, and an amount twice as large as the initial sensitization test dose (40 μg) was instilled, and a specially adapted scale ( model) was evaluated using

The results of the experiment showed that the effect of the samples instilled on the skin and the affected area with biologically active food additives was the same as that of the control animals, and no redness or other changes were observed on the skin.

*Summary:* "BIODARMON", "BIOCHOY" and "BIOMOJIZA" biologically active food supplements do not have allergenic properties.

***Pathomorphological examinations***

At the end of the toxicological experiments conducted on animals for the tests of biologically active food additives "BIODARMON", "BIOCHOY" and "BIOMOJIZA", the animals were dissected, and the main focus was on internal organs - the heart focused on changes in pka, liver, kidney, stomach, spleen, intestines.

According to the inspection results, the colour, size, weight, and location of the internal organs of the experimental animals did not differ from those of the control animals.

*Summary:* No visible changes in internal organs were observed under the influence of "BIODARMON", "BIOCHOY" and "BIOMOJIZA" biologically active food additives.

***General conclusions on toxicological investigations***

The average lethal dose of biologically active food additives "BIODARMON", "BIOCHOY" and "BIOMO'JIZA" in the stomach of white rats is higher than 5000 mg/kg, and according to this indicator, according to the state standard (GOST 12.1.007-76), it belongs to the substances of the 4th class with low danger.

When bioactive food supplements "BIODARMON", "BIOCHOY" and "BIOMO'JIZA" are exposed to the skin once, the total sum of points of local changes (redness - 0 and swelling - 0) is equal to 0, according to a special classification, it belongs to substances that do not cause local effects (inflammation) on the skin;

"BIODARMON", "BIOCHOY" and "BIOMO'JIZA" biologically active food supplements are not absorbed into the body through the skin, that is, they do not have absorption properties;

"BIODARMON", "BIOCHOY" and "BIOMO'JIZA" biologically active food supplements do not cause damage to the eye due to local effects on the mucous membrane and cornea;

Biologically active food additives "BIODARMON", "BIOCHOY" and "BIOMOJIZA" belong to the class of substances with a functional cumulative feature;

"BIODARMON", "BIOCHOY" and "BIOMOJIZA" biologically active food supplements do not cause allergies in animals;

Biologically active food additives "BIODARMON", "BIOCHOY" and "BIOMOJIZA" do not cause pathomorphological changes in internal organs when they are exposed to the animal body once.

**Conclusions on Chapter II**

Made from amaranth, mint, chamomile flowers and leaves, "BIOCHOY" balances the body's metabolism. It has a calming effect on nervous tissue. Cardiac cells have a positive inotropic effect on cardiomyocytes. Increases the regeneration properties of liver cells - hepatocytes and epithelial cells. Actively affects the process of angiogenesis and blocks the growth of new blood vessels in atypical cells. Taking part in oxidation and reduction reactions in the body, excess cholesterol increases the oxidation process.

"BIODARMON" capsule, made from amaranth seed powder, mint, safflower leaves and flowers, is a source of biologically active substances and micronutrients, improves the functioning of the central nervous system, and helps saturate the blood with oxygen. It normalizes the activity of the gastrointestinal tract, improves appetite, improves digestion, has a good effect on the liver and gall bladder, and reduces flatulence and spasms.

"BIOMOJIZA" biologically active food supplement, prepared on the basis of amaranth and sunflower oil, with the addition of vitamin D3, helps to saturate

the blood with oxygen and has a positive effect on the central nervous system as a source of biologically active substances and micronutrients. secretes, the squalene contained in the oil stops the development of cancer cells, rejuvenates the body, strengthens the immune system, restores the hormonal system of the organs, and at the same time increases the length of a healthy life (see Figure 2.6).

In general, these biologically active food supplements relieve fatigue, relieve headaches, increase tone, increase immunity, restore the natural colour of hair, have a rejuvenating effect on the body, and treat impotence and frigidity. will help.

Biologically active food additives "BIODARMON", "BIOCHOY" and "BIOMO'JIZA" according to the average lethal dose (LD50 per os >5000 mg/kg), state standard GOCT 12.1 According to .007, belong to substances of the 4th class with low risk, they do not have a negative effect on the skin, eyes, have functional cumulative properties and do not cause allergies in animals.

Therefore, from the toxicological point of view, biologically active food additives "BIODARMON", "BIOCHOY" and "BIOMOJIZA" can be produced and used appropriately.


**Figure 2.6. New biologically active food additives based on amaranth**

## CHAPTER III. DEVELOPMENT OF NEW BIOACTIVE FOOD ADDITIVES AND DEVELOPMENT OF STANDARDS TO ENSURE THE STATUS OF THE GOODS.

### § 3.1. Brand indicators of new biologically active food additives

New biologically active food additives are produced in the following range:

- "BIODARMON" in the form of tablets, capsules and powder;
- "BIOCHOY" in the form of tablets, capsules and powder;
- "BIOMIJIZA" in the form of oil.

The new group of biologically active food additives must meet the requirements of the organization's standard, and be produced according to technological instructions and recipes in compliance with the sanitary norms and rules approved in the prescribed manner [119-123].

**Requirements for raw materials and materials.**

Raw materials of plant species of the flora of Uzbekistan and materials used for the production of biologically active food additives must be allowed to be used by the Ministry of Health of the Republic of Uzbekistan. The use of raw materials and materials is carried out in accordance with the control of GOST 24297 [124].

The following raw materials and materials are used for the production of food additives:

- amaranth seeds – Amaranthus c. L– according to GOST 24027.0-80 or certificate of conformity [125];
- amaranth leaves, and flowers - in accordance with current regulatory documents;
- chamomile – Matricaria chamomilla L. – GOST 2237, FS 42 Uz-0259 or certificate of conformity [126];
- peppermint – Mentha piperita L. – certificate of conformity according to GOST 23768, FS 42 Uz-0263 or [127];

- safflower leaves and flowers Carthamus tinctorius L. – according to GOST 12096 or certificate of conformity;
- sunflower oil – Helianthus annuus L. – according to GOST 1129 [128];
- D3 – in accordance with applicable regulations or a certificate of conformity.

**Supporting materials.**

- calcium stearate in accordance with applicable regulatory documents or a certificate of conformity;
- magnesium stearate in accordance with applicable regulations or a certificate of conformity;
- microcrystalline cellulose purified according to the applicable regulatory documents or imported according to the certificate of conformity;
- White sugar according to GOST 3 1361 or GOST 31895 [129];
- potato starch according to GOST 7699;
- maltodextrin according to the current regulatory documents or according to the certificate of conformity;
- natural food extracts or flavourings imported according to GOST 32049 or according to a certificate of conformity [130];
- purified water according to the certificate of conformity;
- Drinking water according to own DST 950 [131].
- Citric acid according to GOST 908 or according to the certificate of conformity [132];
- sodium citrate according to the current regulatory documents or according to the certificate of conformity;
- imported potassium sorbate according to the certificate of conformity;
- Rectified ethyl alcohol from food raw materials according to own DST 3115 [133];

- gelatin capsules according to the current regulatory documents or according to the certificate of conformity;
- product packaging materials must meet the requirements of approved standards.
- Residues of toxic elements and microbiological indicators exceeding the maximum allowed by SanQM 0283 are not allowed to produce raw materials [134].

**Packaging.**

Food additives in the form of oil are filled in various types of screw-thread vials or glass, PET bottles with a capacity of 10.0 ml to 500.0 ml in accordance with current regulations.

The Ministry of Health of the Republic of Uzbekistan allows the use of other containers for this product.

Bottles and vials containing a biologically active food additive should be tightly closed and should not leak from the mouth of the container when turned.

According to GOST 7933, and GOST 33781 instructions packing in cardboard boxes is allowed. The gross weight of the shipping container must not exceed 10 kg.

BAA in the form of powder/granules weighing from 1.0 g to 200.0 g in cardboard boxes according to GOST 7933 or in a box weighing from 0.5 g to 10.0 g 1 to 100 units per carton in single-use sachets or imported paper bags for sachets [135].

Biologically active food additives with a net weight of 1.0 g to 500.0 g are placed in polyethene film approved for placing food products according to GOST 10354 [136] or cellophane according to GOST 7730 release in film bags is allowed [137].

For glueing packages and paper bags, it is necessary to use an imported polyvinyl acetate dispersion according to GOST 18992 [138] or according to a certificate of conformity. Plastic bags must be sealed by Thermo welding, and

single-use bags must be sealed by heat treatment. It is allowed to use self-adhesive stickers for boxes.

Biologically active food supplements in the form of capsules/tablets weighing from 300.0 mg to 1000.0 mg, polyvinyl chloride film and varnished aluminium printed foil (blister), approved for use by the Ministry of Health of the Republic of Uzbekistan. from 1 to 30 units in contour-cell packaging made of or from 10 to 140 units in vials made of polymer materials in accordance with current regulatory documents. Blisters and vials from 1 to 4 units are placed in cardboard boxes prepared according to GOST 7933, and GOST 33781 [139].

Packages, packages, and vials (glass containers) are placed in corrugated cardboard boxes imported according to the certificate of conformity or prepared according to GOST 13511 [140]. Boxes are sealed with paper adhesive tape according to GOST 18251 [141] or with imported adhesive tape according to the certificate of conformity.

Negative deviations from the permissible mass for packaged goods should be in accordance with the requirements of Own DST 8.022 [142].

Product packaging must meet the requirements of UzTR 476-021 [143].

**Labeling.**

Each packaging unit - consumer unit must be marked with an adhesive paper label made of label paper according to GOST 7625 [144] or writing paper according to GOST 18510 [145], and it must contain the following specified:

- the name of the manufacturer, its trademark (if any), address (legal and real) and telephone number;
- product name;
- composition;
- release form;
- instructions for use;
- information about contraindications;
- volume, ml (for fats);
- net weight (tablets, capsules, powders), g;

- quantity in a package, pieces;
- production date (day, month, year);
- expiration date (month, year);
- inscription: "BFQ for food, not medicine";
- storage conditions;
- organization standard;
- certification information;
- barcode with registration number (if necessary);
- "Made in Uzbekistan" or "Proizvedeno v Uzbekistane" for the domestic market, "Made in Uzbekistan" for export

If it is not possible to place all the necessary information on the packaging unit, it is allowed to include the missing information on the packaging sheet (abstract, instructions for use).

Each shipment is labelled according to GOST 14192 "Fragile. With care!" (for glass containers), marked with cautionary signs such as "Keep away from sunlight", and "Protect from moisture" [146].

For each unit of the transport container loaded with packed products, one edge of the box is marked with a stamp, stencil, and label containing the following information:

- manufacturer's name, form of ownership, trademark (if any), address (legal and real), telephone number;
- product name;
- number of packaging units, and pieces;
- net weight, kg;
- production date (day, month, year);
- storage conditions;
- expiration date (year);
- certification information;
- organization standard;

- "Made in Uzbekistan" or "Proizvedeno v Uzbekistane" for the domestic market, and "Made in Uzbekistan" for export.

The product label must comply with the requirements of UzTR 490-022 [147].

According to organoleptic indicators, BAA should meet the requirements shown in Table 3.1 [148].

**Table 3.1. Organoleptic indicators of biologically active food additives of the new group**

| Indicators | Description | | | |
|---|---|---|---|---|
| Release form | powder/ /granule | Tablets | Capsules | Oil |
| Appearance | Crushed | Round or other shape. With/or without company embossing on one side | Hard cylindrical gelatin capsules filled with smooth, undamaged surface, crushed mass | The same transparent liquid. A SLIGHT blur is allowed |
| Colour | Light green to green | Depending on the colour of the components | | Light yellow to brown |
| Smell and taste | Weak aroma, slightly bitter, bitter, foreign taste and odour composition of plants | | | |

According to physicochemical parameters, BAA in the form of granules/powder should meet the standards shown in Table 3.2 [149-157].

**Table 3.2. Physico-chemical parameters of the new group of biologically active food additives (granules/powders)**

| Indicators | The norm |
|---|---|
| Moisture, %, not more | 10.0 |
| The amount of extractive substances, based on the absolute dry mass of raw materials, is not less than % | 20.0 |
| The mass area (fineness) of the large fraction, %, no more | 5.0 |
| Mass fraction of metal-magnetic mixture | not allowed |
| The composition of foreign additives:<br>- mineral (soil, sand), %, no more<br>- organic (parts of other non-toxic plants), not more than %; | 0.1<br>0.1 |
| The mass fraction of browned parts of raw materials is not more than .% | 4.0 |
| The presence of mould and rot | not allowed |
| Presence of poisonous plants and their parts | not allowed |
| Infestation by warehouse pests | not allowed |
| The average weight of powder/granules in one package, g | From 0.5 to 200 |

According to physico-chemical indicators, BAA in the form of tablets/capsules must meet the requirements shown in Table 3.3.

**Table 3.3. Physico-chemical parameters of a new group of biologically active food additives (tablet/capsule)**

| Indicators | The norm |
|---|---|
| The average weight of tablets/capsules, g | 0.3-1.0+ 15% |
| Mass percentage of moisture, %, not more | 9.0 |
| Breakdown, min., no more | 30 |

In terms of physicochemical and safety indicators, BAA should meet the requirements shown in Table 3.4 [158-173].

**Table 3.4. Physicochemical parameters and safety indicators of a new group of biologically active food additives**

| Indicators | The norm |
|---|---|
| Acid number, mg KOH, no more | 2.25 |
| Mass percentage of moisture and volatile substances, %, no more | 0.15 |
| Mass fraction of non-fatty compounds | no |
| Peroxide number of active oxygen, mmol/kg | 10 |
| Mass fraction of unsaponifiable matter, %, not more | 0.5 |
| Toxic elements, mg/kg, not much: | |
| - lead | 0.1 |
| - arsenic | 0. l |
| - cadmium | 0.05 |
| - Mercury | 0.03 |
| - iron | 5.0 |
| - copper | 0.5 |
| - zinc | 5.0 |
| Mycotoxins: aflatoxin Bi, mg/kg, no more | 0.005 |
| Pesticides: | |
| - hexachlorocyclohexane (α-, β-, γ-isomers), not more than mg/kg | 0.05 |
| -DDT and its metabolites, mg/kg, no more | 0.1 |
| Cesium-137 Bq/kg | 60 |
| Strontium-90 Bk/kg | 80 |

The composition of toxic elements, the residual amount of pesticides, radionuclides and microbiological indicators must be in accordance with the requirements specified in SanQM 0283. Determination of the content of pesticides and mycotoxins is carried out according to the methods approved by the Ministry of Health.

Control methods of UAE in the form of oil, powder/granules, and capsules/tablets are carried out in accordance with the regulatory and technical documents in the form of DSt, DF, and GOST. The quality of the packaging and the correctness of the label are checked visually. It is also allowed to use other control methods approved in the prescribed manner, which are not specified in the organization's standard and provide reliable test results.

## § 3.2 Technological guidelines for the production of new biologically active food additives

This technological instruction applies to the production process - a new group of biologically active food additives obtained from plant sources and trace elements, used as an additional source of biologically active substances.

The new group of biologically active food supplements is available in the following range: "BIODARMON" in the form of tablets, capsules and powder; "BIOCHOY" in the form of tablets, capsules and powder; "BIOMOJIZA" is produced in the form of oil.

Biologically active food additives must be biologically produced in accordance with the requirements of the TSh 26821898-001:2018 standard, in accordance with the sanitary standards and regulations of SanQM No. 033816, according to these technological instructions and recipes [119-123, 175].

***Recipes for the preparation of a new group of biologically active food additives***

**Table 3.5. "BIOCHOY" biologically active food additive (tablets/capsules and powder)**

| Composition | The ratio of g to 10 g of the finished product (powder). | mg ratio of 500 mg finished product (for 1 capsule/tablet) |
|---|---|---|
| Amaranth leaf | 2.5 | 100 |
| Amaranth flowers | 2.5 | 100 |
| Chamomile | 2.5 | 100 |

| | | |
|---|---|---|
| Mint | 2.5 | 100 |
| Assistant: | | |
| Sugar | - | 70 |
| Starch | - | 25 |
| Calcium stearate | - | 5 |

Active substances: vitamins A, C, B1, B2, B5, B6, B9, K, PP; calcium, magnesium, zinc, selenium, copper and manganese, iron, phosphorus, sodium minerals and plant fibre; amino acids leucine-0.195 g, isoleucine-0.119 g, valine-0.137 g; ascorbic acid (120 mg), proteins (2.46 g), fats (0.33 g) and carbohydrates (4.02 g).

**Table 3.6. "BIODARMON" biologically active food supplement (in the form of tablets/capsules and powder)**

| Composition | The ratio of g to 60 g of the finished product (powder). | mg ratio of 500 mg finished product (for 1 capsule tablet) |
|---|---|---|
| Amaranth seeds | 57.0 | 230 |
| Safflower leaves | 2.0 | 70 |
| Safflower flowers | 0.5 | 50 |
| Mint | 0.5 | 50 |
| Assistant: | | |
| Sugar | - | 70 |
| Starch | - | 25 |
| calcium stearate | - | 5 |

Active substances: antioxidants (vitamin E and C); B group vitamins, D folic acid, pantothenic acid, etc.; zinc, phosphorus, calcium, potassium, magnesium, manganese, iron, sodium and other minerals; pectins, natural fibres, squalene, phospholipids; amino acids lysine, tryptophan, arginine, methionine and phenylalanine.

**Table 3.7. "BIOMOJIZA" biologically active food supplement (oil form)**

| Content | 25.0 ml compared to the finished product, in ml |
|---|---|
| Amaranth seed oil | 20.0 |

| | |
|---|---|
| Sunflower seed oil | 5.0 |
| Vitamin D3 | 5 μg |

Active ingredients: omega-3, omega-6, omega-9, as well as palmitic and stearic acid; vitamins B1, B2, B3 (PP), B4, B5, D, E (choline), P; calcium, potassium, iron, sodium, magnesium, copper, zinc, phosphorus macro- and microelements; serotonin, lysine biogenic amines; phospholipids and squalene - up to 8%.

*Properties of raw materials and materials.*

Raw materials used for the production of biologically active additives to food products must be approved for use by the Ministry of Health of the Republic of Uzbekistan. The use of raw materials and materials is carried out in accordance with the control of GOST 24297.

The following raw materials and materials are used for the production of food additives:

- amaranth seeds – Amaranthus h. L. – according to GOST 28636 or certificate of conformity [154];
- amaranth leaves, and flowers - in accordance with current regulatory documents;
- chamomile – Matricaria chamomilla L. GOST 2237, FS 42 Uz-0259 or certificate of conformity [126];
- Peppermint – Mentha piperita L. Certificate of conformity according to GOST 23768, FS 42 Uz-0263 or [127];
- safflower leaves and flowers Carthamus tinctorius L. – according to GOST 12096 or certificate of conformity;
- sunflower oil – Helianthus annuus L. – according to GOST 1129 [128];
- D3 - in accordance with applicable regulations or a certificate of conformity.

*Supporting materials.*

- calcium stearate in accordance with applicable regulatory documents or a certificate of conformity;
- magnesium stearate in accordance with applicable regulations or a certificate of conformity;
- microcrystalline cellulose purified according to the applicable regulatory documents or imported according to the certificate of conformity;
- White sugar according to GOST 31361 or GOST 31895 [129];
- potato starch according to GOST 7699;
- maltodextrin according to the current regulatory documents or according to the certificate of conformity;
- natural food extracts or flavourings imported according to GOST 32049 or according to a certificate of conformity [130];
- purified water according to the certificate of conformity;
- Drinking water according to own DST 950 [131].
- Citric acid according to GOST 908 or according to the certificate of conformity [132];
- sodium citrate according to the current regulatory documents or according to the certificate of conformity;
- imported potassium sorbate according to the certificate of conformity;
- Ethyl alcohol rectified from food raw materials according to its DST 3115 [133];
- gelatin capsules according to the current regulatory documents or according to the certificate of conformity;
- product packaging materials must meet the requirements of approved standards.
- Residues of toxic elements and microbiological indicators exceeding the maximum allowed by SanQM 0283 are not allowed to produce raw materials [134].

*Standards of consumption of raw materials*

The consumption of raw materials and basic materials per 1000 packages is calculated according to the attached recipe. For 1000 packages of food additives, the loss rate will not exceed 5.5% of the raw material content.

1 packet of powder/granules, 1 capsule or 100 ml of oil, 1 tablet production auxiliary materials, consumption of detergents and disinfectants, inventory for washing equipment, packaging materials and containers are accounted for at actual costs.

*Description of the technological process*

Preparation of production buildings, raw materials and technological equipment for production in accordance with SanQM 0338-16 "Hygienic requirements for the production and circulation of biologically active food additives".

The technological process of production of powder, tablets/capsules includes the following stages:

***Technological process of powder production***

*Weighing in.* The calculated amount of ingredients and components necessary for the production of biologically active additive powder for food is weighed.

*Grinding plant components*

*Elash.*The measured components are sieved on a sieve with a diameter of 0.5 mm.

*Preparation of homogenized mixture.*

The components are loaded into the mixer and thoroughly mixed for 20 minutes until uniform. The mixture is submitted to the same mixture analysis. After receiving a positive analysis for uniform mixing of the mixture, the powders mixed with anchor and high-speed mixers are lowered through the discharge hatch and distributed to the plastic in a uniform thickness.

The appearance of the initial portions of the powders is evaluated, and the average weight and the uniformity of the dosage are determined.

Evaluation of the appearance of the powder is carried out by examining 20 g of powder with the naked eye.

The average weight of one package is determined by weighing every 15 minutes during production, and the average weight should be between 0.5 g ± 15.0% and 200 g ± 15.0%.

The weight of one package varies from 0.5 g ± 15.0% to 200 g ± 5.0%.

If the powders do not meet the weight requirements, then the packing machine will be adjusted.

Losses during preparation are 5.5%.

High-quality powders are collected in a container, tightly closed, weighed, and marked with the name of the drug, batch number, gross weight, net weight, date of manufacture, and the name of the person responsible for weighing. the label is attached.

***Technological process of tablets/capsules production.***

*Weighing in.* The calculated amount of ingredients required for the production of biologically active food supplement tablets or capsules is weighed.

Elash. The measured components are sieved on a sieve with a diameter of 0.5 mm.

Preparation of homogenized mixture.

A ≈5% solution of the homogenized mixture (5% starch paste) is prepared in a V-50l container.

Taking the mixture for tableting or encapsulation

Dry mixing, wetting and granulation.

The components and auxiliary substances are loaded into the mixer-granulator, and the mixture is thoroughly mixed for 20 minutes until it is uniformly mixed. The mixture is sent to the same mixing analysis. After receiving a positive analysis for uniform mixing, the required amount of homogenized mass (moisture: ethyl alcohol 70%, starch paste) is taken in small portions from the anchor and high-speed mixers, and the granulation process is

carried out. The process is carried out until the granules are formed in the required size and have the same colour.

The obtained granules are lowered through the discharge hatch and distributed to the plastic in the same thickness.

*Granulate drying.* Wet pellets are provided for drying. Granules are dried in an oven at a temperature of 55-60 °C for 3-5 hours. The moisture content of the dried granules should be between 2 and 5%. During drying, the granules should be mixed by hand from time to time to ensure uniform drying.

*Preparation of granules.* Dry granules are passed through a 2.0 mm sieve. Unsieved large granules are crushed in a grinder and sieved again. The screened granules are collected in a dry granule collector and transferred to the granule dedusting stage.

*Dusting of dry granules.*

Granules and magnesium stearate or calcium stearate sieved with a diameter of 0.5 mm are put into the mixer. Spin for 3-5 minutes to remove dust (6 rpm). After the dust removal process is completed, the pellets are placed in a collector with a label indicating the name of the product, batch number, net weight, date of manufacture, and the full name of the operator responsible for weighing. A quality control laboratory inspector takes a sample of the granules for analysis in order to quantify uniformity and active ingredients.

After receiving a positive result from the analysis, the granules move to the pressing or encapsulation stage.

*Tabletting.* The pelletization of granules is carried out in a percussive tabletting machine. Depending on the recipe and the average weight, punches and moulds with a diameter of 9-15 mm are used.

The dust-free granules are put into the tablet press hopper, and the gap between the punches in the moulds, the tablet pressing pressure and the weight of the tablets are adjusted.

The appearance of the initial tablets is evaluated, and the average weight, and the uniformity of the dosage are determined.

The appearance of the tablets is evaluated based on the naked eye examination of 20 tablets. Tablets should not be broken. They should have full edges without creases.

The average weight of the tablets is determined by weighing 20 tablets every 15 minutes during the production process, and the average weight should be between 0.3 g ± 15.0% and 1.0 g ± 15.0%.

Tablet weight ranges from 0.3 g ± 15.0% to 1.0 g ± 15.0%.

If the tablets do not meet the weight and hardness requirements, then the tabletting machine is adjusted.

Loss during tableting is 5.5%.

High-quality tablets are collected in a collector, weighed, and tightly closed, the name of the drug, batch number, gross weight, net weight, date of manufacture, and name of the person responsible for weighing are indicated. the label is attached. Defective tablets are collected in a collector, and weighed, a label with the name of the drug, batch number, net weight, date of manufacture, and full name of the person responsible for weighing is attached and sent for processing. , where it is crushed and added to the next series in size of up to 15%, as indicated in the technological documents with a mandatory sign.

*Encapsulation*. The encapsulation process is carried out according to the instructions.

Initial capsules are evaluated by their appearance, average weight, and uniformity of dosage.

The average weight of the capsules is determined by weighing 20 capsules every 15 minutes during the production process and should be 0.3 g ± 15% of the average weight of the capsules.

Permissible deviations from the net weight should not exceed ± 15%.

Capsule loss is 5.5%.

High-quality capsules are collected in a stacker, tightly closed, weighed, and marked with the name of the drug, batch number, gross weight, net weight,

date of manufacture, and the name of the person responsible for weighing. the label is attached.

Defective capsules are collected in a collector, weighed, labelled with the name of the drug, batch number, net weight, date of manufacture, and full name of the person responsible for weighing, and sent for processing. , where it is crushed, separated, granules and capsule material are separated, and granules are added to the next series in the size of up to 10%, as indicated in the technological documents with a mandatory sign.

*Packaging.*

Product packaging is carried out using packaging equipment. Before starting work, you should check the following:

- Cleanliness of the workplace;
- Absence of foreign objects in the workplace;
- Cleanliness of packaging equipment;
- Correctness and accuracy of scales;
- Operation of thermal sealing equipment;
- Wearing a cotton-gauze mask or dust respirator.
- Packaging of products is done on tables. Packing is done by hand.

The master controls the sequence of operations and the quality of packaging and labelling. The packaging must be intact, and the amount of products received for packaging, labelling and packaging is recorded by the master in the loading and unloading log.

Food additives in the form of oil are filled in various types of screw-thread vials or glass, PET bottles with a capacity of 10.0 ml to 500.0 ml in accordance with current regulations.

The Ministry of Health of the Republic of Uzbekistan allows the use of other containers for this product.

Bottles and vials containing a biologically active food additive should be tightly closed and should not leak from the mouth of the container when turned.

According to GOST 7933, and GOST 33781 instructions spacking in cardboard boxes is allowed. The gross weight of the shipping container must not exceed 10 kg.

BAA in the form of powder/granules weighing from 1.0 g to 200.0 g in cardboard boxes according to GOST 7933 or in a box weighing from 0.5 g to 10.0 g 1 to 100 units per carton in single-use sachets or imported paper bags for sachets [135].

Biologically active food additives with a net weight of 1.0 g to 500.0 g are placed in polyethene film approved for placing food products according to GOST 10354 [136] or cellophane according to GOST 7730 it is allowed to be issued in bags made of film.

For glueing packages and paper bags, it is necessary to use an imported polyvinyl acetate dispersion according to GOST 18992 [138] or according to a certificate of conformity. Plastic bags must be sealed by Thermo welding, and single-use bags must be sealed by heat treatment. It is allowed to use self-adhesive stickers for boxes.

Biologically active food supplements in the form of capsules/tablets weighing from 300.0 mg to 1000.0 mg, polyvinyl chloride film and varnished aluminium printed foil (blister), approved for use by the Ministry of Health of the Republic of Uzbekistan. from 1 to 30 units in contour-cell packaging made of or from 10 to 140 units in vials made of polymer materials in accordance with current regulatory documents. Blisters and vials from 1 to 4 units are placed in cardboard boxes prepared according to GOST 7933, and GOST 33781 [139].

Packages, packages, and vials (glass containers) are placed in corrugated cardboard boxes imported according to the certificate of conformity or prepared according to GOST 13511 [140]. Boxes are sealed with paper adhesive tape according to GOST 18251-87 [141] or with imported adhesive tape according to the certificate of conformity.

Negative deviations from the permissible mass for packaged goods should be in accordance with the requirements of Own DST 8.022 [142].

Product packaging must meet the requirements of UzTR 476-021 [143].

**Conclusions on Chapter III**

New biologically active food supplements meet the requirements of the organization's standard, complying with the sanitary norms and rules approved in the prescribed manner, according to technological instructions and recipes in the following assortment: "BIODARMON" in the form of tablets, capsules and powder; "BIOCHOY" in the form of tablets, capsules and powder; "BIOMOJIZA" should be produced in the form of oil.

Raw materials of plant species of the flora of Uzbekistan and materials used for the production of biologically active food additives must be allowed to be used by the Ministry of Health of the Republic of Uzbekistan. The use of the main raw materials and auxiliary materials should be carried out in accordance with the control of relevant normative documents.

In packaging, packaging materials approved by the Ministry of Health of the Republic of Uzbekistan are used, taking into account the appearance of oil, powder, granules, capsules, and tablets. The shape, composition, and type of packaging materials are controlled by relevant state standards and technical conditions.

Labelling is made of writing paper or adhesive paper for each packaging unit and contains the name of the manufacturer, his trademark (if any), address (legal and valid) and telephone number; product name; composition; release form; instructions for use; information about contraindications; volume, ml (for fats); net weight (tablets, capsules, powders), g; quantity in a package, pieces; production date (day, month, year); expiration date (month, year); The inscription "UAE for food, not medicine"; storage conditions; organization standard; certification information; barcode with registration number (if necessary); "Made in Uzbekistan" or "Proizvedeno v Uzbekistane" for the domestic market, "Made in Uzbekistan" should be displayed when the product is delivered for export.

New biologically active food additives must be biologically produced in accordance with the requirements of the TSh 26821898-001:2018 standard, in accordance with the sanitary standards and regulations of SanQM No. 033816, according to the technological instructions and recipes of TI 26821898-001:2019 [ 174-176]

## CONCLUSIONS

1. "BIODARMON", "BIOMO'JIZA", "BIOCHOY" biologically active food additives as main components are medicinal plants: amaranth (Amaranthus hypochondriacus L.), a new "O Uzbekistan", "Andijan", "Ulug'nor" and "Marhamat" varieties, mint (Mentha piperita L.), chamomile (Matricaria chamomilla L.), safflower (Carthamus tinctorius L.), sunflower oil (Helianthus annuus L.) was used. Amaranth, peppermint, chamomile, safflower, sunflower oil, which are components of new biologically active food additives, each has sufficient specific biological activity, and auxiliary substances: sugar, starch, calcium stearate, filler vitamin of D3chemical composition and properties do not change the chemical composition of these components and do not affect their biological activity, the level of danger for the human body belongs to the 4th class at the lowest level.

2. Made from amaranth, mint, chamomile flowers and leaves, "BIOCHOY" balances the body's metabolism. It has a calming effect on nervous tissue. Cardiac cells have a positive inotropic effect on cardiomyocytes. Increases the regeneration properties of liver cells - hepatocytes and epithelial cells. Actively affects the process of angiogenesis and blocks the growth of new blood vessels in atypical cells. Taking part in oxidation and reduction reactions in the body, excess cholesterol increases the oxidation process.

3. "BIODARMON" capsule, made from crushed amaranth seed powder, mint, safflower leaves and flowers, is a source of biologically active substances and micronutrients, improves the activity of the central nervous system, and helps saturate the blood with oxygen. It normalizes the activity of the gastrointestinal tract, improves appetite, improves digestion, has a good effect on the liver and gall bladder, and reduces flatulence and spasms.

4. "BIOMOJIZA" biologically active food supplement, prepared on the basis of amaranth and sunflower oil, with the addition of vitamin D3, helps to saturate the blood with oxygen and has a positive effect on the central nervous

system as a source of biologically active substances and micronutrients. secretes, the squalene contained in the oil stops the development of cancer cells, rejuvenates the body, strengthens the immune system, restores the hormonal system of the organs, and at the same time increases the length of a healthy life. This BAA is made from "Marhamat" amaranth oil, which contains the most squalene.

5. New biologically active food supplements in general relieve fatigue, relieve headaches, increase tone, increase immunity, restore the natural colour of hair, have a rejuvenating effect on the body, and treat impotence and frigidity. will help

6. "BIODARMON", "BIOCHOY" and "BIOMO'JIZA" biologically active food supplements are less dangerous according to the average lethal dose (LD50 per os >5000 mg/kg) They belong to the 4th class substances, they do not have a negative effect on the skin and eyes, have a functional cumulative nature and do not cause allergies in animals. From the toxicological point of view, biologically active food additives "BIODARMON", "BIOCHOY" and "BIOMO'JIZA" can be produced and used for consumption in the daily diet.

7. New biologically active food additives were approved by the Ministry of Health of the Republic of Uzbekistan on 14.03.2019. in accordance with the requirements of technical condition Ts 26821898-001. in accordance with the rules and regulations, in the following assortment: "BIODARMON" in the form of tablets, capsules and powder; "BIOCHOY" in the form of tablets, capsules and powder; "BIOMOJIZA" should be produced in the form of oil.

8. In packaging, it is necessary to use packaging materials approved by the Ministry of Health of the Republic of Uzbekistan, taking into account the appearance of oil, powder, granules, capsules, and tablets. The shape, composition, and type of packaging materials are controlled by relevant state standards and technical conditions.

9. Labelling is made of writing paper or adhesive paper for each packaging unit and contains the name of the manufacturer, his trademark (if

any), address (legal and valid) and telephone number; product name; composition; release form; instructions for use; information about contraindications; volume, ml (for fats); net weight (tablets, capsules, powders), g; quantity in a package, pieces; production date (day, month, year); expiration date (month, year); The inscription "UAE for food, not medicine"; storage conditions; organization standard; certification information; barcode with registration number (if necessary); "Made in Uzbekistan" or "Proizvedeno v Uzbekistane" for the domestic market, "Made in Uzbekistan" should be displayed when the product is delivered for export.

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## INFORMATION ABOUT THE AUTHORS

**Tokhtabaev Nozimjon Khoshimjonovich**

Born in 1971 in Namangan region. From 2017 to the present, he is the Dean of the Faculty of Natural Sciences of Andijan State University. Doctor of Chemical Sciences, Associate Professor. Author of more than 250 scientific-methodical works, including 3 textbooks, 1 monograph, 8 educational-methodical works. Under his leadership, 3 Republican innovative scientific grant projects were implemented in cooperation with the university and the "Center for the Implementation of Innovative Ideas" under the Andijan city administration. Agreements were concluded with 3 farms in the region aimed at growing plant raw materials with prospective economic value and production of biologically active additives that replace imports. 7th, 8th, and 9th-grade textbooks for general secondary schools written in co-authorship and methodical manuals for teachers have been published in 7 languages in several million copies and are being used in practice. Along with leadership activities, he also conducts scientific research in the field. He is continuing his scientific research on the speciality "Classification and certification of goods based on their chemical composition" and is working on his doctoral dissertation.

**Shodiev Dilshodjon Abdulojon ogli**

He was born in 1992 in the city of Fergana. In 2015, he was accepted as a student at the Fergana Polytechnic Institute based on a state grant. In the 2018-2019 academic year, he was awarded the "Beruniy" state scholarship. In 2021, he graduated from Fergana Polytechnic Institute, majoring in "Food Safety". D.A. Shodiyev started working as an assistant at the Institute's "Food Technology" department. Currently, scientific research is aimed at creating a technology for obtaining a protein-rich nutritional supplement for athletes based on amaranth grain. Researches the preparation of the production of children's and sportsmen's porridge containing amaranth from the grains of local medicinal plants and their use in functional nutrition. More than 70 scientific works related to the field have been published in the USA, Indonesia, Great Britain, Germany, and Russia, as well as in our country's prestigious scientific journals and scientific conference materials. In 2022, he took part in the International Articles Competition and won the "Best Scientific Researcher" badge. He was the owner of the grant project of the start-up competition "Development of enterprises in remote areas of the Fergana Valley".

**Najmitdinova Guljahon Komiljon kizi**

He was born in 1991 in the city of Fergana. In 2010-2014, students were admitted to Fergana Polytechnic Institute based on a payment contract. In the 2015-2017 academic year, she graduated from the Fergana Polytechnic Institute with a master's degree in "Food Safety". In 2020, Najmitdinova Guljahon started working as an assistant at the "Food Technology" department of the institute. Currently, her scientific research is aimed at "Creating the technology of making energy drinks that increase tone based on amaranth extracts." Localized medicinal plants are researching the preparation of energy drink compositions and their use in functional nutrition. More than 10 scientific papers related to the field have been published in the USA, Russia, and our country's prestigious scientific journals and scientific conference materials.

**Abduvalieva Mohidil Adhamjon kizi**

He was born in 2003 in Rishton district of Fergana region. In 2021, after successfully passing the tests at the Fergana Polytechnic Institute, she was admitted to study at the Faculty of "Chemical Technology" in the direction of "Food Technology" based on a payment contract. Until now, under the leadership of D. Shodiyev, she has been conducting scientific research on the topic of "Establishment of food supplements from domesticated medicinal plants". The preparation of food additives of a prophylactic nature for functional nutrition based on local varieties of localized medicinal plants and, the development of technologies for obtaining nutritional additives is researched. More than 10 scientific works related to the field have been published in the USA, Turkey, Indonesia, Great Britain, Germany, and Russia, as well as in prestigious scientific journals and scientific conference materials of our country.

N.KH. TUKHTABOEV, D.A. SHODIEV,
G.K. NAJMITDINOVA, M.A. ABDUVALIEVA

# INNOVATIVE APPROACHES TO DEVELOPING FUNCTIONAL FOOD ADDITIVES FROM MEDICINAL PLANTS

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