TECHNOLOGIES FOR PRODUCING CELLULOSE FROM SAFLOR PLANTS AND PRODUCING CARBOXYMETHYL CELLULOSE BASED ON IT

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Annotation: Since cellulose is a polycyclic high molecular weight compound that contains many polar hydroxyl groups, its macromolecular chain is not flexible, it is tightly packed because the macromolecule is highly ordered. From this it can be concluded that cellulose is soluble only in some solvents, but not in various solvents

Key words: Carboxymethyl cellulose, cellulose ethers, degree of polymerization, degree of substitution, ash content, temperature, humidity, mercerization

Аннотация:Поскольку целлюлоза представляет собой полициклическое высокомолекулярное соединение, которое содержит много полярных гидроксильных групп, ее макромолекулярная цепь не гибкая, она плотно упакована, поскольку макромолекула высоко упорядочена. Из этого можно сделать вывод, что целлюлоза растворима только в некоторых растворителях, но не в различных растворителях.

Ключевые слава:Карбокиметилцеллюлоза, целлюлоза, эфиры целлюлозы, степень полимеризация, степень замещения, зольность, температура, влажность, мерсеризация

Strengthening the independence of the Republic of Uzbekistan in the economic sphere provides the creation of its own productions for the production of pulp and paper products based on local cellulose-containing plants.

Analyzing the chemical composition results obtained after the extract of the vegetative part of safflower (Table 1), it can also named as a ligno-carbohydrate complex, with about 65% of carbohydrates accounting for more than 35-40% of the total cellulose content of polysaccharides. The non-hydrolysable part of plant raw materials-lignin is 1/3 of the sum of polysaccharides.

Further studies were conducted to establish the optimum cooking temperature. For this purpose, a series of experiments were conducted on cooking safflower at different temperatures and at an alkali concentration of 50 g / l for 5 hours. Qualitative parameters of the obtained samples were studied. The obtained data are given in Table 2.

From Table 2 it can be seen that before reaching 1000C, non-cellulose substances are not produced and the raw material retains its external fibrous appearance (does not crumble).

As a result of cooking at 1000 ° C, the yield of pulp is much higher, about 40.0%, humidity 3.6%, ash content 1.15%, content of α-cellulose 93.2% and SP-850.

With increasing temperature, the qualitative characteristics of cellulose change markedly. It is known that an increase in temperature leads to an increase in the rate of destruction (hydrolysis) of the ether bond between the glucopyronose cycles of the macromolecule of cellulose. Therefore, an increase in temperature by 10 ° C leads to a decrease in the yield of cellulose to 36.7%, a cellulose content of 90.6%, a DP feeds up to 740. Reduction of the content of sol in cellulose is due to an improvement in its solubility at elevated temperatures.

Table 1.

Effect of temperature on the yield of cellulose and other indicators of cellulose

№	NaOH, г/л	temperature, °C	τ, hour	Exit, %	Humidity, %	slush, %	α-cellulose, %	PP
1.	20	98-100	5	-	-	-	-	-
2.	30	98-100	5	-	-	-	-	-
3.	40	98-100	5	44,1	-	1,25	90,1	960
4.	50	98-100	5	41,2	3,0	1,15	93,2	850
5.	60	98-100	5	35,4	3,1	0,89	94,3	740

The pulp obtained in the optimal cooking mode after cooking is a pale brown mass. Color bleaching has been carried out to bleach the pulp. As a bleaching agent, the hydrogen peroxide (H_2O_2) was used, which is an environmentally friendly and non-toxic liquid substance.

From the literature data it is known that the bleaching process with hydrogen peroxide is carried out at a temperature of 70 ° C in an alkaline medium. To determine the optimum concentration of H_2O_2 in the bleaching of cellulose obtained from the vegetative part of Jerusalem artichoke, studies were conducted of the dependence of cellulose whiteness on the content of H_2O_2 in the bleaching mixture under the above conditions. The obtained data are shown in Table 2.

Table 2.

Influence of bleaching conditions on the basic indicators of cellulose

Content , H_2O_2, %	White , %	Content α-cellulose , %	PP	slush , %
1,5	62	87,6	-	0,86
2,0	68	88,4	-	0,84
2,5	74	89,8	840	0,82
3,0	82	93,8	820	0,97
3,5	84	94,1	710	0,78

From Table 3 it follows that as the concentration of H_2O_2 in the bleaching mixture increases, the brightness of cellulose increases from 62 to 82%.

An increase in the concentration of hydrogen peroxide reduces the ash content of cellulose. Apparently, atomic oxygen oxidizes inorganic substances to a maximum degree of oxidation, which are more soluble in water.

As can be seen from the table, the brightness of cellulose increases with increasing concentration of H_2O_2 to 82% and then increases insignificantly.

Therefore, to obtain cellulose with sufficient whiteness and a high content of a-cellulose, a greater degree of polymerization behind the optimal concentration of H_2O_2, it is possible to take 3% in the bleaching mixture.

To confirm this assumption, as well as to expand the assortment of raw materials for the production of various cellulose ethers, we subsequently obtained simple and esters based on cellulose obtained from Jerusalem artichoke. Ethers were prepared from carboxymethylcellulose, from complex acetylcellulose. The choice of these ethers is explained by the fact that two large enterprises operate in Uzbekistan (in Namangan for the production of carboxymethyl cellulose, in Fergana for the production of cellulose acetate)

The water-soluble carboxymethylcellulose (Na-CMC) is obtained by the action on alkaline cellulose monochloroacetic acid according to the following reaction:

$$[C_6H_7O_2(OH)_3NaOH]_n + nCH_2ClCOONa \rightarrow$$
$$[C_6H_7O_2(OH)_2\ OCH_2COONa]_n + n\ NaCl + n\ H_2O$$

For the synthesis of CMC, a sample of cellulose obtained from Jerusalem artichoke with the following qualitative indices were used (Table 3):

Table 3.
Influence on the main indices of Na-carboxymethyl cellulose obtained from cellulose Safflower, concentration of sodium hydroxide and molar flow of Na-MHUK

Consumption of components		Indicators of carboxymethylcellulose			
Concentration, NaOH g / l	Cellulose: Na-MHUK, mole	Content of the basic substance, %	SZ on carboxyl groups, γ %	Power polymerization (PP)	Solubility in water, %
220	1,0	42,0	0,64	970	97,1
	1,5	42,0	0,67	950	97,0
	1,6	44,3	0,72	890	97,2
240	1,0	48,4	0,75	810	97,2
	1,5	48,9	0,75	780	97,0
	1,6	48,2	0,77	750	97,3
260	1,0	48,0	0,78	690	97,9
	1,5	50,2	0,78	680	98,4
	1,6	51,6	0,80	640	98,6

It is known that the CMC production process consists of several stages, including alkaline mercurying, alkylation, pre-ripening, and drying. The obtained CMC on the basis of the above-mentioned stages undergoes various destructive effects for the entire technological path, which leads to mechanical, thermal, and chemical degradation. In this case, the rupture of elementary links in the chain of fiber macromolecules adversely affects the qualitative characteristics of the CMC obtained (Table 4).

Table 4.
The condition for obtaining CMC from Jerusalem artichoke pulp and the industrial condition for obtaining CMC of their cotton linters

№ п/п	Name of conditions	Prototype	The industrial grade of carboxymethylcellulose 85/600 produced from CC and DC at Namangan chemical plant according to OST 605-386-80
1	The temperature of the mercerization process, °C	20-25	26
2	The duration of the mercerization process, min	15-30	60
3	Extraction degree of cellulose from	3	2,6

	excess alkali		
4	The content of sodium hydroxide in alkaline cellulose, %	17	13
5	The duration of crushing of alkaline cellulose, h	0,5	2
6	The esterification temperature,ºC	35-40	25-33
7	The duration of mixing alkaline cellulose with NaMKhUK, min	60	120

As can be seen from Table 4, the condition for obtaining CMC prototypes from the Jerusalem artichoke pulp practically does not differ from production ones.
Qualitative parameters of CMC, obtained from cellulose of Jerusalem artichoke, were compared with samples of CMCs obtained from other sources of raw materials of CC, DC and existing in production (Table 5).

Table 5.
Physicochemical parameters of the prototypes of carboxymethylcellulose and the production mark produced according to TU - 88.2 - 12-2005.

№ п / п	Indicators	Samples of carboxymethylcellulose			
		Cellulose from safflower	Cellulose from poplar wood	Of cotton cellulose	TU-88.2-12 2005
1	Power polymerization (PP)	640	760	930	500
2	The content of the main substance,%	52	51	53	50
3	The viscosity of a 2% aqueous solution, cPs	128,0	135,0	140,0	100
4	Solubility in water,%	98,2	98,4	98,8	97

As can be seen from the data in Table 3, the CMC, obtained from the pulp of Jerusalem artichoke, is practically inferior in quality to CMCs obtained from other raw materials, meets the requirements of the specifications, and it is quite possible to use it in the same industries that they are used for.

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