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USE OF PERENNIAL PLANTS AS A RAW MATERIAL IN THE PAPER INDUSTRY

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ABSTRACT

In this paper, the process of obtaining semi-finished products for the paper industry from the fibrous waste of the medicinal plant Amaranta is studied. The study examined the possibility of obtaining alkaline cellulose from amaranth plant waste. The effects of boiling, bleaching and neutralization of cellulose on its quality were studied. It was found that the increase in the concentration of alkali in the boiling solution adversely affected the yield of cellulose. The effect of the concentration of caustic soda in the boiling solution on the quality of cellulose was studied.

KEYWORDS: *Amaranth Medicinal Plant, Paper Industry, Paper, Secondary Fiber Waste, Cellulose, Alkali, Bleaching And Neutralization.*

INTRODUCTION

In the production of paper,cotton cellulose plays an important role. The obtained cellulose is made of high-quality porous paper, which has a high puffiness and a very smooth surface. In the production of paper, cotton cellulose is usually used in combination with other fibrous raw materials. Although the amount of α-cellulose is the same in different celluloses, the lengths of the chains may be different. As a result, the properties of cellulose and the properties of the paper obtained from it change.

Theobtaining method of cellulose or lignin-containing material for use in the production of paper is the processing of cellulose or lignin-containing dry raw materials by ionizing radiation **[1].**

The capabilities of using cellulose, paper and cardboard from perennial plants and agricultural waste were studied. The production of fibrous semi-finished products from hemp, soybeans and other plants has been experimented with. They have a higher content of cellulose and a lower acidity than wheat and rice straw. Yields of perennials are 10-12 t/year. The height of the stem is 1-2 m **[2].**

Since non-wood raw materials do not contain adhesives and do not require the use of sodium sulfide as a catalyst, it was proposed to use only sodium hydroxide as the active chemical for boiling non-wood raw materials.

Because of those, in the process of boiling cellulose by the sodium method, most of the weight of the cellulose is obtained from this raw material. In this case, the raw material is heated to a pressure of 140-170°C in a large concentration of alkaline preservative boiling solution. Under these conditions, some of the lignin is soluble **[3].**

According to the Resolution of the President of the Republic of Uzbekistan dated August 23, 2017 No. 3244 "On the creation of additional capacities for the production of pulp and paper in the Republic", it is planned to implement an investment project in supplying of the national economy with pulp and paper products, the reduction its imports. At the same time, in order to produce a wide range of high-quality cellulose-paper with the rational use of local raw materials: agriculture and water management, forestry, agriculture, the People's Bank, at the suggestion of the city government, p annual (poplar and other) and annual (cotton stalks, Jerusalem artichokes, rice, rice plant) through the deep processing of local plants, the organization of production of high-demand products with a production capacity of 16.5 thousand tons per year construction of a pulp and paper mill **[4].**

Cotton cellulose is one of the most important raw materials used in paper production. The obtained cellulose is made of high-quality porous paper, which has a high elasticity and a very smooth surface. In the production of paper, cotton cellulose is usually used in combination with other fibrous raw materials. Although the amount of α-cellulose is the same in different celluloses, the length of the chains can be different. As a result, the properties of cellulose and the properties of cellulose derived from it change. The mechanism of delignification of cellulose obtained from wheat straw in 2 different ways and its topochemical properties were studied.

The capability of using cellulose, paper and cardboard from perennial plants and agricultural waste was studied. The production of fibrous semi-finished products from hemp soybeans and other plants has been experimented with. They have a higher content of cellulose and lower salinity than wheat and rice straw. Yields of perennials are 10-12 t/year. The height of the stem is 1-2 m **[5].**

Extraction of cellulose from annual and perennial plants is carried out in the following technological sequence: Preparation of plant stem (raw material) → Purification of raw materials → Boiling → Washing → Cleaning of coarse waste → Crushing → Hydrocyclone cleaning → Mixing → Squeeze → Drying → Pressing → Packaging.

Methods

The possibility of obtaining cellulose by alkaline method of semi-finished products for the paper industry from fibrous waste of the medicinal plant Amarantawas studied. Cellulose boiling, bleaching and neutralization processes were performed in accordance with the requirements of GOST standards.

Results and Discussion

The process of exposure of the analyte to electromagnetic waves in the infrared, visible, ultraviolet and X-ray fields of the spectrum forms the basis of optical methods. Infrared (IR) rays were first invented in 1800 by the English astronomer U. Gershel (1738-1822) in a very simple but attractive way. 1666 y. the great English scientist I. Newton (1643-1727) had discovered the phenomenon of the separation-spectral of light of 7 different colors when sunlight passed through a prism.U. Gershel divided sunlight into spectra using a prism, studied the effect of different colored rays on the thermometer, observed that the temperature of the rays in the field after the visible red rays was higher, and concluded that there were rays invisible to the human eye after the red rays, "because these rays act on the substance at a higher temperature than the visible rays," and called this field heat rays. According to the method of recording the spectrum, the following names of spectral instruments are used: spectroscope - a device for visual observation of the spectrum, spectrograph - a device for recording the spectrum on a photographic plate, spectrometer - a device for recording the spectrum as a curve (curves can also be formed by points). , spectrophotometer - a device that records the spectrum on a curved line or points, and at the same time measures the intensity (brightness) of the spectrum. Although IR-rays, discovered in 1800, were not used for analysis until the end of the 19th century, IR-spectroscopy is widely used in modern analytical chemistry.

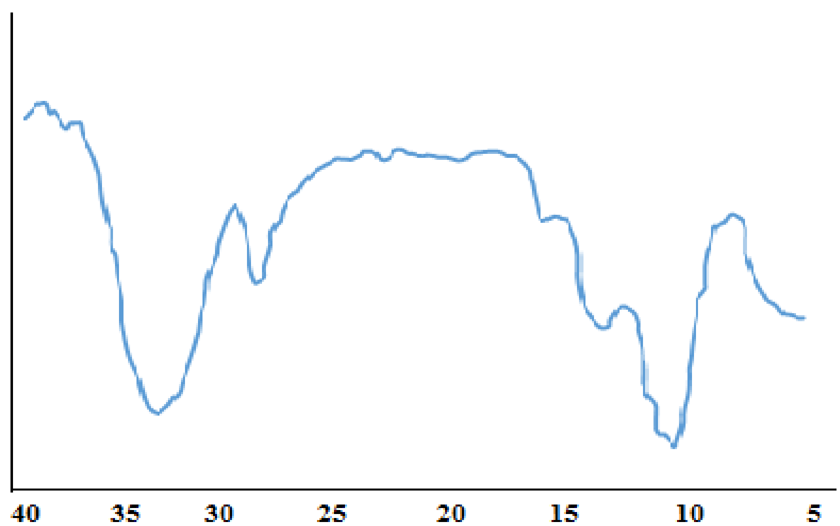

Figure 1.Infrared rays (IR) spectrum of cotton cellulose.

In the 3400 cm^{-1} region of the infrared spectrum of the obtained cotton cellulose, the valence oscillations of the hydroxyl groups corresponding to the intermolecular and intramolecular hydrogen bonds are observed. The valence oscillations of S-N bonds of methylene and methylene groups of cellulose are observed in the area of 2895 cm^{-1}, and in the area of 1635 cm^{-1} oscillations of adsorbed water molecules. Absorption lines in the areas 1420 cm^{-1}, 1335-1375 cm^{-1}, 1202 cm^{-1}, 1075-1060 cm^{-1} correspond to the deformation oscillations of the groups CH, -CH_2, -OH, -CO and the valence oscillations of the C-O group.

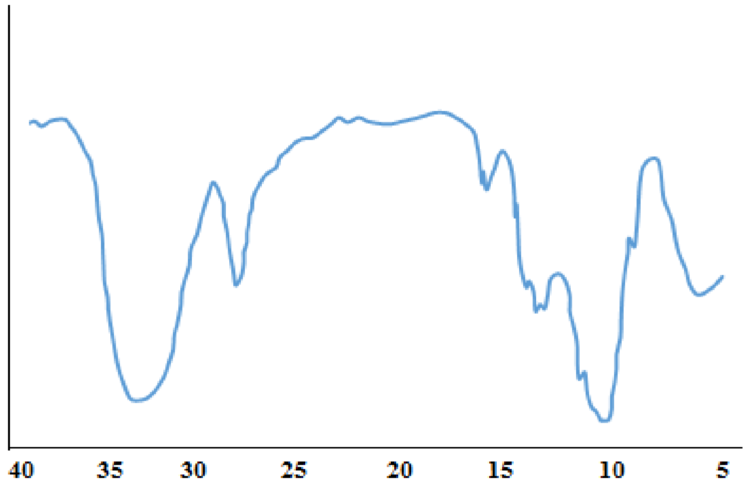

Figure 2. IR spectrum of wood cellulose.

The obtained cotton cellulose in the 3400 cm^{-1} region of the IR spectrum shows the valence oscillations of hydroxyl groups corresponding in value to intermolecular and intramolecular hydrogen bonds. The valence oscillations of S-N bonds of methylene and methylene groups of cellulose are observed in the area of 2895 cm^{-1}, and in the area of 1635 cm^{-1} oscillations of adsorbed water molecules. Absorption lines in the areas 1420 cm^{-1}, 1335-1375 cm^{-1}, 1202 cm^{-1}, 1075-1060 cm^{-1} correspond to the deformation oscillations of the groups CH, $-CH_2$, -OH, -CO and the valence oscillations of the C-O group, but in wood cellulose IR the peak intensities in the 2780 cm^{-1} and 1610 cm^{-1} areas are longer.

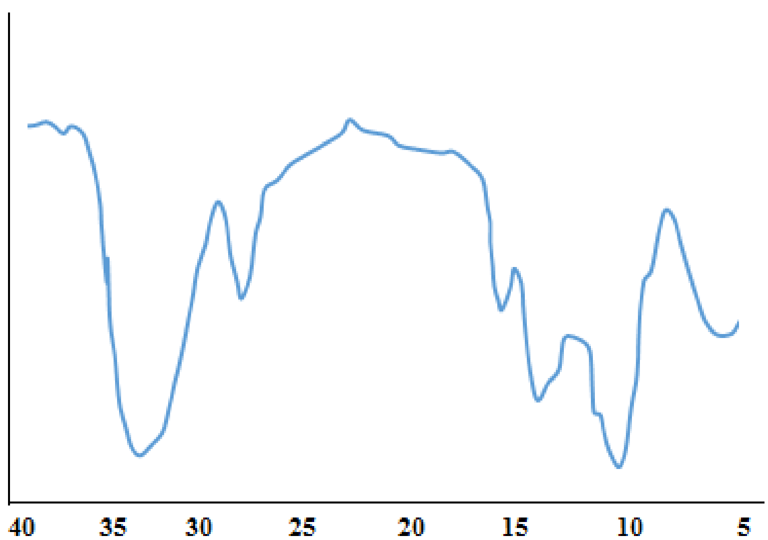

Figure 3. Amaranta cellulose IR spectrum

The obtained cotton cellulose in the 3400 cm^{-1} region of the IR spectrum shows the valence oscillations of hydroxyl groups corresponding in value to intermolecular and intramolecular hydrogen bonds. The valence oscillations of S-N bonds of methylene and methylene groups of cellulose are observed in the area of 2895 cm^{-1}, and in the area of 1635 cm^{-1} oscillations of adsorbed water molecules. Absorption lines in the areas 1420 cm^{-1}, 1335-1375 cm^{-1}, 1202 cm^{-1}, 1075-1060 cm^{-1} correspond to the deformation oscillations of the CH, $-CH_2$, -OH, -CO groups and the valence oscillations of the C-O group, but It can be seen that amaranth cellulose is pushed in the IR at the peaks of 1420 cm^{-1} and 1635 cm^{-1} branches at the peaks of 1480 cm^{-1} and 1635 cm^{-1} branches.

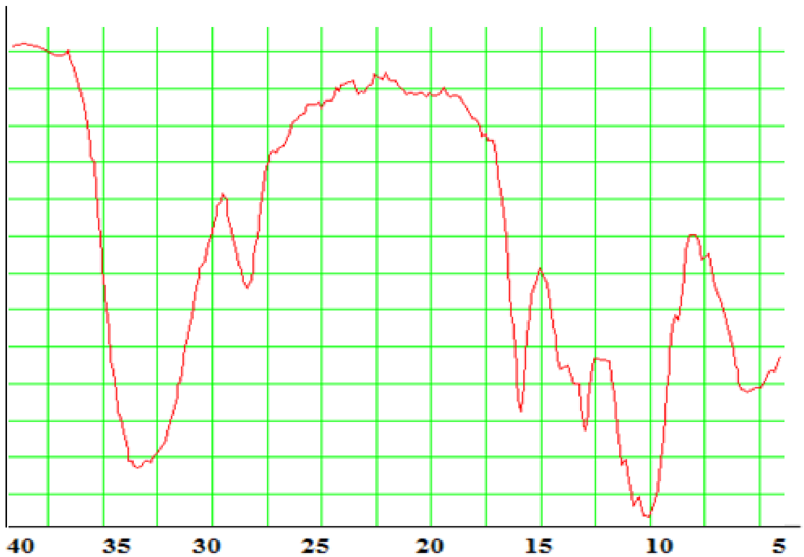

Figure 5.IR spectrum of Licorice root waste cellulose.

It can be seen that in the 3550-3100 cm^{-1} section for cellulose obtained from licorice root waste, the OH groups formed an intermolecular and intramolecular hydrogen bond.

The displacement of C-H - bonds from methylene and methyl groups of cellulose obtained from licorice root waste is located at 3000–2800 cm^{-1}. According to Lyanga and Marchessolt [65], lines 2945 and 2853 cm^{-1} are characterized by asymmetric and symmetric valence shifts of methylene groups, four out of five C-H valence shifts are 2914, 2897 and 2870 cm^{-1} (I) cm^{-1} and 2970 cm^{-1} (II) ga teng. Molecules of adsorbed water in the range of 1605 cm^{-1} were absorbed. As the volume of the water molecule increases, high-wave interference is observed.

Summarizing and analyzing the data obtained on the IR spectrum of amaranth plant cellulose, it can be concluded that the main peaks of the obtained cellulose in the IR spectrum are consistent with cellulose. Therefore, it is planned to use this fibrous semi-finished product as a composition in the production of paper.

The weight of the fibrous cellulose in the waste of medicinal and agricultural plants is a good raw material for paper production. Due to the bulk of these raw materials, their transport and logistics require on-site processing of pulp. Obtaining pulp from the wastes of annual and perennial non-wood plants and finding opportunities to produce paper based on local fiber raw materials are urgent tasks. The results of the research, ie the possibility of obtaining alkaline cellulose from amaranth plant waste, were studied. In order to offer a technology for the rational use of cheap, local plant raw materials for the paper industry of the Republic, the technological characteristics of the local amaranth plant were studied.

Amaranth belongs to the family Amaranthus, which includes more than sixty species. Homeland is South America, where it has been cultivated for seed for 8,000 years. Amaranth is widespread from South America to North America, India, and from there to other parts of the world. There are now many varieties of amaranth in India and China, which are considered to be the second home of amaranth. In these countries, the amaranth plant is widely used in local medicine, national cuisine and industry.

The amaranth flower is popularly known as the "flower rooster" because of its small-flowered inflorescence, pink, dark pink, red and crimson, and reminiscent of a rooster's crown. Amaranth is an annual plant that can be grown in a variety of areas, including vegetables (Amarantusgangeticus, Amaranthusmangostanus), cereals (Amaranthuscaudatus, Amaranthuspaniculatus), ornamental and (Amaranthusblitum) food crops. In our country, amaranth is grown only as an ornamental crop. The main reason for this is that its velvety flowers retain their charm for a long time, are resistant to external influences and can withstand drought for several months. Probably because of this featureamaranta is called an immortal flower.

Although the medicinal properties of the plant have not been sufficiently studied and scientifically tested by the medical staff of the Republic, there is information that it has long been widely used in our national medicine. Abu Ali Ibn Sina used amaranth extensively in the treatment of skin wounds (measles, rubella), bad breath and other ailments from knife wounds.

At the Institute of Botanical Research, seeds of amaranth from India, Cameroon, China, Germany, France, Bolivia, Mexico, Tanzania, Tajikistan and local varieties are being studied on the basis of valuable economic characteristics. Each of these amaranth samples has its own unique characteristics. Growth period is 100-140 days. These samples are a valuable resource for various areas of selection and are provided to selection sites. This article describes the results of experiments on the processing of amaranth medicinal plant, the extraction of cellulose from the part (stem) by the sodium method.

In the production of semi-finished products containing cellulose, the boiling process plays a key role, because during the boiling process most of the non-cellulose additives are lost and there are significant changes in the structure of the fiber. This will increase the productivity of the paper. Boiling experiments are carried out in the presence of solutions of caustic soda in different concentrations (40, 50, 60 g / l).

It was found that the increase in the concentration of alkali in the boiling solution adversely affected the yield of cellulose. The effect of the concentration of caustic soda in the boiling solution on the quality of cellulose was studied. During the boiling process, 10-50 cm long amaranth stem waste was used. Crushed amaranth stem waste is used. The crushed amaranth stem was boiled at 180 degrees Celsius for 180 minutes (M1:10).

TABLE 1. INFLUENCE OF ALKALI CONCENTRATION ON THE INDICATORS OF CELLULOSE QUALITY

Sample	NaOH, gr/l	Polymerization degree	α-content of cellulose %	cellulose Output %	The content of sol %
1	40	892	86,3	51,4	8,4
2	50	710	88,1	45,6	7,8
3	60	650	88,9	42,3	6,9

During the experiment, it was found that as the concentration of caustic soda increases, the yield of cellulose increases from 51.4% to 42.3%, the degree of polymerization from 892 to 650, the amount of sol from 8.4% to 6, Decreased by 9%, while the content of α-cellulose increased from 86.3% to 88.9%.

The temperature is 130-145^{0}C, the boiling time is 1-3 hours, during the boiling process, the non-cellulose waste is decomposed and dissolved, and in the process, oil and waxy compounds are removed from the fiber. The fiber is given a hydrophilic texture. At the end of the boiling process, the solution is cooled to 90^{0}C, the pressure in the boiler is reduced to 1-1.5 atm, and the pulp is dropped into a pressure washer, washed with hot water. The washed cellulose is diluted with water to a concentration of 2.5-3% and transferred to a bleaching vessel.

In the process of alkaline treatment, the yellowed plant is bleached (discolored). The cellulose of the amaranth plant is bleached in a solution of hydrogen peroxide. Neutralization is carried out using a solution of sulfuric acid 0.5-4 g/l.

Bleaching with cellulose hydrogen peroxide depends on the amount of reagent, the effect of temperature, the concentration of the mass. When the mass concentration is high, the bleaching rate increases and the processing time decreases.

A sample of cellulose obtained from wet amaranth is selected for the bleaching process. The following table shows the whiteness of cellulose. T - 80^{0}S, t - 60 minutes.

TABLE 2. THE EFFECT OF NAOH CONCENTRATION ON THE WHITENESS LEVEL OF CELLULOSE

NaOH concentration, g/l	Whiteness level, % H_2O_2(relative to the mass 8 %)
40	85,6
50	88,9
60	90,2

CONCLUSION

It is difficult to prepare special equipment for dehydration and mixing of the mass with the solutionin high-concentration bleaching. Bleaching is high when the hydrogen peroxide solution is at its maximum concentration. When the concentration is above 3%, the bleaching rate is high, ie 10-15%. The results of the experiments were developed, the experimental batch of cellulose from the amaranth plant was obtained on the basis of a technological sequence in the scientific laboratory of the Institute of Polymer Physics Chemistry under the Academy of Sciences of the Republic of Uzbekistan.

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