Preparation And Research Of Sorbents For Food Purification

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Abstract: The results of the use of adsorbents obtained from rice husks by a special technology in the process of purifying alcohols are presented. The data obtained illustrate the adsorption of organic impurities. It is also shown that the obtained adsorbents are promising in comparison with activated carbon.

Keywords: adsorbent, rice husk, ethyl alcohol, activated carbon**.**

1. Introduction

With the increasing requirements for the quality of food products, the issue of improving the quality and competitiveness of food products that meet international standards becomes relevant. The food industry of the Republic of Uzbekistan has been tasked with further modernization and diversification of the industry by transferring it to a qualitatively new level, aimed at the advanced development of high-tech processing industries, first of all, for the production of finished products based on deep processing of local raw materials; mastering the production of fundamentally new types of products and technologies, ensuring on this basis the competitiveness of domestic goods in foreign and domestic markets.

At present, serious requirements are imposed on the quality of food products. This, in turn, requires the improvement of purification processes, allowing to completely remove undesirable and harmful impurities to human health, while maintaining the quality of products.

For example, unrefined crude (black) vegetable oils, in addition to the main components of triglycerides, contain many related substances, which include free fatty acids, gossypol (cottonseed oil), chlorophyll and their derivatives, lipid oxidation products, soap residues, hydrocarbon solvent, wax-like substances, sterols, and others, which adversely affect the quality of oils. Many of these substances are removed in the adsorption refining process using dispersed activated adsorbents by the contact method. The efficiency of adsorption refining depends on the chemical composition and structure of the adsorbent [1, p.135-139].

To obtain an active adsorbent, we used industrial waste - rice husk. Adsorbents were obtained according to the following scheme (Fig. 1):

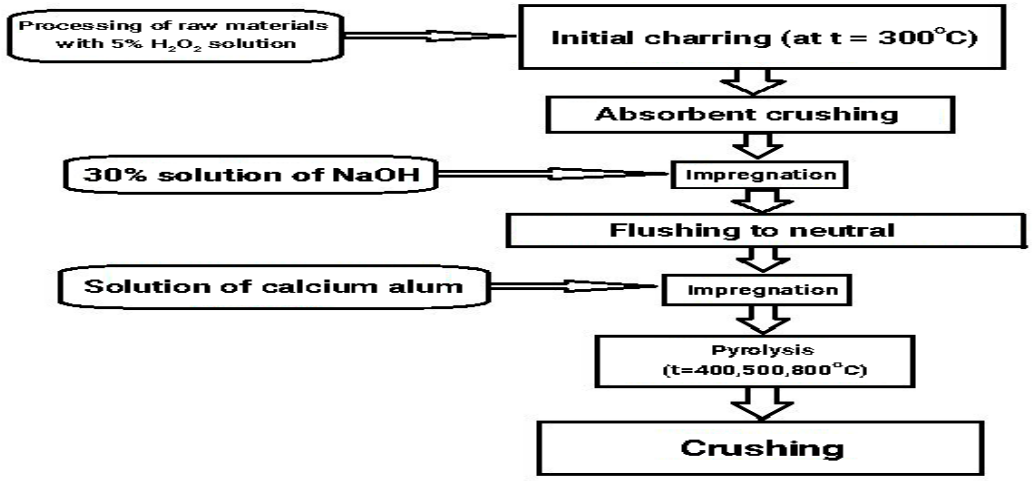

Fig. 1. Scheme of obtaining adsorbents from rice husk

To impart hydrophobic properties, the resulting raw material is subjected to heat treatment, pyrolysis. In the process of pyrolysis, the carboxyl and hydroxyl groups contained in the coal are destroyed, which leads to the hydrophobization of its organic mass [2, p.31-32].

To obtain a new adsorbent, before thermal activation, the raw material was treated with a solution of alum-calcium alum of various concentrations. Thermal pyrolysis of adsorbents was carried out without air access at temperatures of 400 ° C, 500 ° C, and 800 ° C. As a result of this treatment, the resulting sorbent has a high adsorption capacity.

In the production of ethyl alcohol for alcoholic beverages, various impurities are formed in it, which are by-products of alcoholic fermentation. The composition of such impurities includes various chemical substances: aldehydes, ketones, ethers, higher alcohols (fusel oils) and acids. The total content of these substances is 0.3-0.5%, but most of them have a harmful effect on the human body, have an unpleasant odor, and significantly reduce the quality indicators of products [3, p.295-300].

Fusel oil is a whole set of substances that are a by-product of alcoholic fermentation. In moonshine made from rye flour with a strength of 19% vol. contains 0.32% fusel oils, with a fortress of 45% vol. their content can reach 0.63%. Alcohol made from sugar, depending on the strength, can contain from 0.21 to 0.42% fusel oils, corn moonshine can contain up to 0.82%, barley - up to 0.52% fusel impurities. Fusel oil contains two groups of toxic substances, conventionally divided by boiling point: the first group includes substances with a boiling point below 78.4 degrees (boiling point for pure ethyl alcohol) - this includes acetaldehyde and ethyl acetate; the second group includes substances with a boiling point above 78.4 degrees - propyl alcohol, isopropyl alcohol, amyl alcohol, isoamyl alcohol, isobutyl alcohol, acetyl, oil-ethyl ether, furfural and many other little-known and unpleasant compounds. Isoamyl alcohol is especially poisonous (C_5H_4OH), making up 60% of the volume of fusel oil. When it gets on the skin, there is a burning sensation, the skin turns red, and bubbles are formed filled with a light liquid. When using isoamyl alcohol, a person does not experience pronounced discomfort immediately after taking it, and the stage of intoxication is also absent. But after 10-20 minutes, the experimenter "loads" and consistently enters a coma.

For the purification of alcohols in the food industry, solid adsorbents are used, which are capable of removing almost any organic impurities. The most widespread are activated carbons of the BAU-A brand (GOST 62-17-74) [4, p.3-5]. The main disadvantage of using these coals is the complexity of their regeneration, which undoubtedly affects the cost of the finished product.

In this direction, the use of an adsorbent obtained from rice husk seems to be promising. To study the properties of this adsorbent, experiments on the purification of alcohol and vodka were carried out.

When performing work to determine the amount of fusel oils in ethyl alcohol and vodka, we used the methodology given in GOST 10749.13-80 [5] and GOST 5363-93 [6].

During the study, we used an active adsorbent obtained by us from rice husk.

For control experiments, activated carbon of the BAU-A brand (GOST 62-17-74) (Russia) was used in an amount of 2 to 4%. In the main experiments, a new adsorbent was used in the same quantities. The results of the experiments are shown in table 1.

Table 1. Alcohol purification results

№	Name	Mass content of fusel oils in % or mg/l
1	Factory original alcohol	2 0,025% or 2,5 mg/l
2	Alcohol treated with BAU-A activated carbon in an amount of 2%	0,02% or 2 mg/l
3	Alcohol treated with husk adsorbent in the amount of 2%	0,019% or 1,9 mg/l
4	Alcohol treated with activated carbon of the BAU-A brand (GOST 62-17-74) in an amount of 4%	0,006 % or 0,6 mg/l
5	Alcohol treated with an adsorbent from husk in the amount of 4%	0,005% or 0,5 mg/l

As can be seen from table 1, the use of the obtained adsorbent in an amount of 2 to 4% led to a decrease in the content of fusel oils in alcohol from 0.02% to 0.005%.

The resulting adsorbent was used to purify vodka (blend). The obtained experimental data are shown in Table 2.

Table 2. Results of cleaning alcoholic beverages

№	Name	Mass content of fusel oils in % or mg/l
1	The original blend, with an alcohol content of 40% vol.	0,088% or 8,8 mg/l
2	Blend treated with activated carbon in an amount of 2%	0,06% or 6 mg/l
3	Blend treated with activated carbon in an amount of 4%	0,04% or 4 mg/l
4	Blend treated with a new adsorbent in the amount of 2%	0,036% or 3,6 mg/l
5	Blend treated with a new adsorbent in the amount of 4%	0,028% or 2,8 mg/l

As can be seen from table 2, the use of an adsorbent from rice husk instead of activated carbon gave results that were 60-70% higher than those of activated carbon.

Analyzes for the determination of fusel oils in experimental samples were carried out in the central control laboratory of the holding company "Uzplodovoschvinprom (Узплодовощвинпром)". The results of all experiments show that the use of the new adsorbent allows deeper purification of the finished product from organic impurities, and also helps to reduce its cost.

Studies have shown that adsorbents obtained from rice husks according to the developed technology can be used not only for the purification of vegetable oils, but also in the production of edible alcohols.

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