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COMPARATIVE RESEARCHES OF THE COMPOSITION AND PROPERTIES CMC IN DIFFERENT DEGREE OF POLYMERIZATION

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ABSTRACT:

Interest in water-soluble derivatives of cellulose is dictated by resistant to demand from various branches extracting and processing industries. Spheres of application of cellulose ethers constantly widen and there is a necessity for perfection of traditional methods of synthesis of modification of cellulose ethers of giving them the combined properties. Among ethers carboxymethyl cellulose (CMC), represents the big practical interest from the point of view of expansion of its sphere of practical application.

KEYWORDS: carboxymethyl cellulose, cellulose, cellulose ethers, degree of polymerization, degree of substitution, ash content, temperature, humidity, mercerization, natural polymer material, non-woody plant species such as flax, cotton stalks (cottonwood), hemp, jutef.

INTRODUCTION:

Interest in water-soluble derivatives of cellulose is dictated by resistant to demand from various branches extracting and processing industries. Spheres of application of cellulose ethers constantly widen and there is a necessity for perfection of traditional methods of synthesis of modification of cellulose ethers of giving them the combined properties. Among ethers carboxymethyl cellulose (CMC), represents the big practical interest from the point of view of expansion of its sphere of practical application.

The sodium salt CMC has the greatest practical value. Similarly CMC, it represents amorphous white substance in density of 1,59 g/sm^3 whereas the bulk density of this joint makes 300-800 kg/m^3. Possessing softening temperature 170°C, the sodium salt CMC is soluble in water, and also in aqueous solutions of alkalis, ammonia and sodium chloride, and solubility extent is caused by the degree of cellulose esterification. On the contrary, CMC does not dissolve in organic dissolvents and petroleum oil.

Research results of the synthesis of CMC from cotton microcrystalline cellulose are presented in this work.

The sodium salt CMC is obtained by interaction of alkaline cellulose with chloroacetic acid with the semi continuous and monoapparatus methods. The essence of synthesis of CMC consists in the semi

continuous way in preliminary alkaline machining of cellulose and MCC, an aqueous solution of alkali concentration 225-235 g/l the subsequent extraction, the maturation and esterification of alkaline cellulose- chloroacetic acid.

Because of valuable physical and chemical properties the representative of cellulose ethers -Na-carboxymethyl cellulose is made commercially mainly on the basis of wood cellulose all over the world, and its technical brands are widely enough applied in the oil and gas extraction mountain-chemical, textile, paper industry, in the manufacture of synthetic washing-up liquids, tooth-pastes and glues for the building industry. Samples Na-CMC of high purity degree are widely used in medical, perfumery-cosmetic and the food-processing industries.

The periodic method of obtaining CMC, in turn, can be divided into three groups, which refer to: traditional-classical, monoapparatus and suspension.

However, the specified methods have a number of essential deficiencies, the main thing from which is bulkiness and labour content of the basic production operations, polytypic the equipment for which disposing the big floor spaces are required.

These deficiencies are largely eliminated at obtaining CMC by a monoapparatus method. The essence of a monoapparatus way of synthesis of CMC consists in conducting of a stage of alkaline machining of cellulose and MCC with settlement quantity of a solution of alkali promoting to expel a stage of quench of alkaline cellulose. The monoapparatus method is based on conducting of all stages of synthesis in one apparatus by means of loaded settlement quantities of components and their subsequent drying.

Advantage of a monoapparatus method consists in exclusion of a separate stage mercerization, and also the equipment for the dialyzers used at regeneration of completed alkali. Necessity for bulky soda station for preparation and storage of solutions of alkali is thus expelled.

All these lead to considerable decrease of quantity of attendants, clearing of an effective area and according to decrease in the cost price of products. In the course of obtaining CMC on the above-stated method, under condition of the small maintenance of water in a stock high efficiency of use MAN to 84 % is attained. In the capacity of initial raw materials in a monoapparatus method wood (sulphatic, sulphitic) cellulose is used, and also more low-cost aspects of raw materials: the sawdust, the regenerated cellulose, wood flour, chalk mass and other various cellulosecontaining waste. Solubility, viscosity, degree of polymerization, level of replacement and other operational properties CMC largely depend on its obtaining way and raw materials quality indicators. Therefore, a great interest represents conducting of comparative researches of samples Na – CMC from the same raw materials – cellulose and obtained by various methods.

The purpose of the given work there was a comparison of composition and properties of CMC obtained in equal conditions from various raw materials through semicontinuous and monoapparatus method.

In table 1 comparative characteristics of samples of CMC obtained from various raw materials are presented.

Table 1. Comparative characteristics of samples of CMC from cotton and microcrystalline cellulose obtained in the semi continuous and monoapparatus way

Samples	RL	PD	Solubility, %	Obtaining way
Technical CMC Open Company Karbonam manufactures	0,52 0,65 0,73	720 670 450	82 96 98,5	Semicontinuous way
Technical CMC Open Company	0,61 0,70	860 740	75 86	Monoapparatus way

Karbonam manufactures	0,80	670	98	
Technical CMC from MCC obtained in the laboratory of TCTI	0,38 0,44 0,51	210 180 140	56 67 89,5	Semicontinuous way
Technical CMC from MCC obtained in the laboratory of TCTI	0,41 0,46 0,52	240 215 180	74 87 97,5	Monoapparatus way

The analysis of quality indicators of commercial samples of CMC shows that the semicontinuous way allows to obtain samples concerning low values both on replacement level, and on polymerization degree of CMC meeting the requirements of acting standards. The given fact can be explained that at a stage of a saturation of alkaline cellulose its hydrolytic splitting occurs under the influence of air oxygen that promotes decrease in the degree of polymerization of an end-product.

Rather low values of their replacement level can be explained predominance of concurrent reaction of decomposition of chloroacetic sodium upto sodium glycolat under the influence of excess of alkali collecting in cellulose in the course of its extraction.

Despite rather low values of RL samples of CMC obtained in the semicontinuous way rather high values as replacement levels, and degrees of polymerization at their worst values solubility in water.

The given fact can be explained that use of settlement quantities of alkali solution, on stages of caustic treatment and exclusion of a stage of saturation does not allow uniform swelling of cellulose that in turn non-uniform etherification of alkaline cellulose results. Therefore obtained samples of CMC despite rather high values of replacement level and degree of polymerization dissolve in water worse.

Further we conduct comparative researches of semi continuous and monoapparatus way of obtaining CMC from microcrystalline cellulose (MCC).

Apparently from the table the samples obtained from MCC in the semicontinuous way have rather low values of replacement level (0,38-0,52) and degree of polymerization (140-210), at low values of their solubility (56-89 %) in water in comparison with the samples, obtained in the monoapparatus way (degree of polymerization - 180-240, replacement level - 0,41 – 0,52, solubility - 74-97,5 %)

It is possible to explain low values of replacement level of and degree of polymerization of CMC samples from obtained in the semicontinuous way, hydrolysis of MCC in the course of caustic treatment and saturation and a concurrent reaction high speed – decomposition chloroacetic sodium upto sodium glycolat at the etherification stage.

Efficiency of reaction of carboxymethylation in the obtaining Na-CMC by the monoapparatus method largely depends on the cellulose raw materials nature and on its preliminary preparation. The greatest values of operating ratio chloroacetic sodium are attained at carboxymethylation of pulverous cellulose prepared by crushing in rolled viscose cellulose in the laboratory mill (a size of particles < 84 mkm). It is established that such cellulose possesses a high reactive capacity.

It is possible to explain high values of solubility of samples of CMC obtained from MCC in the monoapparatus way concerning its high reactive capacity after comparison with cotton linters.

Thus, water-soluble CMC and MCC obtained in the monoapparatus way for which limiting values of replacement level and the degree of polymerization providing their solubility in water in conformity of acting standard deeds are installed. The reaction products, obtained by the monoapparatus method, have smaller solubility in comparison

with samples of analogous replacement level and the degree of polymerization, obtained by the periodic method. It, probably, is spoken the inequality of distribution of carboxymethyl groups. Besides, by the monoapparatus method because of the restricted volumes of water, swelling of initial raw materials proceeds not in the full, and thus gelling fraction is formed.

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