

TECHNOLOGY OF MICROENCAPSULATION OF GRAIN KERNEL FAT FRACTION AND ITS APPLICATION IN FUNCTIONAL PRODUCTS

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In the food industry, biologically active oils and their fractions are important raw materials for the production of functional products. Grain kernel oil has many biologically active properties, such as reducing cardiovascular diseases, anti-inflammatory effects, and strengthening the immune system. However, these oils are prone to high levels of constant oxidation, which reduces their quality and makes it difficult to properly integrate them into food products.

Microencapsulation technology allows for the stable encapsulation of oils, protecting them from oxidation and facilitating their incorporation into various products. This process requires optimization of encapsulation materials, emulsifiers, drying methods, and process conditions. The purpose of the thesis is to develop a microencapsulation technology for corn kernel oil and to identify the prospects for its application in functional food products.

Corn kernel oil mainly contains linoleic acid (omega-6), its content is about 70–80%. In addition, alpha-linolenic acid (omega-3), oleic acid (omega-9), tocopherols and phytosterols are also present. These components support cardiovascular function, reduce cholesterol levels, and have anti-inflammatory and antioxidant effects.[1]

However, linoleic acid is relatively sensitive and is rapidly oxidized by high temperature, light and oxygen. Therefore, the direct addition of the oil to food products reduces its quality.

Microencapsulation is a process that ensures the preservation of a stable form of the active substance by encapsulating it in a solid or liquid capsule. Microencapsulation for grain kernel oil serves the following purposes:

- Protection of the oil from oxidation;
- Control of taste and odor;
- Extending shelf life;
- Facilitating integration into various food products.[2]

The following materials are used for encapsulation:

Carrageenan, agar-agar - natural polysaccharides;

Gum arabic - converts liquid into a stable emulsion;

Casein, soy protein - creates protein-based capsules;

Maltodextrin - provides the capsule structure during the drying process.

The most commonly used methods for grain kernel oil are:

Spray-drying - mixing the oil emulsion with encapsulating materials and drying it with hot air;

Freeze-drying - freezing the emulsion and removing the water under vacuum;

Coacervation - forming a capsule based on protein or polysaccharide;

Liposomes and nanocapsules – to ensure high bioavailability.

The following parameters are important for increasing the efficiency of microencapsulation:

Emulsion titration and oil particle size – small particles form stable capsules;

Encapsulation material concentration – high concentration increases the efficiency of oil release;

Drying temperature – high temperature leads to oil oxidation;

PH and resistance – determine the stability of the emulsion.[3]

Optimized parameters allow for maximum stable encapsulation of cereal kernel oil and preservation of its biological activity.

Microencapsulated cereal kernel oil can be effectively used in the following products:

Coffee and tea blends – antioxidant enrichment;

Fatty confectionery products – odor and taste control;

Dairy products and sour cream – omega-6 enrichment;

Sports and energy drinks – rapidly digestible fat fraction;

Dietary and therapeutic products – prevention of cardiovascular diseases.[4]

Microencapsulation allows the oil to be stably incorporated into products, preserving its aroma and taste, and extending its shelf life by limiting oxidation.

Scientific studies have shown that:

85–90% of the oil from the kernels of the grain can be stably preserved by encapsulation using the spray-drying method;

The combination of maltodextrin + gum arabic is recognized as the most optimal encapsulation material;

The encapsulated oil maintains its quality at room temperature for 6 months;

When added to functional products, the organoleptic characteristics do not change and biological activity is preserved.

In conclusion, the technology of microencapsulation of the kernel oil of the grain allows for the stable storage of biologically active oils and their use in functional products. By optimizing the encapsulation materials, process parameters, and integration into various products, the oil is protected from oxidation, its shelf life is extended, and its bioavailability is increased. This technology is of great importance in creating innovative and healthy products in the food industry.

References

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