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A Study Of Edible Wheat Germ Oil From Local Grains

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Abstract: This article is devoted to the development of technology for the extraction of oil from the germ product and its processing when obtaining oils for food purposes. The role of rice husk in pelletizing the embryo petals into a single structure of the germ cell for obtaining valuable food oil.

Keywords: wheat germ, wheat germ oil, polyunsaturated fatty acids, lipids, valuable fatty acids, carotenoids, tocopherols, highly unsaturated fatty acids, granulated mesga, rice husk.

The intensive development of grain production, in particular wheat, in Uzbekistan required the study of many varieties that are favorably cultivated on rainfed and irrigated lands under hot climatic conditions. Such cultivated varieties of wheat are among them: Intensive, Sansar-8, Bakht, Yuna, Kupava, Chillaki, Delta, Andijon-1, Andijon-2, Yugtina, Umanka, Echo, Polovchanka, Kroshka, Knyazhna, Hosildor and others.

During ten years these varieties were tested in different regions of the Republic, where their more productive and high-yielding species were identified.

Along with the selection of productive wheat varieties, the physical and chemical, as well as other properties of their embryos, were naturally changed. This should be taken into account when improving the technology of their processing.

In the embryo, all the most valuable and useful things that are in the wheat grain are concentrated. The embryo is a biologically active center of the grain, which concentrates a variety of oral factors that provide germination of the impact on the human body. Besides, the germ part is very rich in vitamin E and selenium, which maintain the functional stability of cells and their resistance to damaging effects,

which is very important for maintaining germination ability. It is known that seedlings contain the most enormous amount of vitamin E (up to 200 mg/100 g) of all known products.

Germ flakes also contain essential polyunsaturated fatty acids, which have a positive effect on blood cholesterol levels and can reduce blood clotting.

However, it is precisely because of the high content of fatty acids, which quickly oxidize and spoil the taste of the product, that such a valuable and biologically valuable part of the grain is removed in the production of ordinary wheat cereals and flour [26].

In terms of lipid content, germ flakes are 5 and 7 times higher than whole grains and top-grade flour, respectively. Moreover, the lipid complex includes valuable fatty acids and carotenoids, and their content significantly exceeds the whole grain. Wheat germ flakes are rich in B vitamins (thiamine, riboflavin) and PP (nicotinic acid). The high content of tocopherols, especially; one of its isomers, vitamin B, indicates the high biological value of germ flakes. The content of tocopherols in germ flakes is 30 times higher than in wheat grains. In terms of sugar content, the flakes are 5 times higher than the whole grain and 20 times higher than the flour.

In terms of the nutritional value of mineral composition germ flakes are much higher than whole grain and flour of the highest grade. In particular, the content of calcium is 1.2 and 2.5 times, respectively; potassium is 2.5 and 5.0 times.

Previously developed technology [1] of extraction of germinal product allowed to establish its efficiency of industrial processing, in particular at the reception of oils for food purposes. At sort wheat grinding extraction of germ, flakes reach up to 0.6% of the mass of processed grain with the frequency not lower than 75%.

However, in this germ product, ¼ part consists of larger germ particles and wheat grain bran, where the extracted oil is inside in spherosomes and globules. Their processing to obtain press and extraction oils is not efficient enough, as there are low oil yields and significant material and energy costs.

Lack of possibility of long accumulation and storage of germ product due to the presence of lipolytic enzymes and others dictates the necessity of its accelerated processing. For example, the breakdown of fats and their oxidation complicates the processing of the germinal product and their use for food purposes.

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Therefore, despite the per-sort processing of wheat grains and to accelerate the accumulation of germinal raw materials for oil and fat enterprises, we found it necessary to study the oil content and other indicators of germinal products derived from some widely cultivated wheat varieties.

Table 3.1 shows the oil content in grain and germinal products obtained from "Chillaki", "Kupova" and "Polovchanka" wheat varieties.

Table 3.1

Oil content of grain and germinal product derived from "Chillaki", "Kupova" and "Polovchanka" wheat varieties

Names of varieties wheat	Contet %	
	In grain	In germinal
Chillaki	1,6-1,8	12-14
Kupova	1,8-1,9	11-16
Polovchanka	1,8-2,0	13-17

It can be seen from Table 3.1 that the oil content in both grains and germ products is not dependent on the local wheat variety.

Thus, for example, the germinal product obtained from the wheat variety "Chillaki" contains 12% oil and "Kupova" 11% oil.

This indicates that they can be processed into a mixture without any restrictions.

To convince us of the correctness of such a decision, we studied other technological indicators of germinal products obtained from wheat varieties "Chillaki", "Kupova" and "Polovchanka".

The results of the analysis are presented in Table 3.2.

Table 3.2.

Changes in germinal product yield and moisture, fiber and ash content depending on "Chillaki", "Kupova" and "Polovchanka" wheat varieties

Names of wheat varieties	Germyieldtograin, %	Content in embryos, % from abs.dry mass.

		Dampness	Fibres	ashes
Chillaki	1,7-1,8	9,5-10,5	2-6	2,0-4,0
Kupova	1,9-2,0	9,0-11,0	2,5-7	3,0-5,0
Polovchanka	1,8-1,9	85-10,0	2-7	2,5-5,0

It can be seen from Table 3.2 that the germ yield of the germ product changes insignificantly with the change in wheat grade, and the moisture, fibre and ash content is also close to each other.

Therefore, processing of their mixtures does not cause significant problems. Currently, grain production is intensively developing in Uzbekistan, both on rain-fed and irrigated pots. In 2007, more than 6.0 tons of grain, including more than 200.0 thousand tons of its embryos, were delivered to the Republic's grain storage facilities. It is known that the wheat germ is rich in such a valuable component as highly saturated fatty acids, tocopherols (vitamin "E") and others.

The main part of the embryos today is used in the production of compound feed for animals and birds because of the lack of effective technology for obtaining oil and other valuable substances from them.

Low oil germination of local wheat varieties of grain (9:15% of the total germ mass) does not provide a high yield of press oil, which dictates the rationality of their direct extraction.

The efficiency of the oil extraction process depends on the quality of preparation of the extracted material, i.e. its structure of porosity, humidity, etc. [1]

The analysis of the structure (appearance, geometric dimensions, etc.) of grain germplants of local wheat varieties showed that depending on the conditions of their growth (on rain-fed or irrigated lands) they have not homogeneous (geometrically strongly varying) mass. Besides, if the germ of grain cultivated on irrigated lands has oil content within limits (12-15% of the germ mass), the germ of grain cultivated on rainfed lands has less oil content (9-11% of the germ mass). This situation requires the development of a new, more effective way to prepare grains of local wheat varieties of their direct extraction.

In this direction, the most interesting is the granulation of wheat germ before its extraction, as one of the rational ways to obtain a homogeneous structure of oil-containing material.

Specific localization of triacylglycerols (TAG) in the structure of wheat germplants requires several technological treatments (rolling, moisture heat treatment and pelletizing) that would allow obtaining easily extractable material with high yield and quality of extractable oil.

In laboratory conditions, we initially obtained a petal from a 0.3:0.5 mm thick wheat germ. Then, by adding a rice husk up to 10% of the germ mass, we obtained a sieve and treated it in a microwave oven (adding the necessary amount of water and other auxiliary components). The resulting ointment was pelletized in a laboratory granulator and dried to 7-8% moisture of the mass of the granule.

Obtained granules from wheat germ were analyzed: for porosity, humidity, husk content and other indicators.

It was found that due to the introduction of 10% rice husk composition of wheat germ in 1,2:1,4 times increases the porosity of the resulting granule, which has a beneficial effect on its extractability.

It is known that by nature rice husk is close to grain products, and it contains harmful substances. This allows us to use it in obtaining granules from wheat germplants.

The analysis of mechanical strength and durability of the received granules has shown that they are stable enough and at transportation practically are not crushed.

In laboratory conditions influence of various technological factors was studied: temperature, the content of oil husk, moisture and others on properties of the received granules.

Thus, during the preparation of embryos for extraction, we paid special attention to the preservation of the initial content of tocopherols both in received granules and in extraction oil.

It is established that it is expedient to use microwave heating for moisture-thermal processing of the moth obtained from wheat germplants as it provides sensible volume heat and mass transfer. Thus optimum technological modes of moisture-thermal processing of a broom received from a germ of a grain of wheat are revealed.

It has been revealed that rice husk in the presence of moisture and after microwave treatment, the germ blades are firmly enough bound in a single structure, i.e. granules.

Thus, the study shows the high efficiency of germination granulation of local wheat varieties before their extraction, which is evident from the high porosity of the resulting structure and minimal losses during their processing.

Today oil and fat-and-oil enterprises of the Republic of Uzbekistan need to supply new types of oil and fat-and-oil raw materials, which can include wheat germ. (1)

Wheat production is increasing in the country from year to year and thus the number of germs that need to be used sustainably is also increasing.

It is known that wheat germ oil is rich in vitamin E (tocopherol) and other biologically valuable substances. Consequently, its use for food and medical purposes is considered rational.(2)

In Uzbekistan wheat is cultivated on rainfed and irrigated lands, which in turn affects the composition of the grain germ. Therefore, studying the peculiarities of the composition and properties of germs and local wheat grains is of both scientific and practical interest.

On the basis of data collection on the composition and properties of grain germplants of local wheat varieties, we made a number of proposals to improve the known technology of oil production from them.

The traditional technology of oil production from wheat germplants is based on the technological scheme "pressing-extraction", where the oil-containing material is subjected to high moisture-temperature treatment. Due to this, the biological and nutritional value of the oil and oil cake obtained is greatly reduced. In addition, there is a significant loss of valuable oil during its refining. All this affects the technical and economic performance of this technology and the cost of products.

Taking into account the abovementioned, we propose to classify wheat germs depending on their oiliness initially, the acid number of oil and conditions of cultivation (on rainfed or irrigated lands) into three groups:

The first group is high-oil and low-acid germs;

The second group is a medium oilseed and acidic germs;

The third group is low-oil and high-acid germs.

The first two types are used in oil production, and the third is used as an additive in the feed.

The long-term practice of pressing vegetable oils shows that to increase the intensity of oil yield, it is necessary to use husk in an amount up to 20% (depending on the type of processed oil raw materials).

Repeated experiments in pressing without a meadow messa have shown the hopelessness of this direction of development of technology for obtaining vegetable oils due to the peculiarities of its structural and mechanical properties.(3)

For example, in sunflower, they use their husk, in cotton seeds - husk, etc. In the wheat grain as such, there is almost no husk after its treatment.

With this in mind, and taking into account the means of wheat rice, we have proposed to use its husk as a structural granule formation when pressing the germ of a grain of local varieties of wheat.

The choice of the latter was also justified by the fact that the rice husk (local raw material) at the republican rice factories was burned, damaging the environment and ecology.

Conclusion: The researched structures and compositions of rice husk showed that it has selectively adsorbing properties, providing absorption of undesirable substances of wheat germ oil. On the basis of laboratory researches, optimum geometrical sizes of received granules from the germ of a grain of local grades of wheat, the maintenance of a rice husk and modes of pressing are established. Thus, summarizing this work, we can say that the conversion of the cake structure of wheat germplants on the granules with the use of rice husk can improve the yield and quality of the resulting oil.

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