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Technology of Obtaining E-466 From Fiber Waste of Cotton Ginning Plants and Pavlonia and Banana Celluloses and Its Properties

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ABSTRACT

a number of practical works have been carried out on the development and research of the technology for obtaining E-466 from high-purity cellulose grades obtained on the basis of fibrous waste of cotton ginning enterprises and Paulownia tree and banana stems. It is characteristic that cellulose ether E-466, which is considered the main raw material and secondary product for various industries, is obtained on the basis of local raw materials

Introduction

Plant ecology is the science of the relationship of plants with the external environment, and studies the effects of certain factors or their combined effects on the appearance of plant forms [01].

Plants are divided into ecological groups in relation to a factor of the external environment. The structure of plants is affected by important factors such as soil and air humidity and light. Plants adapt to these factors differently, so xerophytes or schiophytes (shade-loving plants) differ in their external habitus and internal structures. They have different life forms.

The vital form or biomorph of plants (Greek: bios - life, morpho - form) means the specific external appearance of plants formed during ontogeny by adapting to specific environmental conditions. Habitus depends on the specific growth characteristics of vegetative organs such as above-ground and below-ground plants in the first germination.

Calligonum, Haloxylon, ephedra and many other shrubs growing in the deserts of Central Asia

and other places where summer is dry and hot are characterized by reduced leaves.

Plants are divided into the following groups according to their response to moisture.

1) Xerophytes (xeros - dry; phyton - plant) - plants adapted to permanent or temporary water shortage in soil and air.

2) Mesophytes (Mesos - medium) are plants that grow in places with sufficient moisture.

3) Hygrophytes (hygra - wet) are plants that grow in places where the soil is more humid than the air humidity.

4) Hydrophytes (hydra-water) are plants that are adapted to the aquatic environment. These plants live half submerged in water.

5) Haptophytes - plants that live completely submerged in water. Haptophytes include plants such as Elodea, Vallisneria, and water bears. The roots of some of these plants grow stuck in the mud at the bottom of the ponds, and some float in the water. Only at the time of flowering, the flowers come to the surface of the water.

In haptophytes, gas exchange becomes difficult due to low dissolved oxygen in water. The higher the water temperature, the less oxygen there is in the water. Therefore, the surface of haptophyte organs is more than the total mass, and their leaves are very thin. For example, the leaves of elodea are composed of only 2 rows of cells, and some leaves are divided into filamentous pieces.

Less light reaches plants that grow submerged in water, so haptophytes also have shade-loving properties. In the epidermis, there are chloroplasts involved in photosynthesis.

The epidermis does not have a cuticle or is too thin to prevent water from entering and exiting. Therefore, aquatic plants lose their water completely and dry up in a few minutes when they leave the water.

Water is denser than air, so water holds plants together. In the tissues of plants of this group, there are large intercellular spaces, which are filled with gas and form a well-seen aerenchyma. Therefore, aquatic plants live freely submerged in water, they do not need any mechanical tissue. Conductor tubes are completely absent or develop very slowly, they soak up water with their entire body.

Intercellular spaces not only allow water to float, but are also the place for gas exchange. During photosynthesis during the day, they are filled with oxygen, and in the dark, oxygen is used for the respiration of tissues, the carbon dioxide released during respiration accumulates in the interstices of the cells at night, and participates in photosynthesis during the day. Most haptophytes are vegetative propagate.

Carboxymethylcellulose, sodium carboxymethylcellulose (food additive E-466) is a colorless amorphous substance, a weak acid, according to its chemical nature it is a high polymer ionic electrolyte. Carboxymethylcellulose is obtained from the reaction of monochloroacetic acid with alkylcellulose, which in turn is obtained from cellulose and caustic soda. Carboxymethylcellulose can be genetically modified. It dissolves well in water, is odorless and completely non-toxic. Carboxymethylcellulose does not decompose completely under the influence of bright light, does not dissolve in vegetable and animal fats.

It is known that carboxymethylcellulose (food additive E-466) causes indigestion if the technical process is not followed (for example, when the dose is exceeded). There are no official scientific data on its toxicity when used in the cosmetics industry. In some animal studies, there is unconfirmed evidence that carboxymethylcellulose can increase cholesterol levels and cause tumors and cancer. Food additive E-466 is used as consistency stabilizer, thickener, encapsulating agent. The main feature of carboxymethylcellulose is the ability to form a very viscous colloidal solution that does not lose its properties for a long time. As a thickener in the production of ice cream, cottage cheese mass, mayonnaise; as a consistency regulator in sweets, jellies, creams and pastes; used in shells for fish, meat, confectionery products.

Other uses of Carboxymethylcellulose:

• in medicine, for the production of laxatives;

• in the production of household chemicals and cosmetics (shampoos, shaving creams, hair care products, etc.).

The technology of obtaining E-466 from PTKTCh (cellulose from fibrous wastes of textile enterprises) and paulownia and banana cellulose and its physico-chemical, mechanical-structural

properties were studied on the basis of various objects.

Comparison of some quality parameters of Na-KMTs obtained from PTKTCh cellulose with the requirements specified in Tsh-88.2-12-2005 and Tsh-2231-001-5353-5770-01 and physico-chemical parameters

Table-1

№	Indicators	PTKTCh, Na- CMC	1Tsh	2Tsh 85/600	Paulownia, Na-CMC	1Tsh	2Tsh 85/600	Banana, Na-CMC	1Tsh
1	Degree of polymerization, not less	1400	500	650	920	500	500	650	500
2	Degree of substitution with carboxyl groups	85	80-100	85	85	80-100	65-85	85	80-100
3	The amount of the main substance, %	50	50	53	55	50	48	55	50
4	Dynamic viscosity of a 2% aqueous solution, MPas	124,0	100	215,8	115,2	100	90-150	111,8	100
5	Solubility in water, %	98,4	97	98,8	99,2	97	98	98,9	97
6	Atmosphere, pH	11	8-12	9	11	8-12	8-12	11	8-12

***1Tsh-88.2-12-2005**

***2Tsh-2231-001-5353-5770-01**

It can be seen from the table that several brands of obtained Na-CMC that meet the requirements of the specified technical conditions were obtained.

It was determined that the water solubility, dynamic viscosity, degree of polymerization, degree of exchange, amount of the main substance and similar parameters of the obtained CMC meet the requirements of the technical conditions of Tsh-88.2-12-2005 and Tsh-2231-001-5353-5770-01.

PTKTCh (cellulose from fibrous wastes of textile enterprises), various grades of Na-CMC obtained from the cellulose of paulownia tree and banana stems are widely used in the oil and gas industry and geology as a drilling reagent (85/500), in the production of loco paint and as an adhesive in the matchmaking industry, and in various fields.

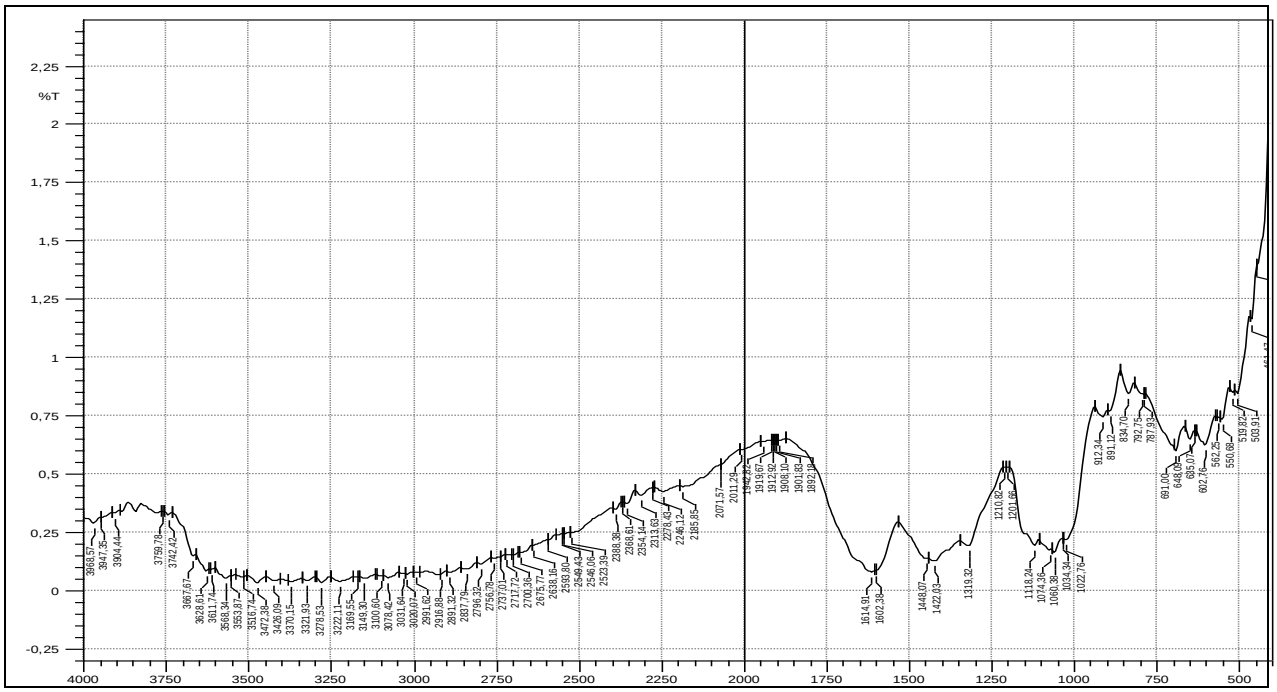

Figure - 2. IR-spectrum of technical CMC.

The spectrum has the following bands, i.e. 3750, 3500, 3250, 3000,...1250, 750, 500 cm^{-1}. From these layers, it can be seen that the degree of exchange of the hydroxyl group of cellulose through the carbonyl functional group has occurred, and the presence of glycolates, which did not react in the IR spectrum (Infrared Spectroscopy) lines of the lower layers, that is, it is shown that they are in the external phase.

The scientific essence is that the cellulose is first soaked in isopropyl alcohol and mercerized in a caustic alkali (NaON) solution. Then, a certain amount of monochloroacetic acid is added to the alkaline cellulose, and the alkylation process is carried out, then the alkylation process is carried out by adding a certain amount of monochloroacetic acid to the alkaline cellulose. The resulting carboxymethyl cellulose is sent for purification 38%, Na-CMC with a moisture content of 40% is calculated into 53% ethyl alcohol, and the extraction process is carried out.

In laboratory conditions, 650 ml of the aqueous solution of 53% ethyl alcohol is taken and placed in a 3000 ml glass container. 150 g of Na-CMC is added to it, and extraction is carried out with stirring for 1 hour. At the same time, various additional compounds contained in Na-CMC are removed and transferred to the composition of alcohol. The purified CMC is separated, pressed and dried from the 860S.

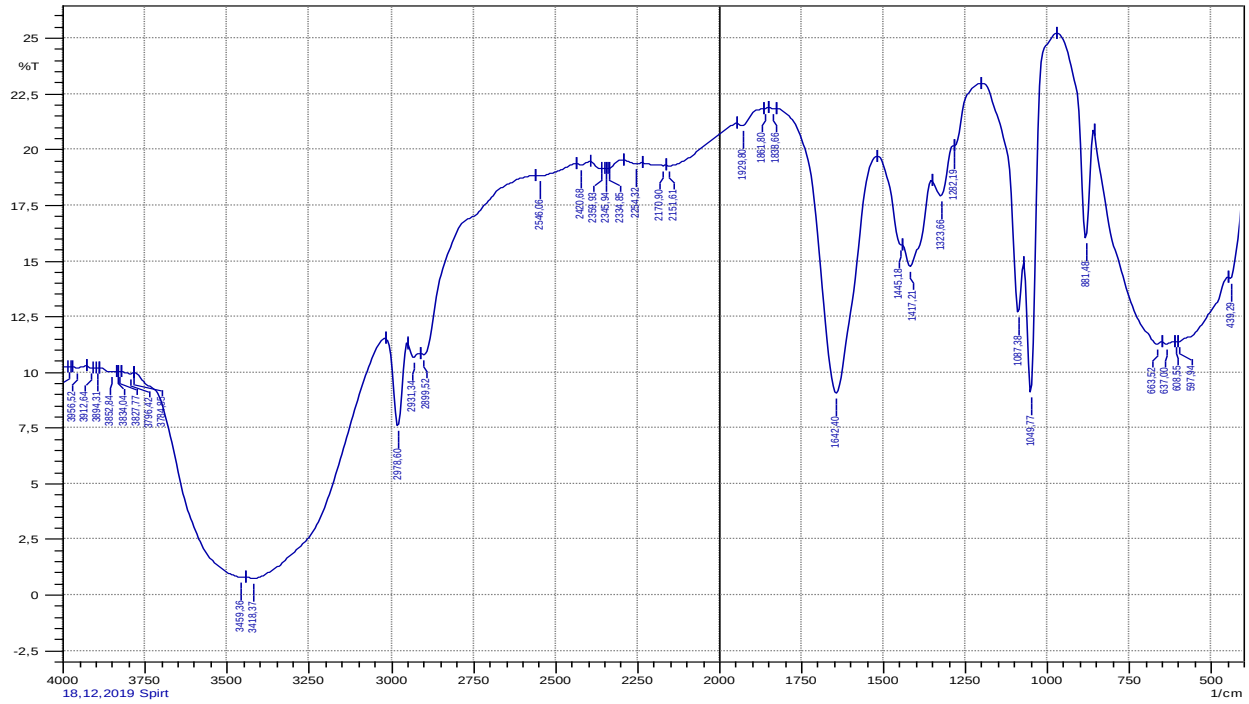

Figure - 3. IR-spectrum of ethyl alcohol after extraction.

The spectra have the following bands, i.e., 3500, 3250, 3000, 2500, 1750, 1250, 750, 500 cm^{-1}. It can be observed from these lines and the lines that can be understood between them that after the extraction of technical CMC in ethyl alcohol, the monochloroacetate, cellulose, caustic sodium hydroxide residues that did not enter into various reactions, i.e. glycolates, passed into the alcohol, and the main substance content of CMC increased from 55 to 98 percent. possible This allows the CMC preparation with high purity to be widely used in various fields in the future, including medicine, perfumery and food industry.

In laboratory conditions, on the basis of the method mentioned above, it is possible to obtain 70/500 grades of purified CMC based on wheat straw cellulose and 85/800 grades of purified CMC based on cotton cellulose.

Code E-466 Food additive is known under the name sodium carboxymethylcellulose salt.

To extract this additive from plant fiber, they are treated and washed with chloroacetic acid in an alkaline medium. It can also be obtained through genetic modification. The ready-to-use supplement is a white or almost white powder or granules, tasteless and odorless. The physical and chemical properties of compounds of this group may vary slightly depending on their chemical structure. Usually they have high solubility in water and alkalis, medium - in glycerol and acids, and insoluble - in vegetable and animal fats and organic solvents.

In the food industry in Russia, the E-466 additive is considered to be approved and pasteurized cream are used as a thickener, stabilizer, and carrier in various TI products (see below for hygiene standards) and in products from birth for dietary correction of metabolic disorders.

The effect on the human body:

Based on many studies, carboxymethylcellulose is approved for use on the territory of the Russian Federation. In the food industry, it is used in a limited way, but certain categories of people should use products containing the additive E-466 in a limited way due to the possible manifestation of intestinal disorders. For people with stomach and intestinal diseases, it is forbidden to use products containing E-466 additive, and those suffering from metabolic diseases should be careful with such food products. Carboxymethylcellulose is non-allergenic and does not irritate the skin. The supplement does not have a confirmed approval for use in the manufacture of baby food.

Additive E-466 is a completely non-degradable substance, a single use of which more than 5 mg can cause a laxative effect. According to independent expertise, it is believed to have an effect on the formation of cancer, as well as an increase in cholesterol levels. The daily permissible amount of carboxymethylcellulose has not been determined.

Carboxymethylcellulose (CMC) E-466

Carboxymethylcellulose is a white to cream-colored powder that is free from additives and excess odor. It is a versatile thickener stabilizer that works over a wide temperature range and has high viscosity. Improves gelling properties, fluidity, firmness and stability, prevents excess moisture (syneresis) release.

Carboxymethylcellulose sodium salt E-466 (CMC). Technological functions - stabilizer, thickener, transporter, coating, encapsulant**.**

DOES NOT CONTAIN GMO SOURCES: We offer thickeners for a wide variety of food and non-food products, including dairy products, toothpaste-creams, sour cream, curd products, and more.

Na-KMTs are non-toxic and non-explosive. The world industry produces two types of Na-CMC: technical and refined. The main contaminants of Na- CMC are sodium chloride and glycolate, but sodium hydroxide and sodium bicarbonate may also be present. Depending on the methods of obtaining Na-CMC, their composition can reach 50%. Depending on the field of application, the content of the main substance in purified Na-CMC should be at least 93%. The sodium salt of carboxymethyl cellulose is widely used in various industries.

Refined grades of Na-CMC are widely used by the food industry as stabilizers, emulsifiers and thickeners of multicomponent systems, suspensions and emulsions, giving them the desired taste characteristics and product consistency. Na-CMC is used in the production of dairy products, mayonnaise, cheese equivalents and ice cream. In the confectionery industry and in the production of bakery products, jelly, mousse, meringue, jam, jam, fruit and berry filling, cream, pasta, baked goods, pasta, as well as sauces, fruit-based products, fruit juices, drinks, aromatic emulsions and diets is used. Na-CMC is used as a consistency regulator of margarines with different fat content, as it is resistant to low temperatures.

Purified Na-CMC has no harmful effects on the human body and is therefore considered a safe food additive. Due to its structuring properties, purified Na-CMC is used in the perfumery and cosmetics industry to produce skin protection and skin care emulsions, facial cleansers, anti-wrinkle creams, shampoos, cosmetic pencils, hair conditioners, shaving creams, etc. . In the pharmaceutical industry, it is used as the main component of medical soaps, ointments, emulsions, tablets, dressings, toothpastes, and mouthwashes. Na-CMC is the basis of adhesives for dental prostheses and therapeutic and preventive toothpastes. In addition, purified Na-CMC is used for the production of electrodes, film materials, electric vacuum devices, etc.

A characteristic feature of almost all cellulose ester production technology is the occurrence of side reactions that lead to the formation of impurities. Depending on the reaction conditions, the proportion of by-products can be quite significant. The basic principle of removing impurities from Na-CMC is to separate them with solvents that dissolve the by-products and do not dissolve the main product CMC. Technical solutions for the purification of CMC 22 are mainly reduced to the search for such extractants or to render the CMC in an insoluble state. The process of obtaining purified Na-CMC can be divided into several methods. To obtain purified Na-CMC by converting Na-CMC into a water-insoluble form by treatment with strong mineral or organic acids and then washing it with water to separate out the impurities. Desalted CMC can then be converted to the salt form by treatment with stoichiometric amounts of hydroxides or carbonates of the corresponding metals.

Disadvantages of this method are the use of strong acids, high concentration and temperature of the solutions, and the long processing time. The high catalytic activity of sulfuric and hydrochloric acids in the hydrolysis of cellulose derivatives leads to a decrease in the degree of polymerization of the initial polymer and the yield of the product. The use of strong acids in the step of converting Na-CMC to its acidic form requires the use of corrosion-resistant equipment. Obtaining CMC in acid form, in which Na-CMC is dispersed in a water-alcohol solution, then inorganic calcium and aluminum salts (chlorides, acetates or hydroxides) are introduced into the solution at the same time or separately, mixed, separated from the product solution and dried. The dried product is treated with an aqueous solution of an inorganic acid (sulfur, chloride, nitrogen or phosphorus), mixed and separated from the CMC solution. Extraction of glycolates is done with water.

The disadvantages of this method are the introduction of additional stages of processing Na-CMC with calcium and aluminum salts and the need to dry the product before acid treatment, recover the organic solvent from a solution containing acid and water, and introduce inorganic calcium and aluminum salts, leading to a decrease in product purity. will come The resulting product has an impurity content of 0.09 to 1.2% in the form of sodium chloride. The method makes it possible to obtain CMC in the form of a practically water-insoluble product, which can be repeatedly washed with water until the presence of a

minimum amount of impurities. The disadvantage of this method is the use of saturated solutions of acidic salts of sulfuric acid, which have high catalytic activity in the processes of destruction of cellulosic materials. As a result of the destruction of cellulose, the cracking of polymer chains leads, firstly, to a decrease in the degree of polymerization, which determines the quality of the resulting product, and secondly, to the formation of low molecular weight water-soluble fractions, a decrease in the output of washing water and the resulting CMC. High product yield is especially important for large-scale production, including the production of CMC [119].

The synthesis process was carried out in 3 stages in 55% - 65% - 80% solutions of ethyl alcohol by extraction. It was determined that the quality indicators of the samples of CMC and PATs with semi- and high purity correspond to the requirements specified in Ts 22235949-003: 2015 and Ts 22235949-003: 2015..

The synthesis process was carried out in 3 stages in 55% - 65% - 80% solutions of ethyl alcohol by extraction. It was determined that the quality indicators of the obtained samples of CMC (carboxymethylcellulose) and POC (polyanionic cellulose) with semi- and high purity correspond to the requirements specified in Ts 22235949-003: 2015 and Ts 22235949-003: 2015.

Table-4

Descriptions of indicators	**70/600-0**	**85/700-C-O**	**85/700-ПО**	**Sample 13.02.2018 *1(85/700-ПО)**	**Sample 28.02.2018 *2(70/600-0, 85/700-C-O)**
1. Appearance					
2. Mass fraction of water, % is not much	10	10	10	**3,9**	**4,8**
3. According to the degree of substitution of the carboxymethyl group, not less	0,65	0,7	0,6	**78**	**79**
4. The mass percentage of the main substance in the absolute dry product,	97	97	63	**82**	**98,7**
5. Its solubility in water, %, is not low	98,5	-	97	**99,0**	**99,2**
6. The dynamic viscosity of a 2% aqueous solution of CMC at a temperature of 20^0C, mPa*s, is not less than	100	100	100	-	-
7. Hydrogen index (pH) of CMC aqueous solution with 1.5% mass fraction	7,0±0,5	6,7-10,0	8-10	**8,1**	**7,8**
8. Water return index of CMC soil solution with a mass fraction of 0.75% calculated on the main substance, cm3/min, not more	4	-	4	**4**	**3,0**
9. Degree of polymerization	600	700	700	**1050**	**820**

*1- N-CMC based on TKTChTs

*2- N-CMC from paulownia tree cellulose

The synthesis process was carried out in 3 stages in 55% - 65% - 80% solutions of ethyl alcohol by extraction. It was determined that the quality indicators of the samples of CMC (carboxymethylcellulose) and POC (polyanionic cellulose) with semi- and high purity correspond to the requirements specified in Ts 22235949-003: 2015 and Ts 22235949-003: 2015. The results were found to be positive, and a proposal for implementation into production was put forward.

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