

## TECHNOLOGY OF THE PRODUCTION PROCESS OF BIOLOGICALLY ACTIVE FOOD SUPPLEMENT “VEGETABLE OILS” “LIK”

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**Abstract.** *This technological instruction applies to the biologically active food supplement (BAA) “Vegetable Oils “LIK”, produced from vegetable oils obtained by the cold-pressing method, which preserves their nutritional and biological value. The product is manufactured in the form of soft gelatin capsules and is intended for distribution through specialized sections of food stores as well as over-the-counter pharmacy departments as a biologically active food supplement.*

*A soft gelatin capsule is a modern dosage form with a hermetically sealed elastic gelatin shell containing a liquid or semi-liquid filler. This dosage form is widely used for medicines, biologically active supplements, and cosmetic products, ensuring protection of active substances from external factors, improving bioavailability, and masking unpleasant taste or odor.*

*The structure of soft gelatin capsules includes a shell composed of gelatin, plasticizers (such as glycerin), and purified water, which provides elasticity and tightness. The filling usually consists of liquid or semi-liquid substances such as vegetable oils, vitamins (D, E), suspensions, or solutions containing biologically active compounds.*

**Keywords:** *bioavailability, soft gelatin capsules, elastic shell, encapsulation, suspensions, emulsions.*

### **Аннотация**

*Настоящая технологическая инструкция распространяется на биологически активную добавку (БАД) к пище «Масла растительные “LIK”», изготовленную из растительных масел, полученных методом холодного прессования, что обеспечивает сохранение их пищевой и биологической ценности. Продукт выпускается в форме мягких желатиновых капсул и предназначен для реализации через специализированные отделы продовольственных магазинов, а также безрецептурные отделы аптек в качестве биологически активной добавки к пище.*

Мягкая желатиновая капсула представляет собой современную лекарственную форму с герметичной эластичной оболочкой на основе желатина, содержащую жидкий или полужидкий наполнитель. Данная форма широко применяется для инкапсулирования лекарственных средств, биологически активных добавок и косметических продуктов, обеспечивая защиту активных веществ от воздействия внешних факторов, повышение их биодоступности, а также маскирование неприятного вкуса и запаха.

Особенностью мягких желатиновых капсул является их состав и структура. Оболочка капсулы формируется из желатина, пластификаторов (например, глицерина) и очищенной воды, что придаёт ей эластичность и герметичность. В качестве наполнителя используются жидкие или полужидкие вещества, такие как растительные масла, витамины (D, E), суспензии или растворы биологически активных компонентов.

**Ключевые слова:** биодоступность, мягкие желатиновые капсулы, эластичная оболочка, инкапсуляция, суспензии, эмульсии.

## Materials and Methods

Vegetable oils used in the production process are stored in barrels or special containers in a dry and dark room at a temperature not exceeding 20 °C prior to technological processing. Calcium carbonate, magnesium oxide, and zinc oxide are used as mineral additives. These substances comply with relevant ГОСТ standards, are supplied in appropriate packaging and labeling, and are stored in dry conditions.

Distilled water is loaded into the reactor and heated to 70 °C. After reaching the required temperature, an antiseptic and glycerin are added while stirring according to the formulation. During the cooking process, a vacuum pump is connected to the reactor to remove air from the gelatin mass. Before the encapsulation process begins, the encapsulation machine is switched on. The temperature of the gelatin base should be maintained at 60–63 °C, while the optimal temperature of the oil filling should be 18–20 °C.

## Results and Discussion

The technological process for the production of the biologically active food supplement “Vegetable Oils “LIK” must comply with the sanitary requirements of the Republic of Uzbekistan SanPiN No. 0338 “Hygienic requirements for the production and circulation of biologically active food supplements.” The production process includes several sequential stages: raw material acceptance, filler preparation, preparation of gelatin mass for the capsule shell, and encapsulation.

### *Raw Material Acceptance*

The main raw materials used in the production of the biologically active supplement “Vegetable Oils “LIK” are cold-pressed vegetable oils: pumpkin oil,

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sesame oil, and black cumin oil obtained from seeds, kernels, and nuts. The use of the cold-pressing method allows preservation of the natural nutritional and biological value of the oils.

Before technological processing begins, the vegetable oils are stored in sealed barrels or special containers in a dry room protected from light at a temperature not exceeding 20 °C.

Mineral additives such as calcium carbonate, magnesium oxide, and zinc oxide are used in the formulation. These substances comply with current GOCT standards, have appropriate packaging and labeling, and are stored in dry conditions in accordance with storage requirements.

#### *Preparation of the Filler*

At the filler preparation stage, vegetable oils are mixed with mineral additives previously sieved through a sieve with a hole size of 0.5 mm according to the formulation. The resulting mixture is thoroughly mixed until a homogeneous mass is obtained.

After mixing, the mixture is filtered through a mesh filter and transferred to a technological container. Before the encapsulation process begins, the prepared oil mixture is kept for 10–15 minutes to remove air bubbles. After the holding stage, the filler is fed into the encapsulation machine.

#### *Preparation of Gelatin Mass for the Capsule Shell*

For the preparation of the gelatin shell, all components are first weighed according to the formulation. Gelatin and glycerin are weighed in clean containers, while the antiseptic is measured in a chemical beaker.

The gelatin mass is prepared in a reactor equipped with a water jacket and a mechanical stirrer. Before starting the process, the tightness of the drain valve and the proper functioning of the stirrer are checked. The internal surface of the reactor must be clean and dry.

Distilled water is loaded into the reactor and heated to 70 °C. After reaching the required temperature, the antiseptic and glycerin are added while stirring according to the formulation. The temperature of the mixture is then increased to 75 °C, after which gelatin is added and the mixture is stirred until complete dissolution at a temperature of 78–80 °C.

The obtained mass is maintained under constant stirring for 2 hours. During the cooking process, a vacuum pump is connected to the reactor to remove air from the gelatin mass. Vacuuming is carried out gradually by periodically opening and closing the reactor valve to prevent excessive foaming. At the final stage, the vacuum valve is fully opened for 10–15 minutes.

After vacuum treatment, the vacuum pump is turned off and air is introduced into the reactor by opening the valve, causing the mass to settle quickly at the bottom of the reactor. The readiness of the gelatin mass is determined by the technologist.

During the preparation process, the reactor lid should not be opened unnecessarily, as this may cause moisture loss and affect the viscosity of the gelatin mass.

The prepared gelatin mass is transferred to a thermostat and held at 55 °C for 6–12 hours to ensure complete deaeration (removal of air bubbles). After draining, the reactor walls and stirrer are washed with hot water and dried with the lid open.

### *Encapsulation*

Before encapsulation begins, the encapsulation machine is adjusted and the level of petroleum oil in the system is checked. After the inspection, the encapsulation machine is started.

The temperature of the gelatin mass should be 60–63 °C, and the optimal temperature of the oil filler should be 18–20 °C.

The following technological parameters are controlled:

- thickness of the raw gelatin shell — 0.6–1.0 mm
- mass of the raw capsule — 0.84–0.90 g
- filler mass and total capsule weight

The encapsulation process begins after the required parameters are reached. The mass of the capsule shell should be at least 15% of the mass of the finished product.

The dosing accuracy of the capsules depends on the stable operation of the dosing pump of the encapsulation machine.

### *Capsule Drying*

Capsules are dried in a drying unit equipped with rotating drums containing cells smaller than the diameter of the capsules and a screw transportation system.

The air temperature during drying should be maintained at 20–24 °C with a relative humidity of 60–65%. In case of increased humidity or reduced temperature, preheating and drying of the air using a heater is recommended.

The drying process lasts from 12 to 24 hours. After drying, the capsules are sent to the washing stage and further packaging.

### **Conclusion**

The conducted studies made it possible to scientifically substantiate and develop a technology for obtaining the biologically active food supplement “Vegetable Oils LIK” in the form of soft gelatin capsules. The developed technology fully complies with current sanitary, hygienic, and pharmaceutical requirements, as well as regulatory documents governing the production of biologically active food supplements.

It has been established that the use of cold-pressed vegetable oils (pumpkin oil, sesame oil, and black cumin oil) as the main raw material ensures the preservation of

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natural biologically active substances, vitamins, and trace elements, which contributes to increasing the biological value of the finished product. The additional inclusion of mineral components such as calcium carbonate, magnesium oxide, and zinc oxide enriches the composition of the supplement and expands its functional properties.

During the study, the main technological parameters for the production of soft gelatin capsules were optimized, including the temperature regime for preparing the gelatin mass, vacuum conditions, humidity and temperature parameters during drying, as well as the physicochemical characteristics of the capsule shell and filler. Compliance with these parameters ensures the stability of the technological process, high capsule quality, hermetic sealing, uniform dosing, and preservation of active components.

The obtained results demonstrate that the developed technology makes it possible to obtain a biologically active supplement with high bioavailability, stability, and safety for human health. The soft gelatin capsule form provides effective protection of active substances from external factors, improves the organoleptic properties of the product, and increases the convenience of its use.

Thus, the presented technology can serve as a scientific and practical basis for the industrial production of the biologically active supplement “Vegetable Oils LIK”. The implementation of this development contributes to the creation of competitive domestic products based on local plant raw materials and expands the range of functional food supplements in the Republic of Uzbekistan.

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