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COMPARATIVE ASSESSMENT OF THE CHEMICAL COMPOSITION OF RICE AND GROUND RICE

Abstract. The article studies the chemical composition of rice and ground ricegrowing in Kazakhstanfor the production of ethyl alcohol. The results of the analysis of the study of the biochemical composition and content of macro - and micro elements in the composition of rice and ground rice are presented. The possibilities of obtaining ethyl alcohol from ground rice are also considered.

It is established that the accumulation of alcohol and volatile impurities depends on the characteristics of the enzyme preparation used at the stage of biotechnological processing, the state of the carbohydrate complex of raw materials and ways to prepare it for fermentation.

Key words: ethyl alcohol, rice, ground rice, biochemical composition, macro-and micro elements.

Introduction. Analysis of the state of the alcohol and liquor industry sets it difficult tasks, primarily to improve the technology and increase output; to reduce heat and power costs, to make more efficient use of raw materials, secondary resources and waste products, to increase the range, improve the quality, and competitive ability of products at the domestic and global level [1].

Kazakhstan has a great potential for implementing innovative projects in the rice industry, as the country has a strong research base and a developed field of education. If we consider the volume of rice production in Kazakhstan by region, we can see that the main areas engaged in rice production are the Kyzylorda, Almaty, Zhambyl and Turkestan regions. They account for more than 100 % of the gross rice harvest. It is safe to say that there is a "rice belt" in Kazakhstan, which unites the Kyzylorda, Almaty, Zhambyl and Turkestan regions.

The SWOT analysis of the rice industry allowed us to assess the possibilities of forming a rice cluster in Kazakhstan and characterize the situation as favorable based on the economic, organizational and resource prerequisites for creating a cluster. The calculated value of the coefficients of localization and per capita production for the rice industry in Kazakhstan is more than one, which allows us to conclude that the creation of a cluster in the rice industry is promising. Kazakhstan has significant advantages for creating a cluster in rice farming, for example, a large number of educational centers for training qualified specialists, a strong research base, and a positive role of the government in promoting cluster development. There are a sufficient number of enterprises in the Republic that can become the basis of a rice-growing cluster (Abzal and Kfull partnership, Nai-Mir limited

liability partnership, Region Of The Aral Sea rice research Institute, Zhalagash Elevator limited liability partnership, agro holding Baikonur limited liability partnership, etc.) [2].

It is known that the alcohol industry is a material-intensive industry. The share of grain in the cost of ethanol is more than 60%. At the same time, the reserves laid down in traditional grain processing technologies that do not provide for fractionation of raw materials and the production of several final products do not significantly increase the profitability of alcohol production [3].

As shown by domestic and foreign experience, the most effective way to use agricultural raw materials is the introduction of fundamentally new resource-saving technologies that provide deep complex processing. Such production methods make it possible to solve the problems of several processing industries simultaneously. The introduction of these technologies can increase the profitability of the main production by more than 30% [4,5].

The raw material for the production of alcohol is a variety of plant materials that contain sufficient amounts of fermentable sugars or other carbohydrates that can be sugared. The most widely used in the industry are starch-containing materials-grain (rye, wheat, corn, barley, oats, millet) and potatoes, sugar – containing materials-molasses (waste from sugar and starch production), defective sugar beet, as well as wood and waste from agricultural plants [6].

Rice is the most common cereal crop on our planet. They feed almost half of humanity and provide more than 30 % of the calories they consume. The use of rice is varied. The most valuable is grain, which is used for food and technical purposes. It contains 73-81 % carbohydrates, 6-9-protein, 0.6-2.6-fat, 0.8-2.0-ash, 0.2-1.0 % cellulose, vitamins. Rice protein is rich in lysine, valine, methionine and other essential amino acids. Rice groats are a valuable dietary product that has high nutritional properties. Hay and scrap obtained from processing raw rice are used to produce alcohol, special varieties of vodka (sake), beer, and starch, which is used in the cosmetics industry to produce rice powder [7].

One of the best accumulators of mineral compounds are plants. The main function of macronutrients is to build tissues, maintain a constant osmotic pressure, ion and acid-base composition. Microelements can increase the body's resistance to various influences [8,9]. Macro-and microelements have an undoubted therapeutic effect in the treatment of human and animal disease s[10]. In this regard, an urgent problem is the study of the mineral composition of rice and ground rice for the production of ethyl alcohol.

RESEARCH MATERIALS AND METHODS

The purpose of this work was to compare the chemical composition of rice and ground rice for the production of ethyl alcohol. Rice and ground rice from the Kyzylorda regionwere used as raw materials.The humidity of medicinal plant raw materials is the percentage of hygroscopic moisture and volatile substances.Air-dry raw materials usually contain 10-14% of hygroscopic water.Increased moisture

content in the raw material leads to its deterioration:the color of raw materials changes, there is a musty smell, mold, and active substances are destroyed.Such raw materials cannot be used.Therefore, the ND for each type of raw material sets the norm of moisture content (humidity) no higher than a certain value.For most types of medicinal plant raw materials, the permissible limit is up to 15%.Ash content represents the incombustible component remaining after a sample of the furnace oil is completely burned.Ash contains K, Na, MD, CA, Fe, C, Si, P, Si, Mn, AI and other elements.These elements are found in ash as oxides or salts of sulfur, phosphorus, and carbon dioxide [11, 12].

Determination of the mass fraction of protein by Kjeldahl method. The method is based on the mineralization of the product suspension when heated with concentrated sulfuric acid in the presence of catalysts.In this case, carbon and hydrogen of organic compounds are oxidized to carbon dioxide and water, nitrogen released as ammonia is combined in the flask with sulfuric acid, forming ammonium sulfate [13].

Methods for the determination of fatty oils. Fatty oils for analysis are extracted from vegetable raw materials in the Soxhlet Apparatus, however, they do not work with water, but with organic solvents (ether, chloroform, etc.). Then the solvent is distilled, and the resulting fat oil is analyzed qualitatively and quantitatively. Methods of refractometry, polarimetry, and gas-liquid chromatography are also widely used here, as well as determining the acid and ether numbers, the saponification number, the iodine number, etc. [14].

Determination of cellulose by the method of Kirschner and Haffer in the modification of A. I. Ermakov. The method is based on the oxidative destruction and dissolution of various compounds that are part of plants (including those that accompany cellulose) with solutions of nitric acid in alcohol and alcohol alkali.In this case, the cellulose is practically not dissolved, but filtered and weighed [15].

RESULTS AND DISCUSSION

Humidity and ash content of rice and ground rice were determined by gravimetric method.The mass fraction of protein was determined by the Kjeldahl method, cellulose by the Kirschner and Haffermethod in the modification of A. I. Ermakov. The fatty oilcontent was determined by gravimetric method using the Soxhlet Apparatus. The content of macro-and micro elements was determined by the method of atomic emission spectral analysis on the AAnalyst 400 device.

The results of the study are shown in tables 1 and 2.

Table 1 – Biochemical composition of rice and ground rice

№	Object of research	Humidity, %	Ash content, g	Starch, %	Cellulose, %	Protein, %	Fatty oil, %
1	Rice	14	0,35	53,6	2,62	10,0	2,0
2	Ground rice	12	0,40	53,4	2,56	9,86	1,96

From the information shown in table 1, it can be noted that the biochemical composition of the substances under study is approximately.

Table 2 – Content of macro-micro elements in the rice and ground rice

Elements	Content, %	Rice	Ground rice
Mg	10^0	>>1	>>1
Ca	10^0	>1	>1
K	10^0	>>1	>>1
Si	10^0	>1	≥1
B	10^0	1	≥1
Fe	10^0	≤1	0,03
Al	10^{-2}	100	100
Mn	10^{-2}	15	0,7
Ti	10^{-2}	2	10
Sr	10^{-2}	2,5	1,5
Na	10^0	>1	>1
Cu	10^{-3}	5	5
Ni	10^{-3}	0,5	0,3
Mo	10^{-4}	3,5	5
V	10^{-3}	0,3	0,35
Zn	10^{-3}	30	25
Ag	10^{-4}	1	0,7
Cr	10^{-3}	≤1	≤1
Pb	10^{-3}	0,35	<0,3

In the studied samples, 19 mineral compounds were found that were classified as macro-and micro elements (table 2). High content of macroelements of magnesium, calcium, potassium and microelements of silicon and boron was noted.

Conclusions. A comparative assessment of the chemical composition of rice and ground rice for the production of ethyl alcohol was carried out.It was found that the composition of rice and ground rice contains more starch.The analysis performed to identify the chemical composition of rice and ground riceshowed the presence of 19 mineral compounds related to macro-and micro elements.

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Резюме

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КҮРІШ ЖӘНЕ КҮРІШ АУСАҒЫНЫҢ ХИМИЯЛЫҚ ҚҰРАМЫН САЛЫСТЫРМАЛЫ ТҮРДЕ ЗЕРТТЕУ

Мақалада этил спиртін алу үшін Қазақстанда өсетін күріш және күріш аусағының химиялық құрамы зерттелген. Күріш және күріш аусағының биохимиялық құрамы және макро-микро элементтер мөлшерін зерттеу нәтижелері көрсетілген. Сонымен қатар күріш аусағынан этил спиртін алу мүмкіндіктері қарастырылған. Спирт және ұшқыш заттардың мөлшері биотехнологиялық өңдеу кезінде қолданылатын ферментті препараттың сипаттамасына, шикізат көмірсулар кешенінің күйіне және оны ашытуға дайындау тәсілдеріне байланысты екені анықталған.

Түйін сөздер: этил спирті, күріш, күріш аусағы,биохимиялық құрам, макро-микро элементтер.

Резюме

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СРАВНИТЕЛЬНАЯ ОЦЕНКА ХИМИЧЕСКОГО СОСТАВА РИСА И РИСОВОЙ СЕЧКИ

В статье изучен химический состав риса и рисовой сечки произрастающие в Казахстане для получения этилого спирта. Приведены результаты анализа исследования биохимического состава и содержание макро- и микро элементов в составе риса и рисовой сечки. А также рассмотрены возможности получения этилого спирта из рисовой сечки. Установлено, что накопление спирта и летучих примесей зависит от характеристик применяемого на стадии биотехнологической обработки ферментного препарата, состояния углеводного комплекса сырья и способов подготовки его к сбраживанию.

Ключевые слова: этиловый спирт, рис, рисовая сечка, биохимический состав, макро- и микроэлементы.