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USE ANNUAL PLANTS AS AN ADDITIONAL RAW MATERIALS FOR OBTAINING TECHNICAL CELLULOSE

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Abstract:

The content of cellulose in annual plants of cereals is comparable to its amount in wood raw materials (34–51% by weight). Existing technologies for producing cellulose from annual plants are based mainly on alkaline cooking methods. The resulting unbleached straw pulp is of low quality. It is used for the production of cardboard, and in composition with wood pulp — for the production of some types of unbleached paper. When obtaining cellulose semi-finished products and cellulose from straw, the methods of alkaline delignification by the thermo-mechanical-chemical method for high yield cellulose can also be used [1]. Currently, cellulose is produced mainly on the basis of cotton linters. Its 70 - 80% share is exported abroad.

Keywords: Plants, cereals, cellulose, wood pulp, raw materials, enterprise

INTRODUCTION.

The content of cellulose in annual plants of cereals is comparable to its amount in wood raw materials (34–51% by weight). Existing technologies for producing cellulose from annual plants are based mainly on alkaline cooking methods. The resulting unbleached straw pulp is of low quality. It is used for the production of cardboard, and in composition with wood pulp — for the production of some types of unbleached paper. When obtaining cellulose semi-finished products and cellulose from straw, the methods of alkaline delignification by the thermo-mechanical-chemical method for high yield cellulose can also be used [1]. Currently, cellulose is produced mainly on the basis of cotton linters. Its 70 - 80% share is exported abroad. The high cost of cellulose obtained from cotton linters is the reason for the increase in the cost of products based on it, and the decrease in stocks of cellulose from year to year does not ensure the full operation of enterprises, where it is considered the main raw material, or in some cases leads to the liquidation of these enterprises.

THE PURPOSE OF THE STUDY.

Taking these factors into account, in order to expand the raw material base for the production of cellulose, the possibility of using fibrous waste from various industrial enterprises was studied. These industrial enterprises include textile enterprises, as these factories generate various fibrous waste. Taking into account the wide range of application of carboxymethyl cellulose, the world practice has studied the possibility of synthesizing it from non-conventional raw materials: beech wood, bark, sugarcane pulp, hydrolysis cellulose, waste of viscose threads. Waste from the production of alkaline cellulose, which does not require additional activation, can also be used as cellulose raw material.

OBJECTS OF RESEARCH.

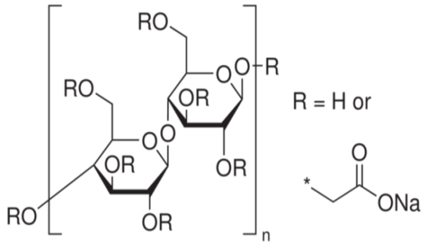
Waste of cereals, i.e. In terms of cellulose content, rice and wheat straws take their place immediately after wood. If cotton contains up to 98%, and wood up to 50% cellulose, then straw contains from 40 to 42% cellulose.

It should be especially noted that in the production of carboxymethyl cellulose from any other type of cellulosic raw material, it is impossible to avoid the process of oxidative-hydrolytic destruction of macromolecules, which significantly affects the properties of carboxymethyl cellulose, as a result of the degree of polymerization of the initial macromolecules, almost 2.5 decreases. In this regard, the question arises about the inhibition of the process of oxidative destruction of cellulose macromolecules using inhibitors with simultaneous modification of the properties of carboxymethyl cellulose during its production [2].

IMPLEMENTATION OF RESEARCH RESULTS.

Cellulose, metered with a 17.5% NaOH solution, from Jerusalem artichoke was squeezed out to a 3-carat weight and treated with dry sodium salt of monochloroacetic acid ($CH_2ClCOONa$) at a temperature of 400C for 30 minutes. Then the resulting mixture was kept under stationary conditions at a temperature of 22 ° C for 24 hours in a closed vessel. During this time, oxidative-alkaline destruction of cellulose occurs: the degree of polymerization decreases, and the reactivity of cellulose increases. Under these conditions, alkylation proceeds at maximum concentrations of the active masses (cellulose and monochloroacetic acid), as a result of which a high degree of alkylation is achieved [2].

It is also believed that when oxygen acts on cellulose, in the presence of alkali, both primary and secondary hydroxyl groups are oxidized to aldehyde and carboxyl groups, which causes, respectively, the breaking of acetyl bonds and a decrease in molecular weight, as shown below:



As a result of oxidative-alkaline destruction, the cellulose chains are split with a decrease in its degree of polymerization and an increase in low molecular weight fractions. Also, there is a chemical change in the molecules of cellulose and its supramolecular structure.

This process, called preconception, is very important in obtaining quality products. In this regard, we considered it necessary to characterize this process in more detail. Other authors suggest that in the process of oxidative-alkaline destruction of cellulose, oxygen is combined with a hydrogen atom bound to carbon in the 1st position of the glucoside bond, as a result of which the cycle of the glucose residue is opened with the formation of carboxyl atom.

The conditions for the merisation were as follows: NaOH concentration - 20%, temperature - 25^{0}C, time - 60 min, bath modulus - 1: 20. After mercerization, alkaline cellulose was squeezed to three-fold weight and ground for an hour at room temperature. Samples of alkaline cellulose were subjected to pre-maturation in a thermostat at a temperature of 25^{0}C for 5, 15, and 30 hours. In cellulose samples after prematurity, the following was determined: the degree of polymerization, the content of α-, β- and γ-cellulose.

The work investigated the influence on the quality and yield of cellulose from straw of cereal crops of the following factors: concentration of alkali, temperature and duration of cooking. At an alkali concentration of 1.5%, a cooking temperature of 130^{O}C and a cooking time of 2 hours, semi-cellulose is obtained with a yield of 60%. To obtain fibrous materials that do not require high whiteness, sodium, soda and lime brews are used, and fibrous materials are used in the production of corrugated cardboard. It has been established that soda and lime brews of straw with a duration of 60 ... 225 minutes have a yield of bleached cellulose 35 ... 45%, semi-cellulose 70 .. 85%. In operation, cellulose is obtained by sequential processing of the raw material with nitric acid and 4% NaOH solution. The resulting cellulose is characterized by a low content of lignin 0.6%, ash 0.6% and pentosans 5.9%. To increase the yield of technical cellulose, it was proposed to treat rice straw with a 2% aqueous solution of NaOH with 0.1% Na-lauryl benzoyl sulfonate as a surfactant, followed by oxidation of O_2. With this method, the semi-finished product yield is 47.6 % with a whiteness of 61.2 %. As can be seen from the data presented, sodium boiling methods and their modifications make it possible to obtain a fibrous material with a relatively high yield and low whiteness.

SCIENTIFIC AND PRACTICAL SIGNIFICANCE OF THE RESEARCH RESULTS.

The works investigated the production of technical cellulose from miscanthus by nitric acid and combined methods and its application in various areas of industry. Many non-conventional methods of cooking, besides the main advantage of environmental friendliness, have other advantages: the temperature of delignification is below 100^{O}C; lack of overpressure; the possibility of using organic solvents with a high delignifying capacity, etc.

Modern trends in the production of cellulose, the main raw material of various compositions of composite polymer materials based on a natural polymer, as well as the direction of the formation of the necessary raw material for its synthesis, promising activities of enterprises that produce cellulose as well as their products based on their products, products necessity of reconstruction and modernization of existing technologies, their requirements for raw materials, as well as the extent to which the method of transition from the old system to the new one has been formed.

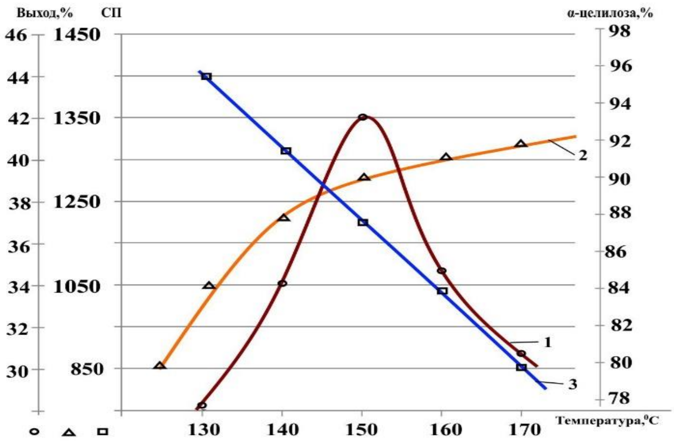


Fig. 1.1. Influence of alkaline cooking temperature on quality parameters of cellulose obtained from sunflower. ◦-1-cellulose yield, Δ-2-α-cellulose, □ -3- degree of polymerization

The influence of different parameters in the process of synthesis of cellulose, suitable for chemical processing on the basis of local raw materials, i.e. sunflower. Fig. 1.1 shows the influence of the temperature of alkaline cooking on the quality indicators of cellulose obtained from sunflower. Accordingly, with an increase in the temperature of alkaline cooking, the yield of α-cellulose is due to a positive growth, since an increase in temperature and activation of destructive factors can significantly reduce the content of cellulose and the degree of polymerization. When investigating the temperature parameters of the alkaline brew in the process, the optimal mode of 150^{0}C was chosen. The yield of cellulose is 42%, and that of α-cellulose is 94%, the degree of polymerization is 1300.

At present, active work is underway in the Republic to increase the number and expansion of operating safflower plantations.

Table 1 shows the effect of alkali concentration during cooking safflower plant on some quality indicators of cellulose.

Table 1.2
Influence of alkali concentration during cooking safflower plant on some quality indicators of cellulose

№	NaOH, г/л	Temperature, °C	Time	Target yield, %	Humidity, %	Ash amount %	α-target	DCP
1	20	90-95	5	-	-	-	-	-
2	30	98-100	5	-	-	-	-	-
3	40	100-110	5	44,1	-	1,25	90,1	960
4	**50**	**120-130**	**5**	**41,2**	**3,0**	**1,15**	**93,2**	**850**
5	60	130-140	5	35,4	3,1	0,89	94,3	740

At the same time, unsuitable parts of safflower plant stems are burned, and thereby cause a negative impact on the environment, which requires the development of rational methods of their disposal. Below is the process of obtaining cellulose from safflower stalks with different parameters. Research has shown that 45% of the safflower stem is cellulose. For this, the process of delegating was carried out, i.e. extraction of cellulose from the safflower stem under the influence of various parameters. The table shows that an increase in the concentration of alkali has a positive effect on the yield of cellulose and α-cellulose, and a decrease in the degree of polymerization, i.e. with an increase in the concentration of alkali, destruction of the cellulose macromolecule is observed.

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