



OBTAINING AND RESEARCH OF SORBENTS FOR THE VEGETABLE OIL PURIFICATION

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ABSTRACT

To raise the sorption capacity of adsorbents obtained from rice husk, the feed is treated with hydrogen peroxide and fired. Before thermal activation, the resulting mass is enriched with a 30% solution of alum-calcium alum. According to the results of laboratory tests, adsorbents that have undergone thermal activation at a temperature of 500 and 800 ° C have whitening ability.

Key words: *adsorbent, rice husk, alum-calcium alum, activated carbon, thermal activation, whitening ability.*

The most important task of the oil and fat industry in modern conditions is the further improvement of engineering and technology, the provision of a high organization of production, which allows us to produce competitive products that meet the highest physiological and nutritional requirements, and withstand the continuously growing flow of food products from abroad on the market .

Vegetable oils contain a number of substances, the amount of which is small, but they determine the quality of oils and fats, significantly affect their technological properties. Adsorption refining (bleaching) is the most important stage of purification of vegetable oils from pigments, as well as the residual amount of phospholipids, salts of fatty acids remaining in oils after the previous stages of refining, and metal ions. The effectiveness of adsorption refining depends on the chemical composition and structure of the adsorbent [1, 135-139].

The problem of obtaining and searching for new sorbents for the purification of such oils, as well as the development of new sorption technologies, is relevant. Of particular interest are the large-tonnage production, such as, for example, timber processing, food industry.

Activated carbons take a leading place among the filtering materials. Activated carbons can be obtained from a variety of carbon-containing raw materials - wood, hard coal and brown coal, peat, etc. In the industrial production of activated carbon, coal, coconut shell and wood are most often used as raw materials; charcoal activated carbon is a unique sorbent [2 -5].

In the food industry, activated carbons of the BAU brand are most widely used: BAU-A - for the purification of alcoholic beverages, OU-B (wet acid coal) - for the purification of starch solutions, glucose, feed carotene, for the purification of xylitol, xylitan in the microbiological industry; OY-B - for cleaning and clarification of edible oils and fats, sugar syrups, glycerin and organic acids in the food industry.

Currently, raw materials for the production of BAU coal (crushed activated charcoal, GOST 6217-74) are grade A charcoal obtained from hard hardwoods, mainly from birch. In this regard, there is a problem both with raw materials in the production of charcoal, which is necessary for the production of activated carbons, and

with an increase in the production of charcoal and activated carbon [6, 106-109]. This problem is solved by expanding the raw material base and processing various types of plant materials.

In accordance with the adopted technology, the vapor-gas activation of carbon-containing raw materials is used in the production of carbon adsorbents, which includes two stages, pyrolysis and carbonization of the raw materials with the formation of a porous carbonized material. Then the latter is activated with an oxidizing agent at high temperature. The most commonly used oxidizing agent is steam [7, 315]. In this regard, the complex two-stage technology does not allow obtaining charcoal activated carbon with a yield of more than 15%.

The decisive influence on the pore structure of activated carbons is provided by the starting materials for their preparation. Activated carbons based on coconut shells are characterized by a larger proportion of micropores, and activated carbons based on coal - by a larger proportion of mesopores. A large proportion of macropores is characteristic of wood-based activated carbons.

The main way to obtain carbon adsorbents from wood, coal, peat, etc. Pyrolysis is considered, i.e., high-temperature heating without oxygen access, which is used in various countries, as well as in industrial enterprises of Russia, Ukraine, etc. The advantage of this method for producing carbon adsorbents is the simplicity of the technology used and the safety of its industrial application.

RESEARCH METHODS

In the research process, the following materials were used:

cottonseed oil that meets the requirements of TU Uz 816-2001 rev. 2 (table 1).

- NaOH meeting the requirements of GOST 11078-78;

- hydrogen peroxide;

- Calcium alum meeting the requirements of GOST 4329-77

Table 1
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Characteristics of prepress cottonseed oil

Name of indicator	Indicators
Acid number, mg KOH	2,6...4,0
Chromaticity, red units at 35 yellow	10...20
Humidity, volatiles%	0,2...0,3
Mechanical impurities, %	0,2...0,4

The color of cottonseed oil was determined using a Lovibond tintometer (AOCSCc 13e-92 method) [8, 235].

The oil intensity of the adsorbents was determined by the formula [9,]:

$$X = \frac{P_1 - (P_2 + P)}{P} 100, \quad (1)$$

where P_1 - is the weight of the funnel with a filter, clay and absorbed oil, g;

P_2 is the weight of the funnel with a filter soaked in oil, g;

P - a sorbent sample, g.

To obtain an active adsorbent, we used industrial waste - rice husk.

Adsorbents were prepared according to the following scheme (Fig. 1):

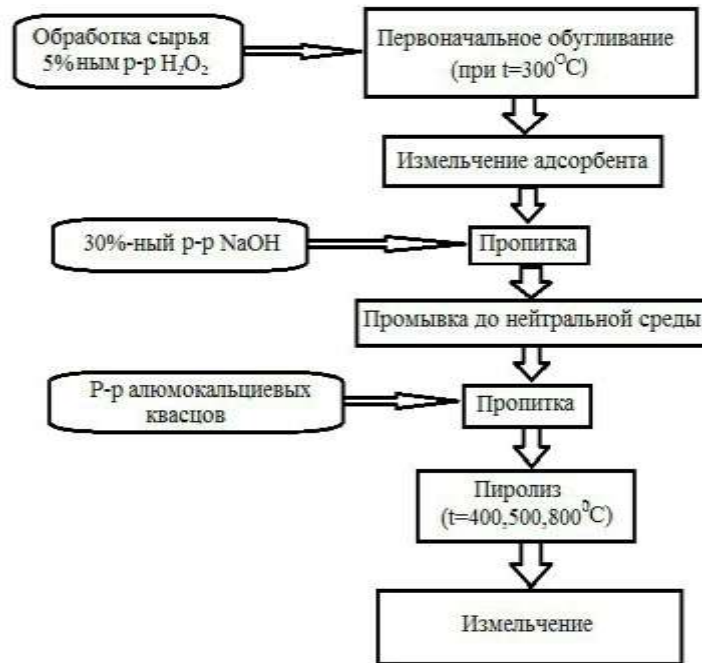


Fig. 1. The scheme for producing adsorbents from rice husks.

To impart hydrophobic properties, the obtained raw material is subjected to heat treatment and pyrolysis. During pyrolysis, carboxyl and hydroxyl groups contained in coal are destroyed, which leads to hydrophobization of its organic mass.

Before thermal activation, the raw materials were treated with a solution of alum-calcium alum of various concentrations. As a result of this treatment, the resulting sorbent has a high adsorption capacity.

Thermal pyrolysis of the adsorbents was carried out in a laboratory setup consisting of a vertical furnace with electric heating, a reactor, a thermocouple with a millivoltmeter, a gas collector for removing gases and liquid products from the reactor through a Würz glass flask, ice-cooled to trap tar and pyrogenic water; measuring device for measuring the gas outlet and the VTI-2 gas analyzer.

The crushed screened coal 2-5 mm in size was subjected to thermal pyrolysis without air at temperatures of 400 ° C, 500 ° C and 800 ° C.

The experiments were carried out as follows: a 50 g sample was poured into a reactor, which was a cylindrical container of heat-resistant material, closed at one end. The reactor with the test sample was heated to a predetermined temperature. Gases were collected in a gas collector, and tar and pyrogenic water were collected in a Würz glass flask, which was ice-cooled outside. Samples were treated with a 20% solution of alum-calcium alum.

In order to determine the optimal pyrolysis temperature of the obtained coals, we studied the physicochemical properties of the obtained adsorbents.

Acetone porosity was determined according to the procedure [10, 39]. Pre-dried to a constant weight, coal was poured into a weighed graduated cylinder with a capacity of 100 ml (diameter 25 mm). Filling the

cylinder to 100 ml tags was carried out in portions of 15-20 g, sealing the coal by shaking the cylinder after falling asleep for each portion. The cylinder with coal was weighed to an accuracy of 0.01 g and filled with acetone to a constant level of acetone above the coal layer. After 30 minutes excess acetone was drained and a cylinder with coal and weighed. The acetone x coal porosity (in vol.%) Was calculated by the formula [10, 39]:

$$x = \frac{(G''_{u,y} - G'_{u,y}) \cdot 100}{\rho V} = \frac{G''_{u,y} - G'_{u,y}}{\rho} \tag{2}$$

where: $G'_{u,y}$ - the weight of the cylinder with coal before impregnation with acetone, g; $G''_{u,y}$ - the weight of the cylinder with coal impregnated with acetone, g; ρ - density of acetone at the test temperature, g / cm³; V = 100 cm³ - volume of activated carbon.

The results are presented in table. 2.

Table2.

ActiveCarbonQuality

Sample	Pyrolysis temperature, °C	Acetone porosity, %
BAU activated carbon (control)	400	42,9
Sample № 1	400	42,0
BAU activated carbon (control)	500	44,4
Sample № 2	500	44,9
BAU activated carbon (control)	800	45,9
Sample № 3	800	46,2

The results obtained (Table 2) show that the porosity (according to acetone) of the obtained sample at a temperature of 400 ° C is - 42.0%; at 500 ° C - 44.9%; at 800 ° C - 46.2%. This means that the resulting adsorbent is not inferior in porosity to the known BAU activated carbon purchased from Russia. The studied activated adsorbents are stored in closed desiccators.

To study the adsorption properties of the obtained samples were tested in the process of bleaching cottonseed oil. Comparative bleaching was performed in a laboratory unit for adsorption refining (Fig. 2) using the obtained carbon adsorbents in an amount of 1% by weight of oil.

This installation allows you to bleach vegetable oils at 70-90 ° C and mixing the phases at a speed of 100-150 rpm

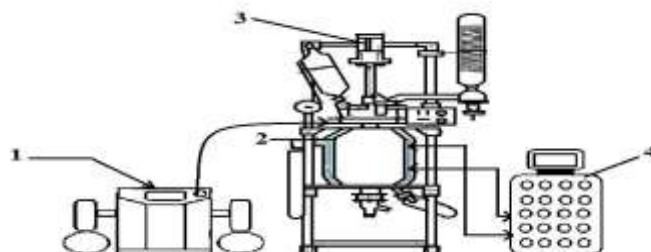


Fig. 2. Laboratory unit for the adsorption treatment of cottonseed oil

The laboratory installation includes: 1-vacuum system; 2-adsorber (reactor); 3-stirrer; 4-thermostat.

The experiments on this installation are carried out in the following order: the purified vegetable oil

and the required amount of the studied powdered adsorbent are loaded into the adsorber. The bleaching of vegetable oil begins with stirring the suspension (oil adsorbent) using a mixer at a temperature of 90 ± 5 ° C. The temperature in the adsorber is measured using a thermometer.

The results of bleaching cottonseed oils are given in table. 3.

Table 3

Whitening ability of adsorbents obtained at various temperatures of heat treatment

Adsorbent	Heattreatment temperature ⁰ C	Adsorbent consumption for bleaching,% by weight of oil	The initial color of the oil at 35 yellow., Cr. units	The color of the oil after bleaching at 35 yellow., cr. units	Whiteningability by adsorbent %
Activatedcarbon BAU (control)	400	1,0	16,0	11,3	29,4
Sample № 1	400	1,0	16,0	11,5	28,1
Activatedcarbon BAU (control)	500	1,0	16,0	11,0	31,2
Sample№ 2	500	1,0	16,0	10,8	32,5
Activatedcarbon BAU (control)	800	1,0	16,0	9,9	38,1
Sample№ 3	800	1,0	16,0	9,5	40,5

From the data of Table 3 it can be seen that the carbon adsorbents obtained by heat treatment at a temperature of 500 ° C and 800 ° C have high porosity, and in adsorption properties they surpass activated carbon of the BAU brand (Russia).

The bleaching ability of the obtained adsorbent at a consumption of 1% by weight of cotton neutralized oil with an initial color of 16 red units at 35 yellow units in a 13.5 cm Lovibond layer is at least 40%.

It should be noted that during thermal pyrolysis of the sample at 800 ° C, the color of the oil is significantly reduced compared to other samples. This means that during thermal activation, an increase in temperature has a positive effect on the activity of the adsorbent. However, the degree of charring is enhanced and the yield of the finished adsorbent is reduced. In addition, it should be noted that during heat treatment of coal above 700 ° C, gases are released that cannot be released into the atmosphere, because they pollute the environment.

CONCLUSION

The developed technology for producing adsorbent from rice husk differs in that for the purpose of highly efficient oxidation of the constituents, rice husk is first treated with hydrogen peroxide and then enriched with a 30% solution of alum-calcium alum. The adsorbent enriched with alum undergoes thermal activation at a

temperature of 400 ... 800 ° C without oxygen for two hours. As a result, the porosity of the obtained adsorbents increases in comparison with the known activated carbon, which positively affects their sorption properties.

According to the results of laboratory tests, the whitening ability of adsorbents enriched with aluminum calcium alum, when heat treated at a temperature of 500 ... 8000C, increases and amount to 30-40% by oil.

REFERENCES

1. Arutyunyan N.S., Kornena E.P., Nesterova E.A. Refining oils and fats. Tutorial. St. Petersburg. GIORD. 2004. - 288 p.
2. Proctor A., Clark P.C. and Parcer C.A. [Rice hull ash adsorbent performance under commercial soy oil bleaching conditions]. USA, 1995. 459 ... 462p.
3. Moneyless L.A., Alekseeva T.N., Shalugin V.S. New adsorbents from vegetable waste for adsorption purification of vegetable oils. Newsletter KDPU imeni Mikhail Ostrogradsky. Vipusk 5/2007 (46). Chastina 1. S. 122-125.
4. Moneyless L.A., Shmandiy V.M. Kinetic patterns of adsorption purification of sunflower oil with a sorbent obtained from waste // Skidno-Evropian Journal of Advanced Technologies. - Kharkov, 2004. -- 3 (9). - S. 88-91.
5. Yuryev Yu.L. About raw materials for producing active carbon BAU / Yu.L. Yuryev, H.A. Nichkov // "Hydrolysis and chemical industry." - 1991. - No. 8. - S. 10.
6. Keltsev N.V. The basics of adsorption technology. Leningrad. Chemistry - 1984. 512 s.
7. American Oil Chemists 'Society. (1997). Official methods and recommended practices of the AOCS (5th ed.). Champaign: AOCS Press.
8. A guide to research methods, technological control and accounting of production in the oil and fat industry. // L.: VNIIZh, t.1, 1967, -585 s.
9. Kolyshkin D.A. and Mikhailova KK, Active carbons. Properties and test methods. Handbook, L.: Chemistry.-1972, - 56 p.