

# Development of Technology for Oil Extraction from Local Sunflower Seeds at Moderate Temperature

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**Annotation.** Cultivation of oil sunflower varieties as the main and repeated crops in Uzbekistan has been increasing in recent years. Sunflower seeds are the main source of high-quality lipids and proteins. In 2022, 45,000 tons of vegetable oil and 83,000 tons of sunflower meal will be produced in Uzbekistan. Currently, the production of sunflower oil in the world is mainly carried out by high temperature pressing and extraction with organic solvents. But the traditional processing technology of sunflower seeds has clear disadvantages. For example, at a high temperature, the acidity of vegetable oil increases, and the protein in the vegetable oil is denatured. Therefore, it is necessary to improve the quality of sunflower oil and protein flour and to increase the level of complex processing in order to ensure the food safety of the oil and the healthy nutrition of people. The article describes the plan for processing this complex and the results expected from it.

**Key words:** sunflower, seeds, oil, protein, variety, pressing, extraction, temperature, complex processing.

**Introduction.** Currently, about 50 percent of the average annual demand for vegetable oil in our Republic is covered by imports. In 2020, the volume of imported sunflower oil was 249 thousand tons [1].

Sunflower is one of the most important oilseed crops in the world today and is popular among consumers as a relatively safe edible oil. In the last five years, sunflower has been cultivated in 72 countries of the world on an area of more than 25-26 million hectares, with an average harvest of 40.5-42.0 million tons. In recent years, the cultivation of oil sunflower varieties as the main and repeated crop has been increasing in Uzbekistan. According to the Ministry of Agriculture, a total of 61,700 hectares of sunflowers were planted in Uzbekistan in 2022. According to preliminary estimates, it is planned to collect 128,000 tons of crops from these fields [1].

45,000 tons of vegetable oil and 83,000 tons of sunflower meal will be produced from the forecasted sunflower crop. The developed sunflower meal is directed to livestock and poultry farms.

Sunflower is planted in the main areas of the Republic of Karakalpakstan, Bukhara, Kashkadarya, Namangan, Tashkent and Fergana regions.

Today, 51 varieties of sunflower suitable for different soil and climate conditions of the republic have been included in the state register of agricultural crops recommended for planting in the territory of the Republic of Uzbekistan by the Agricultural Crops Testing Center [1]. Sunflower varieties: Navroz, Jahangir, Dilbar,

Samarkand white, Olato'n, Rodnik, Pioner and others. Sunflower seeds are the main source of high-quality lipids and proteins.

Chemical composition: Lipidlar - 33-57%; protein - 24-27%; fiber - 23-32%.

In addition to food products, sunflower oil is used in medicine, cosmetology and perfumery. It is yellow and light. Sunflower oil contains up to 62% of biologically active linoleic acid, vitamins A, D, E, K, phosphatides, plant sterols and phospholipids, which can help lower blood cholesterol levels, suppress cholesterol synthesis in the human body, prevent excessive plasma cholesterol, and prevent atherosclerosis. Sunflower oil is used in the production of margarine, mayonnaise, canned fish and vegetables, confectionery, varnishes and soaps [2, 3].

Waste after extraction of oil from seeds - meal and cake - are high-quality feed for livestock. Halva is made by adding sugar after extracting the oil from the seeds. The basket (inflorescence) of sunflower is also a good fodder for livestock. Flowers, leaves and seeds are used in medicine. Seeds contain oil, proteins, carbohydrates, carotenoids, phatic substances. Carotene, sticky substances, rubber, flavonoids, organic acids were found in the leaves. Flowers contain dyes and alcohols [4]. Currently, the production of sunflower oil in the world is mainly carried out by high temperature pressing and extraction with organic solvents.

The high-temperature pressing method has special taste advantages, but the activity of many biologically active substances, including those with functional properties, is lost.

In the low-temperature pressing method, oil with strong functional properties is obtained, but the rate of oil extraction is lower, and the level of residual oil in the pulp is high. Oil quality is affected by oil oxidation, toxic and harmful substances [5,6,7,8].

Oil extraction involves solvent extraction using an organic solvent followed by distillation and other steps to remove the solvent. The advantage of this method is high efficiency of oil extraction, but low quality indicators, at the same time, due to the use of toxic, flammable, explosive organic solvents in the extraction process; it leads to the appearance of solvent residues in oil and slag. In addition, high-temperature sunflower meal protein is highly denatured and of low quality, so it is only suitable for use as feed for cattle.

For these reasons, the traditional sunflower seed processing technology still has obvious disadvantages. Therefore, it is of urgent importance to improve the quality of sunflower oil and protein flour and to increase the level of complex processing in order to ensure the food safety of the oil and the healthy nutrition of people.

**Description of work performed.** The goal of our research is to develop a technology for co-production of oil and protein whey by pressing and extracting local sunflower seeds at a moderate temperature and to introduce this technology on an industrial scale.

The following activities are planned to achieve this goal.

Collection and quality analysis of local sunflower varieties: collection of main raw material varieties of sunflower seeds in Uzbekistan and analysis of raw material characteristics and quality indicators of oil and protein.

Technology for evaluation of sunflower seed suitability for processing: selection of suitable sunflower seed varieties for oil and protein. Processing of isolated cultivars: identification of the main factors affecting the quality of sunflower oil and protein and development of a correlation model and evaluation system between raw material

characteristics and product quality. The effect of processing technology on oil yield and quality: the use of special varieties for processing as raw materials, the effect of the main processing technologies on the nutritional composition and yield of oil is studied.

Effect of processing technology on protein structure and quality: the effect of the main processing technologies on the composition, aggregate state, solubility, and thermal properties of protein aromatic substances is studied. Determination of the optimal parameters of the technological process: the optimal parameters of the process are determined and verified together with the conclusions of the above research.

Establishment of high-quality sunflower oil and protein production line: sunflower seed processing enterprises are selected and a perfect production line is established. A pilot plant is introduced and tested: process technology is introduced and optimized based on laboratory studies. Bukhara Engineering Technological Institute has extensive experience in researching vegetable oil processing technology and equipment, technological engineering design and production line construction.

In the technological line for the production of vegetable oil, a special place is occupied by the process of thermal preparation of skrya for degreasing. This process follows the last before the direct extraction of oil. The yield and quality of the oil mainly depend on the temperature regime, the duration of the process and other conditions of heat treatment. Heat treatment affects one of the main indicators of oil quality - its acid number. In the processed raw materials, the processes of oxidation of oleic acid occur with the formation of peroxides, hydroxyl acids and then low molecular weight acids, and they go the more intensively, the higher the temperature of heating of the raw materials. Low-temperature heat treatment promotes the hydrolysis of triacylglycerol with the formation of di- and monoacylglycerols and free fatty acids. High temperatures of heating seeds are accompanied by the binding of triacylglycerol and free fatty acids. Therefore, heat treatment should be carried out at optimal temperatures in order to minimize hydrolytic processes and at the same time prevent oxidative degradation and lipid binding, which are inevitable at high temperatures [9].

The equipment for pre-treatment with infrared rays was developed for oil-capturing raw materials (fruit seed pulp, seeds of grape and polys products) [10,11]. A technological device for the extraction of vegetable oil using a supercritical carbon dioxide extractant was created and a production line was designed [12,13].

**Conclusion.** For the production of sunflower oil and sunflower seed proteins, 2-3 varieties of seeds are separated. The technology for assessing the suitability of sunflower seeds for processing and the technology for the co-production of sunflower oil and protein through moderate temperature pressing and extraction will be developed. The shelf life of high-quality sunflower oil products is extended to more than 3 months, the residual fat content in meal is from 6% to 1%, protein nitrogen solubility is reached from 36% to 70% in the production of sunflower seed protein products.

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