WEB OF SYNERGY:
International Interdisciplinary Research Journal
*Volume 2 Issue 5, Year 2023 ISSN: 2835-3013*
*https://univerpubl.com/index.php/synergy*

# Direction of Semi-Cellulose and High-Purity Cellulose from the Kavrak Plant to the Process of Obtaining Organic Substances and Products Based on them for Various Industry Sectors

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**Article Information**

**Received:** March 29, 2023
**Accepted:** April 29, 2023
**Published:** May 31, 2023

**Keywords:** *alkali coagulation, turbidity, ash content, cotton lint, Ugar, Ulyuk, degree of polymerization, pentosan, moisture, cellulose, concentration, parometer, optimal conditions, destruction.*

**ABSTRACT**

*Currently, as the chemical industry develops, it occupies one of the leading positions. A number of works are being carried out on the development of the chemical industry and the replacement of existing technologies from its branches with new ones, and on the basis of them, management of production on the basis of new technologies. A number of enterprises are operating only in the field of production of cellulose and its products.*

*The demand for paper and paper products in our country is extremely high. In order to satisfy the demand for paper products, there was a need to create new technologies and strengthen the system of paper and paper products production.*

Research and physicochemical analysis of paper and paper types for functional food industry from kavrak-based hemicellulose.

It is known that nowadays in our Republic, importance is attached to the development of various fields of science. In particular, in terms of training of mature personnel, deep reforms are being carried out based on the criteria of world requirements. Because for the further development of the economy of our Republic, for the production of high-quality, competitive products based on the demands of the new era in various industrial enterprises, there is definitely a high demand for qualified personnel.

Currently, as the chemical industry develops, it occupies one of the leading positions. A number of works are being carried out on the development of the chemical industry and the replacement of existing technologies from its branches with new ones, and on the basis of them, management

of production on the basis of new technologies. A number of enterprises are operating only in the field of production of cellulose and its products.

The demand for paper and paper products in our country is extremely high. In order to satisfy the demand for paper products, there was a need to create new technologies for the production of paper and paper products, and to further strengthen the system.

Paper is a material with a density of 250 g/m$^2$ consisting mainly of cellulose fibers in the form of a sheet or strip (tape).

Paper production is one of the largest industries of the national economy in the world. By now, more than 1,000 types of papers with different properties are being produced in the industry. Paper and paper products can be thin, thick, electrically conductive, electrically protective, waterproof, thin, strong, rough, vapor, various gas, grease-proof. To give the paper the necessary properties, mineral fillers, glue and other substances are added to the paper pulp.

The process of giving shape to paper is carried out by transferring the pulp of fiber paper diluted with water to the mesh part of the paper making machine. The main technical parameters of paper: surface density (4-240 g/m$^2$), thickness (4-400 μm), breaking length (1200-3500 m), breaking resistance (10000) and degree of adhesion (0-3 mm), whiteness ( 0-95%), majority (0-25%). Also, paper's technical parameters include swelling properties, air, steam and oil permeability, puncture resistance, humidity and other parameters.

It is possible to obtain paper with different properties depending on the nature and composition of the fiber components, the treatment given to them, the amount of fillers and adhesives.

The length of cellulose fibers, which make up the basis of paper, is 100-1000 times greater than their diameter. Inside the fiber (cell) there are channels and capillaries through which air and moisture can enter. The length of cellulose obtained from spruce, pine, birch, poplar is on average 2.5-3 mm, and the cellulose obtained from flax, cotton, hemp is 20-25 mm, and the diameter is 25 μm. Cellulose has a very complex and fibrillar structure of the cell membrane. Between the fibrils there are hemicellulose and lignin substances, the amount of which increases from the inner layer of the cell walls to the outer layer. The space between the macromolecules of cellulose is mainly filled with lignin. In the absolute dry wood of various types of trees, the amount of cellulose is up to 60%, hemicellulose is 20% and lignin is about 30%. In addition, they contain a certain amount of mineral salts and up to 3% (in pine) resinous substances.

Fibrous materials are widely used in various sectors of the economy, in technology, in everyday life: these are natural and artificial fibers - cotton, jute, linen, kapron, lavsan, asbestos and so on.

Elasticity is mainly characteristic of organic fibers, while crushing or splitting into fibrils is characteristic only of plant fibers. Pure cellulose fiber is distinguished by its whiteness, flexibility, hardness and elasticity. This is the factor that ensures the advantage of plant fibers in paper production.

Paper and paper products must be able to meet the requirements of technological economy and consumption in terms of quality indicators. A sheet of paper with light weight, i.e., thin enough strength, will have a flat and stronger surface than paper products with a high density.

Improving the production technology of paper products with high quality indicators and introducing innovative technologies created on the basis of new scientific developments into production on an industrial scale will help ensure the demand for paper products in our Republic.

The process of paper production includes the following stages:

- preparation of paper pulp, mixing with various components, gluing, adding fillers.
- mastering the mass at the initial and final stages of the paper casting machine, i.e. preparation of aqueous mixture, cleaning of various impurities, pouring of mass, pressing, drying and

primary processing.

- final processing, i.e. fine grinding in a calender and cutting in the required formats.
- sorting and packing.

Achieving the desired fiber length is directly related to the pulping stage to obtain paper with physical properties. Grinding process is carried out in continuous and continuously working conical and disc mills, grinding equipment such as "roll", refiner.

Substances such as rosin glue, paraffin emulsion, sandy soil are added to the paper mass in order to give the paper a feature intended for smooth writing and to improve its hydrophobic properties.

In order to increase the mechanical strength of the fibers in the paper pulp, starch and animal glue are added, and urine and melamine-formaldehyde resins are added to increase the strength of the wet paper. In order to ensure the level of whiteness, smoothness and softness of the paper, as well as the complete and flawless implementation of the copying process, it is advisable to add various mineral fillers (kaolin, mel, talc), and aniline-containing components to the mass composition.

The types of paper used for water absorption and electrical insulation are produced without glue or fillers. The whiteness of hemp and wheat straw cellulose is higher than that of tree cellulose. This greatly reduces the consumption of chemical bleaching reagents in the process of paper production based on them. For paper production, 2.5-3.5% ready-made paper pulp is pumped from the pulp preparation department into the mixing pool. Here it is mixed with a circulating aqueous mass of 0.1-0.7% and transferred to the paper casting machine. The machine will consist of different tables, press, drying parts and calendering section. The paper pulp is continuously passed through the different table sections of the paper casting machine and is partially dewatered. The rest of the dehydration and strengthening is carried out in the press part of the apparatus. Then a certain amount of moisture in the paper is dried in the drying section. The dried coarse, crumpled paper web is passed between calender shafts and smoothed, giving the paper a high degree of strength. The paper web that has passed through the calender is wound on the drums.

Water is used a lot in the paper production industry, for example, 150 m3 of clean water was used to produce 1 ton of paper. There are rare and other types of paper, the production of which required 4000 m3/t of fresh water. By the second half of the XX century, a "closed system" was applied to production. This led to a several-fold reduction in water consumption by "10 $m^3$ /t". It has even become possible to produce paper by air-dry method without using water in a dispersed medium.

It is difficult to imagine the future of any industry without the modern machinery and equipment used in it. The perspective of the paper production industry is also created and created, without water dependence on the machines working on the basis of advanced technology.

It is known that physical and mechanical properties of paper, paper production technology, quality parameters of fibrous raw material depend on its type. Fibrous raw materials are obtained mainly from plants, that is, from deciduous and coniferous tree species, as well as from trunks and rootstocks of annual plants as a result of mechanical and chemical processing. Their chemical structure, morphological formation of fibers are fully covered in many literatures. That's why we won't dwell on it.

The main part of plant fibers is a natural polymer, that is, cellulose. Cellulose-based paper types are characterized by high strength as a result of the fact that paper fibers obtained from cellulose with high quality indicators form a strong bond without cross-linkers. Cellulose has a high molecular weight and dissolves well in water. Can withstand various chemical reagents and high

temperatures.

The burning process is one of the most important stages of the paper manufacturing industry. This process is an important factor in improving the quality indicators of paper and its physical and mechanical properties. Almost all parameters of the paper obtained on the basis of fibers that have not passed through the burning process do not meet the quality requirements. For example, the non-uniform appearance of the paper, the presence of large porous layers, and the formation of a rough layer on the surface of the paper as a result of the irregular arrangement of fibers due to its lack of density are examples of this. In addition, during the process of paper pouring, thick and long fibers settle down in the machine and cause the structure of the paper being poured as a result of various distribution to be disturbed. Unground fiber has a rough surface, high water permeability, and low adhesion. The purpose of pulp crushing is to eliminate the above disadvantages, namely:

- matching width and height dimensions, which ensures the exact structure of the fiber:
- production of paper that provides fractional aggregation, i.e. has the required density:
- as a result of creating a level of hydration, water molecules are located in the fiber structure and ensure that they are connected through hydrogen bonds:
- give the fiber smoothness, increase its mechanical resistance, ensure its connection with various chemical fillers:
- waterproofing, air tightness, ensuring the clarity of the paper.

The process of shredding paper pulp is carried out in various machines and devices. This equipment consists of continuous and continuous "roll", disk and cone mill, refiner. The mass of paper passing through these machines will be 2-8% water. No matter what type of equipment the burning process is carried out, their level of performance is the same. The fiber suspension continuously passes through the shredding blades located inside the device. Grinding blades are movable in disc or conical mills and fixed in the cone housing.

Taking into account the above, during the research, composite paper samples were taken on the basis of kavrak cellulose and various local object celluloses.

Below is a table comparing some quality indicators of composite paper samples based on Kavrak semi-cellulose and straw and cotton cellulose with the requirements of the Interstate standard (GOST) 7247-2006.

**1 - T a b l e Comparison table of some quality indicators of composite paper samples based on kavrak semi-cellulose and straw and cotton cellulose with the requirements of the Interstate standard (GOST) 7247-2006**

| Indicators | Value for paper stamps | | | | Methods of detection |
|---|---|---|---|---|---|
| | 1-example | GOST 7247-2006 | 2-example | GOST 7247-2006 | |
| 1. Weight of paper area 1 $m^2$, g | 195 ± 8 | 180 ± 5 | 90 ± 5 | 80 ± 3 | BY GOST 13199 |
| 2. The thickness is MKM | - | - | 115 ± 5 | 110 ± 5 | BY GOST 27015, 9.4 the real standard |
| 3. Density, g/$cm^3$, not less | 0,74 | 0,80 | - | - | BY GOST 27015 |
| 4. The breaking force in the transverse | 82 | 75 | 45 | 40 | BY GOST |

| Indicators | Value for paper stamps | | | | Methods of detection |
|---|---|---|---|---|---|
| | 1-example | GOST 7247-2006 | 2-example | GOST 7247-2006 | |
| direction, N, is not less | | | | | 1924-1 |
| 5. Tensile tensile strength, N, in the wet state when treated with water for 6 minutes, not less | - | - | - | - | BY GOST 13525.7 |
| 6. The relative elongation in the transverse direction, %, is not less | 2,3 | 2,0 | 3,1 | 2,8 | BY GOST 1924-1 |
| 7. The level of whiteness in the upper part, %, is not low | 85 | 80 | 82 | 80 | BY GOST 30113 |
| 8. When wetting the paper on one side with the area, the surface absorption of water is 1 m2, g, Kobb60, not less | 24 | 25 | 25 | 25 | BY GOST 12605 |
| 9. the smoothness of the upper part, s, is not less | 18 | 20 | 21 | 20 | BY GOST 12795 |
| 10. Humidity, % | 5 – 8 | | | | BY GOST 13525 19 |

It can be seen from the table that the paper samples obtained on the basis of composite objects meet the requirements of GOST 7247-2006. In this way, paper and paper products were obtained from cellulose pulp for functional food products and composite mixtures of various local plant celluloses. Their quality indicators were determined.

**Research of physico-chemical analysis methods on the extraction, production and quality indicators of its simple ester croscarmellose (E468), which is used as an emulsifier for the food industry on the basis of kavrak cellulose.**

For a long time, the status of food additive E-468 was unclear due to many studies, debates and disagreements in the scientific community. GOST 33782-2016 approved in July 2016 (the document entered into force on 03.01.2017) classified the synthetic substance as a stabilizer. Additive E468 is the sodium salt of cellulose glycol acid. This is the result of a multi-stage chemical reaction.

The first natural cotton is treated less quickly with the help of caustic alkali with tree cellulose. Carbon dioxide in the presence of chloroacetic acid is added to the obtained alkaline cellulose (carboxylated). In the final stages, the substance is oxidized, cleaned and dried until the fibers are partially cross-linked.

**2-Table Quality indicators of croscarmellose (carboxymethylcellulose) obtained in the composition of cotton cellulose composite with kavrak cellulose.**

| **Indicators** | **Standard values** |
|---|---|
| color | white |
| Composition | carboxymethylcellulose, admixtures, table salt, sodium glycolate, unsubstituted cellulose, empirical formula: $(C_8H_{11}O_8Na)n \bullet x\ H_2O$ |
| Appearance | Powder in appearance |
| The smell | without smell |

| | |
|---|---|
| Solubility | 98,4% |
| Composition of ethoxyl groups | Swells by partially dissolving in cold water. Insoluble in organic solutions |
| The taste | tasteless |
| Density | not defined |
| Other indicators | high hydrophilicity, 1g of the product absorbs about 200ml of water, pH 5-7 (1g per 1000ml of water) |

**Research, physical-chemical and mechanical-structural properties of organic composite materials obtained on the basis of kavrak cellulose.** Below is the IR-spectrum of a composite paper made of kraft hemicellulose and straw cellulose.

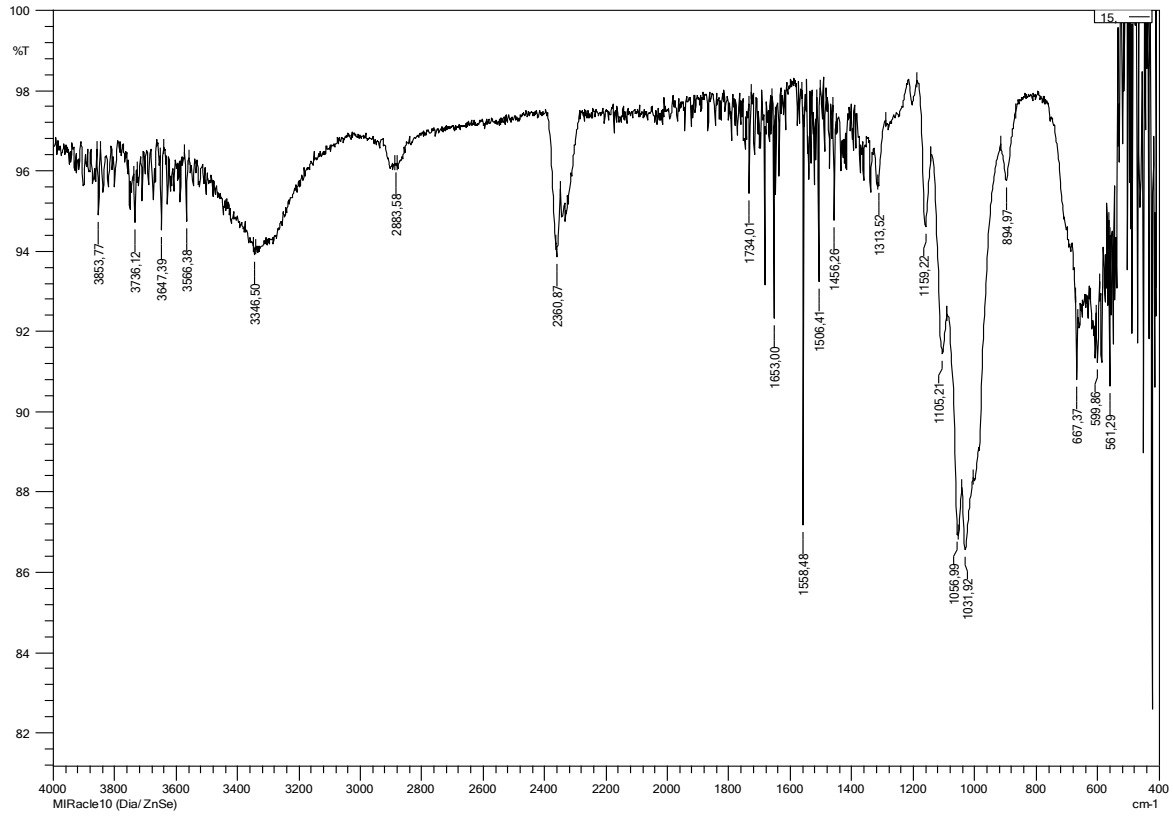



**Fig - 1. IR-spectrum of composite paper of kavrak hemicellulose and straw cellulose**

It can be observed from the peaks of the IR-spectrum at the values of 1600 to 600 and 400 that the processing of composite fiber raw materials based on domestic raw materials and cellulose pulp will allow to obtain paper products from it in the future.

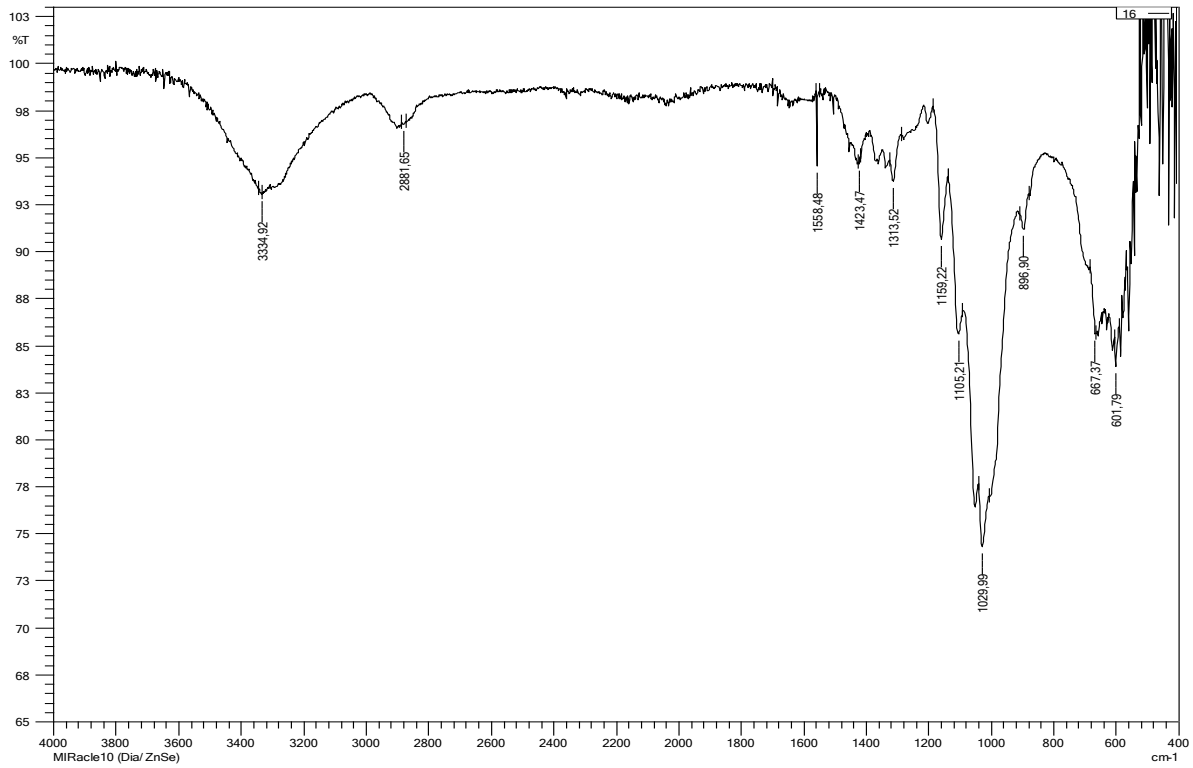



**Fig - 2. IR-spectrum of Kavrak hemicellulose**

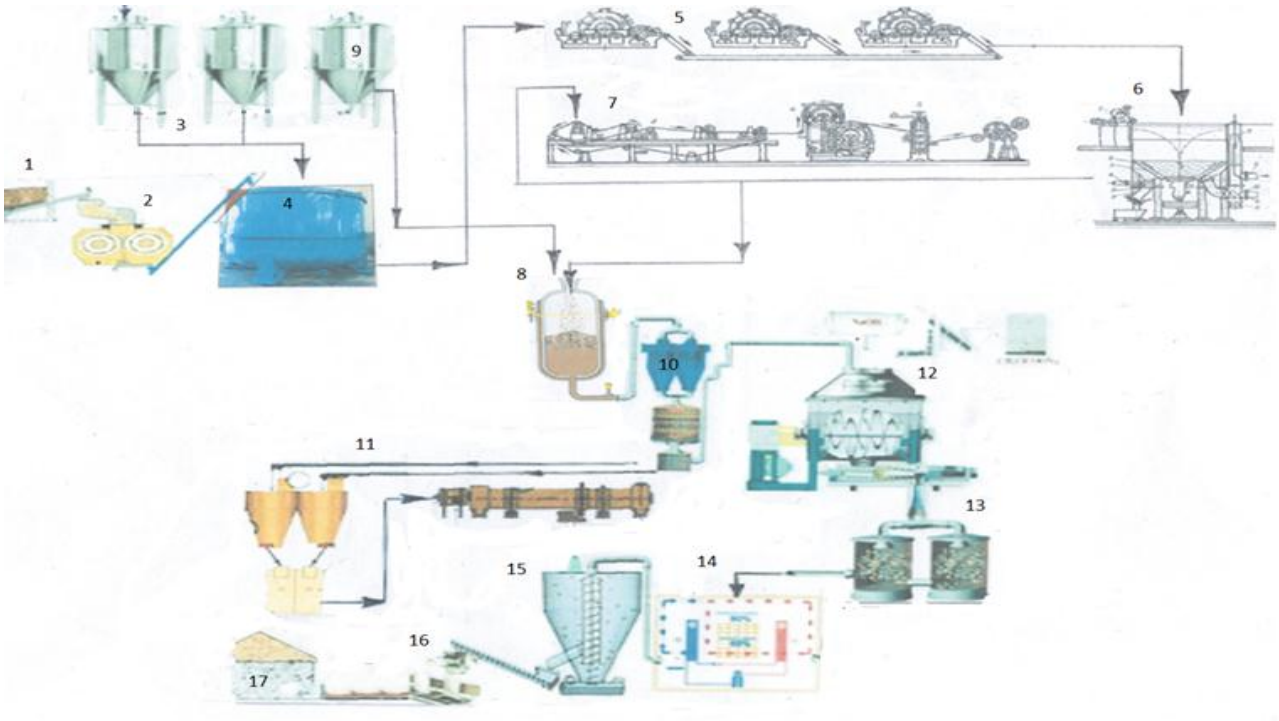
It is possible to observe the peaks of the IR-spectra, i.e. 2800, 3400 and 1200 and 800 and 600 spectrum peaks, the component of hemicellulose separated after the delignification process, i.e. lignin-based mineral bricks, and the manifestation of hydroxyl groups.

**4.4. The innovative technology of obtaining organic substances and products based on them for various industrial sectors from the local raw material "Asafetida-kavrak (ferula foetida, ferula tadshikorum)" is a principled technological scheme.**

Below is the principle scheme of the created innovative technology for obtaining organic substances and products based on them for various industrial sectors from the local raw material "Asafetida- kavrak (ferula foetida, ferula tadshikorum)" plant, and it is recommended for production on an industrial scale. It can be observed from the technological principle scheme that initially the stalks of kavark (1) are separated in special mills (2) into strips. Nitric acid is poured from a previously prepared solution (3) into a container (4) with a peat moss, and pyrolysis processes are carried out.

**The principle scheme of the created innovative technology of obtaining organic substances and products based on them for various industrial sectors from the local raw material "Asafetida- kavrak**

**(ferula foetida, ferula tadshikorum)"**




**3-fig:** 1-Cake stalks, 2-Crushing mill, 3-$HNO_3$ storage tank, 4-Special hydrolysis tank, 5-ROLL-crushing mill, 6-Hydrotizer, 7-Paper casting machine, 8-Cooking boiler, 9-NaOH solution storage tank, 10-centrifuge, 11-alkaline ball bending schematic device assembly, 12-monoapparatus, 13-oxidation capacity, 14-drying chamber, 15-cyclone bender, 16-mill, 17-finished product warehouse.

At the end of the acid hydrolysis process, the fiber is neutralized and transferred to the ROLL crushing unit (5). Here, the process of dlegnifikatsya is carried out under the influence of a certain concentration of the agent and temperature. The hemicellulose extracted from cowpea fibers is crushed into a watery solution under the influence of a large shear force in a HYDROTYPE (6) and transferred to the process of obtaining packaging paper for functional foods (7).

Hemicellulose is transferred to the process of obtaining pulp suitable for chemical processing. It is loaded into the boiling pot (8) and the cooking process is carried out for 6 hours under a pressure of 2 atm in a 20g/l alkali solution. The resulting cellulose is neutralized and compressed with the help of centrifuges (11) and directed to the production process of CROSCARMELOSE. The operation continues in the monoapparatus (12) and in the heating capacity (13). The resulting mixture is dried (14) and brought to a powder state in mills (16) through a cyclone (15) - it is placed in warehouses (17).

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