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Steps of the Process of Obtaining Paper and Paper Products from the Cellulose of the Pavlovnia Tree

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During the next study, the stages of the process of obtaining paper and paper products from the pulp of the Pavlovnia tree were studied.

The paper production process 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, casting 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 pulp.

Types of paper used for waterproofing and electrical insulation are produced without glue or fillers. The degree of 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 consists of different tables, press, drying parts and calender 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 done in the press part of the machine. Then a certain amount of moisture in the paper is dried in the drying section. The dried coarse, crumpled paper web is

sanded by passing between calender shafts, giving the paper a high degree of strength. The paper web passed through the calender is wound on drums.

Water is used a lot in the paper production industry, for example, 150 m^3 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 m^3/t of fresh water. By the second half of the XX century, a "closed system" was applied to the 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.

Equipment used in paper production:

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 their high strength, as a result of the fact that the fibers of cellulose-based paper with high quality indicators form a strong bond without interlinkers. Cellulose has a high molecular weight and dissolves well in water. It can withstand various chemical reagents and high temperature.

The burning process is one of the important stages of the paper production industry. This process is an important factor in improving the quality indicators of paper and its physical and mechanical properties. Almost all indicators of 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. The surface of the raw fiber is rough, has a high tendency to transfer water, and has a low level of friction with each other, that is, 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 settle 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 pulping process is carried out on various machines and devices. This equipment consists of continuous and continuous "roll", disk and cone mill, refiner. The mass of paper passing through these devices is 2-8% water. No matter what type of equipment the burning process is carried out, their performance level is the same. The fiber suspension continuously passes through the grinding blades located inside the unit. Grinding blades are movable in disc or conical mills and fixed in the cone housing.

In addition to determining the level of adhesiveness, the quality paper was also measured by its water absorption and water impermeability. The effect of Na-KMTs on the cited indicators of these papers is expressed.

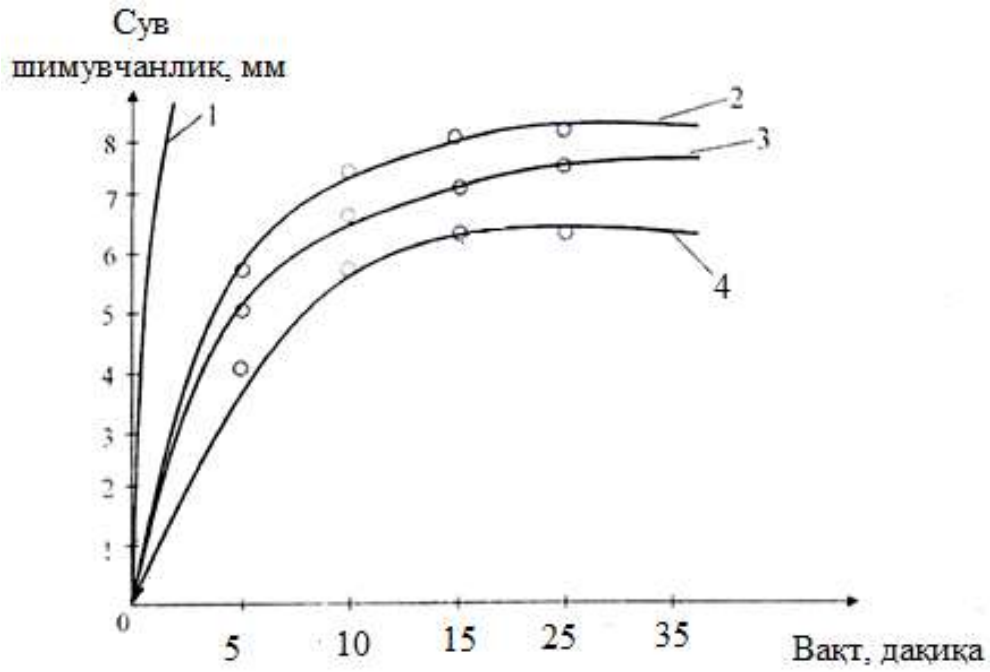


Figure 1. A. The effect of the concentration of KMTs on the water absorption properties of paper made from Gypych straw cellulose:

1st processing is not given; 2- 0.5%; 3- 1%; 4- 1.5%; 5-2%.

The working mechanism of paper shredder mills is the same, that is, they are based on grinding the aqueous mass with knives and teeth.

The figure shows a fiber suspension passing water between a pair of 4 mm thick blades, one fixed and the other moving at high speed. In this process, the stages of fiber structure change can be observed. In this case, the diameter of the fiber is 20 μm.

Blades can become dull as a result of friction, corrosion and similar factors.

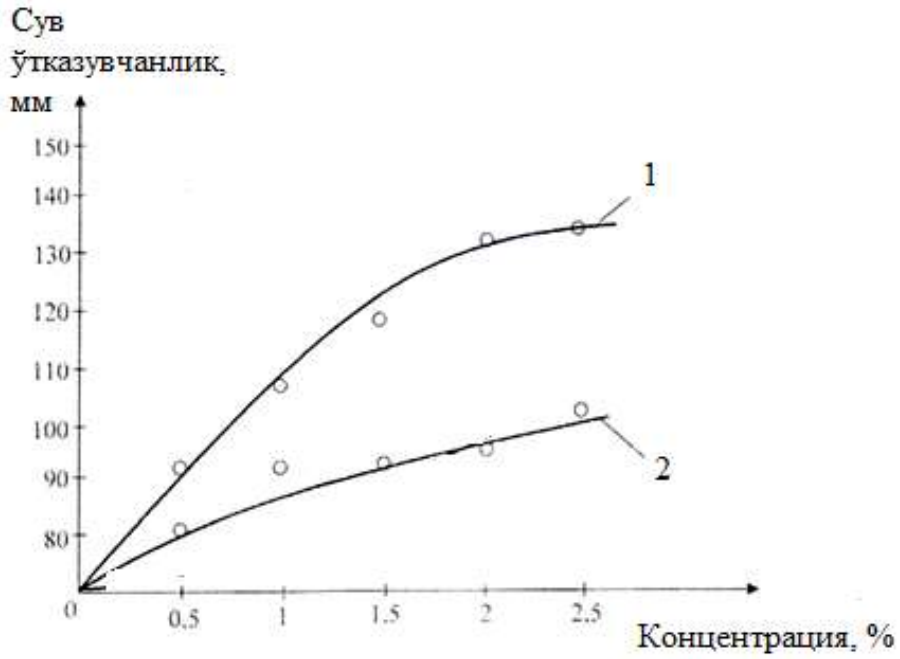
Cutting of fiber in aqueous suspension by mill blades takes place in 3 different ways (Fig. 2.6. a, b, c). When the thin fiber passes between the knife teeth, it enlarges and breaks (Fig. 2.6, c). Coarse-looking fiber, for example, dry fiber, that is, the grinding of non-chipped fiber, is represented in Fig. 2.6 a, case. In addition to fiber crushing, shortening, and crushing stages, external and internal fibrillation, as well as partial breakage, are observed in the fiber. Such changes occur as a result of the collision of mill blades moving at a certain angle.

For cases "b" and "g" in Figure 2.6, the fibers are not only crushed between the blades, but the fibers are stretched under the influence of rotational and torsional forces, and in case "d" the fibers are elongated. The "j" in this figure represents the uniform orientation of the compressed fibers between the blades.

Fig – 2.

The different types of fibers in the above images are conventionally represented, the fiber suspension moves randomly between the blades, and the presented images are simultaneously realized between the fiber and the blades. Depending on the type of paper, the level of its shredding is determined, and the paper mass is crushed based on the views given above.

It can be seen from the following pictures that the amount of Na-KMTs required for making paper from pavlovian cellulose to increase its waterproofing, water absorption and adhesiveness level is less than when making paper from the cellulose of one-year-old plants.



1- Paper made from paulownia wood pulp;

2-Paper made from cotton pulp.

3 – Fig. The effect of KMTs concentration on the water permeability property of paper

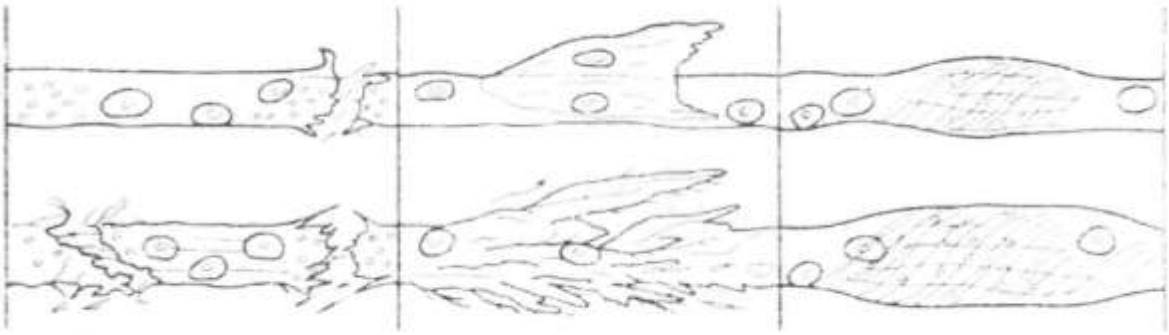
The figure shows three different effects of the fiber grinding process on the fiber.

First, the fiber is shortened, that is, it breaks (first from the thin part of the fiber). As a result of such a process, the cut parts of the fiber have a saw-like appearance.

The second is the external fibrillation of the fiber, that is, it is observed that it breaks up into small fibers as a result of friction. This process often occurs with the destruction of the primary wall in the fiber.

Sometimes the inner layer of the fiber is attached to the secondary wall and fibrils, microfibrils, nanofibrils and cellulose molecules, as well as the hemicellulose surface, can be observed under the microscope. In some variations, the fibrils exhibit very thin sheets (plates) within which the cell envelope is located.

Fig-4



Third, internal fibrillation is observed in the fiber as a result of crushing, rubbing, grinding, and grinding the fiber under pressure.

Fiber changes its internal and external structure based on the above-mentioned factor. Such structural changes determine the quality index of all types of paper.

In addition, the special properties of pavlovian cellulose in gluing the paper obtained from it through KMTs and the positive change of water permeability properties compared to other samples are expressed in the table below.

1-table Glued paper feature

The composition of the glue	Glue ratio, %	Water ratio, %	Name of the paper,	Confusion, t-20°C C	Paste speed, C	1m^2 paper mass g/l	Paper humidity%	The degree of ash of the paper, %
KMTs/water	0,5	99,5	T-A	25-30	20-22	72,6	3,01	2,98
	1	99	T-A	35-37	18-22	72,7	3,81	2,24
	1,5	98,5	T-A	39-43	22-23	73	3,62	2,00
	2	98	T-A	42-45	17-23	73	3,91	2,18
	0,5	99,5	П-С	25-30	23-25	71,6	3,02	3,01
	1	99	П-С	35-37	16-18	71,8	3,41	3,21
	1,5	98,5	П-С	39-44	25-26	71,9	3,51	3,08
	2	98	П-С	42-46	22-25	71,8	3,40	3,08

T-A- Paper made from poplar wood cellulose;

П-С- Paper made from cotton cellulose.

The process of cleaning paper pulp is an important step in paper production. Pulp cleaning not only affects the quality of the paper, but also ensures smooth operation of the paper casting machines and equipment without any malfunctions. Pulp cleaning is considered a process before paper casting. Various impurities in the mass are cleaned, including mechanical, metal and small objects of various forms, minerals, fibrous solids, etc. This waste mainly consists of solid chemical reagents that did not react during the preparation of various adhesives through semi-finished product warehouses, as a result of waste paper standing in basins during wastewater treatment, repair of equipment, and various oil, iron scraps and other types of impurities that have been released. will be produced. Taking into account the above, waste can be divided into the following types:

1. mineral waste: gypsum, monosulfite, lime, sand, water, various fillers, etc., contained in fibers that have not been well washed and not cleaned of good quality in cellulose production enterprises;
2. impurities based on metals, textiles and paper waste: metal fragments in the fiber formed as a result of breaking and rusting of mill blades as a result of stresses and strains in the process of grinding paper pulp, etc.;
3. fiber waste: fibers and shavings of wood pulp containing unsorted cellulose, large fiber yarns of textile enterprises, pulp pulp and paper waste, etc.;
4. organic impurities: rubber fragments of transport belts, various tar nodules formed and used after the coagulation process, plant and animal organisms, etc.;

Impurities in the mineral and metal series are cleaned in a centrifuge working under the influence of centrifugal force or by grinding. It is sorted with the help of impurities contained in textile and paper waste.

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