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CHEMICAL COMPOSITION OF SECONDARY RISE PRODUCTS AND PROSPECTS FOR PRODUCING PROTEIN-LIPID CONCENTRATES FROM THEM.

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Abstract: This article examines the chemical composition and biological value of secondary products formed during rice processing, as well as the scientific foundations of technology for obtaining protein-lipid concentrate from them. During the study, the physicochemical parameters of rice bran, crushed rice fractions, and rice husks were analyzed, and the content of proteins, lipids, carbohydrates, vitamins, and minerals in them was evaluated. The functional properties of protein fractions and biologically active lipid components in rice bran were determined, and the technological stages of obtaining a protein-lipid concentrate from them were described. The research results showed that the complex processing of secondary rice products allows for the production of functional products with high added value.

Keywords: rice bran, secondary product, protein-lipid concentrate, extraction, biological value, functional food, antioxidant, lipid fraction, technology.

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Ensuring global food security, deep processing of agricultural products, and the development of waste-free technologies are among the priority areas of the modern food industry. Population growth and the increasing demand for products with high biological value necessitate the integrated use of available raw materials. In this regard, the processing of secondary products formed during the processing of grain products is of great scientific and practical importance. Rice (Oryza sativa L.) is one of the world's primary food crops. According to UN data, more than half of the world's population consumes rice products in their daily diet. Rice ranks 3rd on the planet in terms of the area of sown land. Rice is obtained as the primary product during rice processing, but up to 30-40% of the total raw material is allocated as a secondary product during this technological process.

These secondary products include:

1. rice bran;
2. bark;
3. crushed rice fractions;
4. includes embryonic remains.

Although these products have been used primarily as fodder for many years, modern scientific research indicates that they contain proteins, lipids, tocopherols, gamma-orizanol, phytosterols, and other bioactive components with high biological value.Rice bran is considered a promising raw material for the production of functional food products. Its protein and lipid

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complexes are rich in physiologically active components and exhibit antioxidant, hypocholesterolemic, and immunomodulatory properties in the human body.

Therefore, the in-depth study of the chemical composition of rice by-products and the development of technology for obtaining protein-lipid concentrates from them is one of the most pressing scientific issues.

Objects and methods of research

The object of the research is secondary products formed at rice processing enterprises, including:

- ✓ rice bran;
- ✓ crushed rice fractions;
- ✓ rice husks were removed.

Modern physicochemical and biochemical analysis methods were used to determine the chemical composition.

Methods used:

- ➢ determination of protein content - Kjeldal method;
- ➢ determination of fat content - Soxhlet extraction method;
- ➢ moisture determination - gravimetric method;
- ➢ determination of ash substances - muffle furnace roasting method;
- ➢ determining amino acid composition - chromatographic method.

The obtained results were statistically processed, and average values were calculated.

Chemical composition of secondary rice products,

Physicochemical characteristics of rice bran.

Rice is one of the most widely cultivated grain crops in the world. During its processing, various secondary products are formed alongside the main product. These products are used as essential raw materials in the food, agricultural, pharmaceutical, chemical, and energy industries. The main by-products of rice include rice bran, rice husks, crushed rice, rice straw, and rice bran oil. Their chemical composition is characterized by a high content of biologically active substances, minerals, proteins, fats, and polysaccharides. Rice bran is the primary byproduct formed during the polishing process and serves as a source of biologically active substances. Rice bran is a product obtained from the outer layer of rice grain and possesses high nutritional value. The bran contains a large amount of protein, fat, vitamins, and antioxidants.

According to the research results, the chemical composition of rice bran was characterized by the following indicators:

Indicator	Amount (%)
Protein	12.4-16.8
Lipid	15.2-21.6
Carbohydrate	28.5 - 34.7
Fiber	7.2-10.4
Ashes	8.1–9.6
Humidity	8-11

Research results have shown that rice bran contains a high amount of protein and lipid components, which determines its biological value.

Rice by-products are considered valuable raw materials in terms of their chemical composition. While rice bran is rich in protein, fat, and vitamins, rice husks are an important source of silicon compounds. Crushed rice is widely used in starch production, while rice straw is

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used in the production of biofuels and organic fertilizers. The efficient use of rice waste is crucial for reducing environmental problems and increasing economic efficiency.

Description of protein fractions

The proteins in rice bran are complex organic compounds with high biological value. Bran proteins contain essential and non-essential amino acids necessary for the human body. These proteins are distinguished by their nutritional value, good digestibility, and biological activity. Rice bran proteins primarily consist of albumin, globulin, and gluten fractions, which are important in the food and feed industries due to their richness in amino acids.

Rice bran proteins differ from other cereal proteins in their amino acid composition and biological value. The protein contains:

- albumin;
- globulin;
- gluten;
- the presence of prolamine fractions was detected.

The main share falls on the glutelin fraction, and its content in the total protein composition is 60-65%.Analysis of the amino acid composition revealed the presence of essential amino acids such as lysine, methionine, threonine, and leucine. This increases the biological value of rice bran protein.

Description of the Lipid Complex

Lipids in rice grain and its secondary products are organic substances of significant biological and energetic importance. Lipids are primarily concentrated in the rice bran and embryonic part, consisting of fatty acids, phospholipids, glycolipids, waxes, and sterols. Rice lipids are distinguished by their high nutritional value and richness in biologically active substances. The lipids in rice bran mainly consist of unsaturated fatty acids, and their physiological activity is considered high.

Essential fatty acids:

❖ oleic acid - 42-45%;
❖ linoleic acid - 30-37%;
❖ palmitic acid - 15-18%.

In addition, the lipid contains:

- gamma-orizanol;
- tocopherols;
- tocotrienols;
- phytosterols were detected.

Gamma-orizanol possesses antioxidant properties and plays a crucial role in regulating lipid metabolism.

Technology for producing protein-lipid concentrate

The production of a protein-lipid concentrate from rice bran includes several sequential technological stages.

Stage of raw material preparation

Rice bran first:

- cleaned of mechanical impurities;
- Dried to a moisture content of 8-10%;
- crushed;
- divided into factions.

This process made it possible to increase the efficiency of extraction.

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Lipid extraction

The solvent extraction method was used for lipid extraction. A hexane solvent was used during the study.

Extraction process:

- 55–60 °C;
- It was carried out for 4-6 hours.

As a result, the bulk of the oil was extracted. Biologically active components were preserved in the resulting oil.

Protein extraction

The alkaline extraction method was used to extract protein from the composition of the defatted bran.

The process was carried out in the following stages:

1. The raw material was mixed with a NaOH solution;
2. pH was maintained within the range of 8.5–9.5;
3. The proteins were transferred to the solution;
4. Filtration and centrifugation were performed;
5. The protein was precipitated at an isoelectric point;
6. Bleaching and drying processes were performed.

As a result, a concentrate with a high protein content was obtained.

Functional properties of the resulting concentrate

The technological and functional properties of the protein-lipid concentrate obtained during the study were studied.

It was found that the concentrate:

- high emulsifying capacity;
- the ability to retain water and oil;
- has antioxidant activity.

These properties characterize it as a promising component for use in the food industry.

Practical application of concentrate

In the food industry

Rice lipids and rice bran oil are widely used in various sectors of the food industry. Due to the presence of biologically active substances, unsaturated fatty acids, and antioxidants, they are of great importance in increasing the nutritional value and technological quality of many products.

Rice bran protein-lipid concentrate:

- bakery products;
- confectionery products;
- baby food;
- can be used in the production of dietary and functional food.

The concentrate serves to enhance the biological value of the product.

In animal husbandry

The concentrate as a high-protein feed additive:

- birds;
- fish;
- can be used in cattle rations.

In pharmaceuticals and cosmetology

Biologically active substances in rice bran oil:

- antioxidant preparations;
- biologically active supplements;
- used in the production of cosmetic products.

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Technological problems and ways to resolve them

The main problem in processing rice bran is the rapid oxidation of lipids. This is explained by the high activity of the lipase enzyme.

To reduce this problem:

- infrared drying;
- thermal stabilization;
- inactivation of enzymes;
- it is recommended to use vacuum packaging methods.

Summary

As a result of the conducted research, it was determined that rice by-products, especially rice bran, are promising raw materials with high biological value. The research results demonstrated that rice bran contains high levels of protein, lipids, and biologically active components.

The possibility of obtaining a protein-lipid concentrate with high biological value from rice bran using modern extraction technologies has been substantiated. The resulting concentrate can be widely used in the food industry, animal husbandry, pharmaceuticals, and the production of functional nutrition products.

The comprehensive processing of secondary rice products plays an important role in increasing economic efficiency, reducing environmental problems, and effectively utilizing local raw materials.

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