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Technology for Obtaining Several Brands of E-466 With High Purity for the Pharmaceutical and Medical Fields From Celluloses Based on Local Raw Materials

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ABSTRACT

In this section, several brands of E-466 with high purity for the pharmaceutical and medical fields have been studied from fiber wastes of cotton ginning plants and cellulose obtained from paulownia tree and banana stems.

The technical process of purified CMC includes the following steps: preparation of products and solutions; extraction; squeezing and pinching; drying of purified Na-CMC; grinding; packaging of the finished product; cleaning up the used solution.

Introduction

Carboxymethylcellulose has a high-water holding capacity. 1 part of carboxymethylcellulose can bind up to 120-130 parts of water. This feature is the most attractive for using this additive in meat and fish processing.

Carboxymethylcellulose, CMC (E-466) - technological functions - thickener, stabilizer, encapsulant, coating, carrier. It dissolves well in cold and hot form, but it is an ionic cellulose ester, and its effect depends on the salt concentration and other properties of the medium. Typical applications of Carboxymethylcellulose E-466 are: 1-3g/kg consistency regulators in sweets; ice cream, jelly 2-8g/kg; carboxymethylcellulose in mayonnaise, sauces, creams and pastes 3-8g/kg; Carboxymethylcellulose 5-20g/kg in shells for meat, fish, confectionery, nuts. This is due to the high-water holding capacity of CMC: 1 part can bind up to 120-130 parts of water.

Physicochemical properties of carboxymethylcellulose, SMS (E-466) - varies depending on chain length and degree of exchange. It dissolves well in water and alkalis;

moderately soluble in acids, glycerol; insoluble in organic solvents.

Metabolism and toxicity carboxymethylcellulose, SMS(E-466) - non-absorbable, indigestible soluble ballast substance; A single dose of more than 5 g may cause a laxative effect.

Hygienic standards carboxymethylcellulose, KMTs (E-466) - unlimited. Hazards according to GN-98: MPC 10 mg/m3 in workplace air, hazard group 3.

Carboxymethylcellulose is approved as a consistency regulator in 8 food standards:

canned sardines up to 20 g/kg;

- Canned mackerel up to 2.5 g/kg; mayonnaise up to 1 g/kg;
- some types of margarine up to 10 g/kg;
- up to 5 g / kg of cottage cheese and cream;
- processed cheese up to 8 g/kg;
- flavored yogurt, etc. up to 5 g/kg;
- soups, broths up to 4 g/kg.

In the Russian Federation, carboxymethylcellulose, CMC (E-466) is allowed as a consistency stabilizer, thickener, texturizer, binder and carrier-filler in pasteurized cream and other food products in accordance with the TI (item 3.1.8, 3.6.58, 3.16.53 Sanitary rules and regulations 2.3.2.1293-03).

Carboxymethylcellulose, SMS (E466) is a part of encapsulating and tableting agents, a carrier of food additives, a part of food adhesives.

Commercial forms of carboxymethylcellulose, SMS (E-466) - differ greatly in the viscosity of solutions and the ability to retain moisture.

In this section, researches were carried out to obtain several brands of E-466 with high purity for pharmaceutical and medical fields from fiber waste of cotton ginning plants and cellulose obtained from paulownia tree and banana stems.

The technical process of purified SMS includes the following steps: Preparation of products and solutions; Extraction; Squeezing and pinching; Drying of purified Na-CMC; Grinding; Packaging of the finished product; Cleaning up the used solution.

The main task of the technological process is to clean the additional compounds contained in Na-SMS by extraction with an aqueous solution of ethyl alcohol, that is, to extract and dry the SMS with the help of continuous wicks, and to squeeze the finished product in the equipment used using a continuous mechanism.

Purified Na-SMS represents the sodium salt of cellulose glycolic acid.
Purified Na-CMC is a powder or fiber product that varies in color from white to yellow to clear brown depending on the product brand. Purified Na-CMC is well soluble in aqueous solution of 40% ethanol and acetone. Insoluble in other types of organic solvents. All quality indicators of purified Na-CMC must meet the requirements of TU 6-55-39-90 and Ts 22235949-003:2015 (internal Ts in the required production of "KARBONAM"). At the initial stage of scientific work, synthesis processes were carried out on the basis of Na-CMC, PTKTCh, Pavlonia and banana cellulose.

It is known from the literature that Na-CMC mainly involves mercerization of cellulose (NaOH), alkylation of the resulting alkaline cellulose with sodium monochloroacetate reagent, and the last step of oxidation. The following is a principle technological scheme of the Na-CMC extraction process and the technology for obtaining several brands of high-purity E-466 for the pharmaceutical and medical industries based on it;

It can be seen from Figure-1 that the principle scheme of obtaining several brands of high purity E-466 for the pharmaceutical and medical industries from fibrous wastes of cotton ginning plants and celluloses obtained from paulownia trees and banana stems is presented in Figure-1. (1) is loaded into "Monoapparatus" (3) through special transporters. A mercerization process is carried out using a concentrated solution of caustic alkali (NaOH). The resulting alkali cellulose is exposed to the monochloroacetate (2) reagent, and the exchange process is carried out. The pre-calculated reagents are transferred to the distillation (4) (dose calcium) unit after the semi-finished technical Na-CMC alkalization process based on the consumption norm. In this unit, a semi-finished product is produced as a result of an exothermic reaction. In the process of oxidation, the temperature is from 500C to 1100C. At the end of the distillation process, the technical CMC product with 35-40% moisture content is transferred to the innovative E-466 product extraction process with high purity, i.e. to the sprite extraction unit - extraction unit (capacity) (6). Here, a stepwise extraction process is carried out at different concentrations of ethyl alcohol.

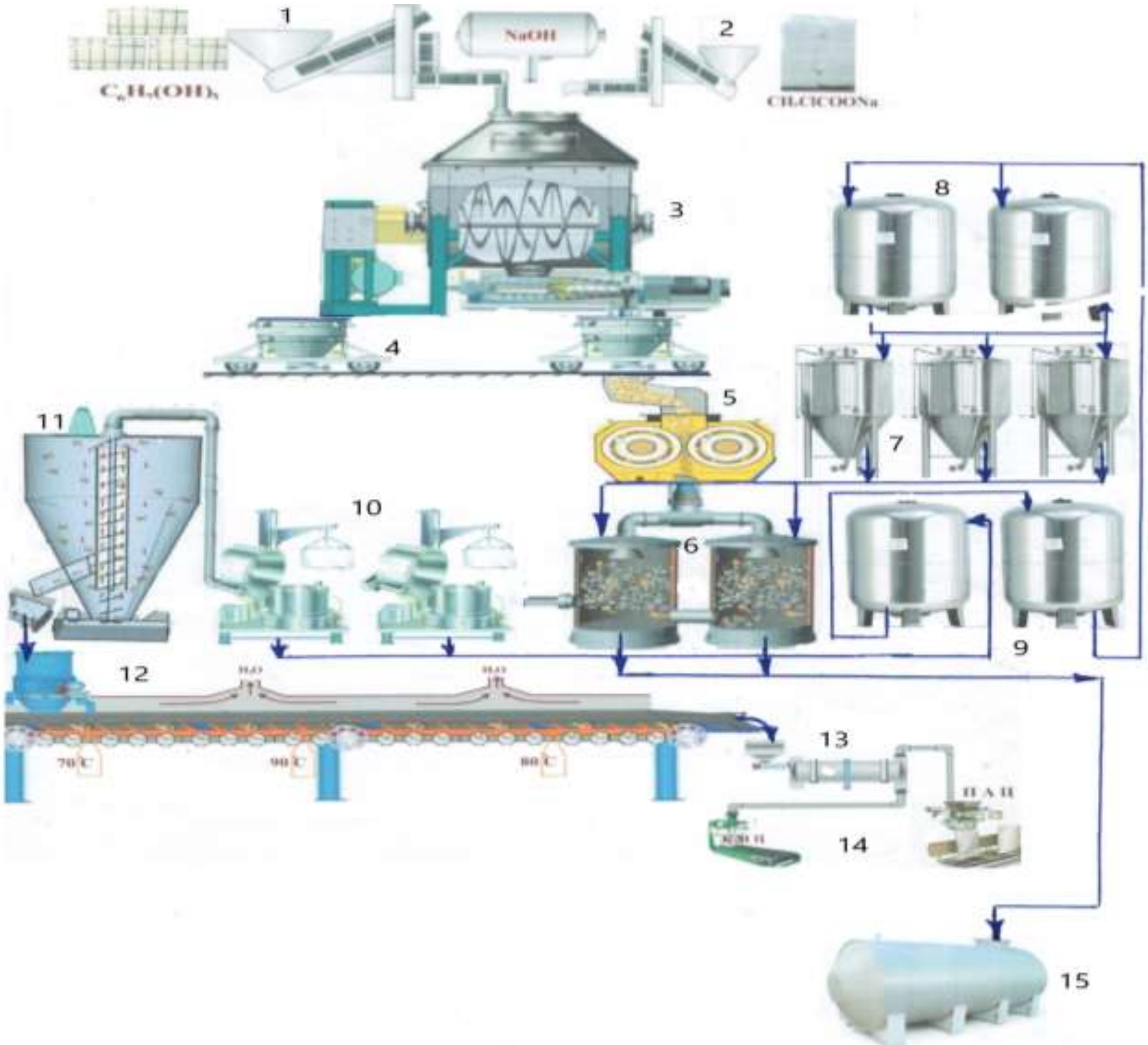

Fig-1: 1-cellulose, 2- sodium monochloroacetate, 3-"MONO APPARAT", 4-ethylizing capacity, 5-double screw stopper, 6-extraction section - capacities, 7-extraction reagent, 8-extraction reagent (ethyl alcohol) rectifier capacity, 9-extraction reagent (ethyl alcohol), 10-centrifuge, 11-semi-finished product bender-presser, 12-drying cannon, 13-special mill-crusher, 14-finished product, 15-glycolates resulting from extraction black bender .

As a result of sending the required concentrations of ethyl alcohol from the disposal process (7-8-9 capacities) to the capacity, the process of cleaning from various secondary products, organic bricmes, in a word, glycolates is carried out. The purified E-466 product is compressed using special centrifuges (10) and is dried using a hopper (11) and transferred to a drying cylinder (12). The precipitate of ethyl alcohol separated from the centrifuges containing gullets is sent to the utilization sections, and the sediments in the sludge and cleaning filters are sent to a special bender (15).

The drying process is carried out in a structure consisting of a conveyor belt conveyor device at temperatures between 700C and 900C. The dried finished innovative product E-466 is passed through special mills (13) to the required grinding level and packed in packaging departments (14).

Below you can see the tables showing the effect of various parameters and factors on some quality parameters of technical Na-CMC from fiber waste of cotton ginning enterprises and cellulose obtained from paulownia tree and banana stalks and E-466 with high purity for pharmaceutical and medical fields, namely;

Some physico-chemical parameters of Na-CMC samples obtained by the "INNO-CELL-MONO" method, based on the technology currently in production

Table-1

Na-CMC samples	Indications of Na-CMC						
	Moisture content, %	Degree of substitution with carboxyl groups	Amount of main substance, %	Dynamic viscosity of a 2% aqueous solution, mPas	Solubility in water, %	pH	PD
Na-CMC based on PTKTCh cellulose							
1*	11	81	45	109,3	97,2	12	420
2+	7	85	50	140,4	98,7	9	600
Na-CMC based on Paulownia wood cellulose							
1*	10	82	50	98,6	97,8	12	360
2+	8	85	55	124,2	98,8	9	550
Na-CMC based on banana stem cellulose							
1*	11	82	52	120,2	97,9	12	500
2+	9	85	55	168,2	98,8	8	650

1*- Physico-chemical indicators of CMC obtained on the basis of technology currently in production

2+- Physico-chemical parameters of CMC obtained by INNO-CELL-MONO method

It can be seen from the table that there is a noticeable difference between the physico-chemical parameters of the CMC samples obtained by the "INNO-CELL-MONO" method and based on the existing technology. Because the difference between the proposed technology and the analogues of the first type is the intensification of the "Monoapparatus" construction in the process of producing alkaline cellulose, that is, the sharp reduction of various chemical and mechanical destructive processes due to the increase from 120 to 240 rpm, and the destruction of the elementary groups of the resulting product and the macromolecule of alkaline cellulose can be explained by a sharp decrease.

Effect of Na-CMC obtained on the basis of fiber waste from cotton ginning plants and cellulose of pavlovnia tree and banana stems on the extraction time on the main substance content.

Table-2

№	CH_3-CH_2-OH Ethyl alcohol, C^0	Na-CMC obtained on the basis of cotton TKTCh cellulose		Na-CMC obtained on the basis of paulownia tree cellulose		Na-CMC obtained on the basis of banana stem cellulose	
		The amount of the original main substance, 50%		The amount of the original main substance, 55%		The amount of the original main substance, 55%	
		Extraction time, minutes	The amount of the main substance, %	Extraction time, minutes	The amount of the main substance, %	Extraction time, minutes	The amount of the main substance, %
1	**55**	10	56	10	77	10	78
2	**55**	20	66	20	86	20	89
3	**55**	30	75	30	97	**30**	**98**
4	**55**	40	86	**40**	**98**	40	98
5	**55**	50	89	50	98	50	99
6	**55**	**60**	**96**	60	99	60	99
7	**55**	70	98	70	98	70	98

The table shows the effect of the extraction time on the amount of the main substance of the innovative product E-466, in which the extraction time increases, that is, as a result of the purification of various elements of the technical KMTs - glycolate content by extraction in a 550 solution of ethyl alcohol - from 10 to 70 minutes, each For one object, different optimal parameters were calculated. In particular, the extraction time for the E-466 innovative product based on PTKTCh cellulose is 60 minutes, the extraction time based on paulownia tree cellulose is 40 minutes, and the extraction time of the E-466 innovative product based on banana plant cellulose is determined as the optimal parameter. The higher extraction time of the product based on PTKTCh compared to the products obtained based on paulownia and banana cellulose is due to the fact that the fibers of the cotton fiber are chaotic and tangled. Because during extraction, the process of removing glycolates, which are located in tangled parts of such fibers, from the fiber is difficult. In particular, it can be observed that the extraction process of the innovative product based on paulownia tree and banana plant cellulose quickly frees their fibers from glycolates in a short period of time without any complications.

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