PHYSICAL AND CHEMICAL PROPERTIES OF POLYCOMPLEX GELS OF CARBOXYMETHYL CELLULOSE WITH UREAFORMALDEHYDE OLIGOMERS

Alimdzhanov I.I., Inagamov S.Ya., Abzalov A.A., Mukhamedov G.I.
Tashkent Pharmaceutical Institute, Tashkent city, Republic of Uzbekistan,
E-mail: sabitjan1957@mail.ru.

The physicochemical and technological properties of polycomplex gels with the possibility of their use in pharmacy have been evaluated. The possibility of regulating the structure of supramolecular formations of polycomplex gels of sodium carboxymethylcellulose with urea-formaldehyde oligomers has been shown by varying the ratio of components when nanostructures with adjustable nanoscale sizes are formed as a result of the self-organization of macromolecules.

Key words: polycomplex, polycomplex gels, oligomer, sodium carboxymethylcellulose, urea formaldehyde oligomer, properties.

Topicality: Currently, of great scientific and practical interest is the study of the ability of many water-soluble natural and synthetic polymers to form stable products of cooperative reactions between dissimilar polymers, called polymer complexes (PC). In terms of solving this problem, the products of the interaction of natural polymers with oligomers, which form polycomplex gels (PCG), are of the greatest interest. PCG are promising products in pharmacy and are increasingly used as thickeners and stabilizers for suspensions, prolongers of action of medicinal substances, film formers for capsules and tablets, as a basis for ointments and other soft dosage forms, as they reveal a number of unique and most valuable properties [1-2].
Macromolecular complexes based on sodium carboxymethylcellulose (Na-CMC) (polyanion) and synthetic urea-formaldehyde oligomers (UFOs) of linear structure (polycations), which form in PCG water systems, are very interesting and promising in this aspect. In this connection, it is of interest to study the whole complex of properties of PC and PCG, which is caused by specific interactions in high-molecular matrices. In this aspect, the most interesting was the study of the structure and physicochemical properties of the concentrated aqueous systems of polycomplex gels "Na-CMC and UFO".

Materials and methods of research: As the main object of the study was used purified Na-CMC of the Namangan chemical plant, with a degree of substitution (DS) 70 and a degree of polymerization (DP) 450. Urea of brand pure was used for analysis (p.f.a), without additional cleaning. Industrial urea-formaldehyde oligomers of the brand CFLT (carbamide-formaldehyde low-toxic resin) and CFV (carbamide-formaldehyde viable resin) which is a 60-70% solution containing the products of condensation of urea and formaldehyde were used. Na-CMC solutions in bidistilled water were used in concentrations from 0.01 to 0.4 bas.mol/l. The reaction mixtures of the required concentrations were prepared by mixing the reagent solutions in an appropriate proportion at room temperature and pH 6.5-7.0. The study of the rheological properties of concentrated systems of polycomplex gels was carried out on a Reotest-2 rotational viscometer (Germany) in the system of coaxial cylinders in a voltage range of 2-380 Pa.

Results and discussion: when aqueous solutions of Na-CMC and UFO are mixed, polycomplexes are formed, and in more concentrated solutions (0.4 bas.mol/l) PCG are formed

that are stabilized by ionic bonds between Na-CMC carboxylate anions and UFO amino groups, as indicated by a shift absorption bands of 1600 cm^{-1} and 1410 cm^{-1} at 10–20 cm^{-1} [2].

The physicochemical and technological properties of PCG, obtained on the basis of Na-CMC and UFO, were studied. Experimental data showed that the studied PCG is easily applied to the skin and maintains its homogeneity and stability during long-term storage [2]. The quality indicators were determined: color, smell, appearance, pH, aggregative stability during centrifugation and under the influence of temperature, as well as a shelf life that is more than 2 years (see table).

Table

Physico-chemical properties of polycomplex gels Na-CMC and UFO

№	Composition	Appearance	pH value (1:10) (Norm 6.5-7.6)	Stability		Film formation (min.)	Term storage (in years)
				When heated ($40^0 \pm 0.2^0$C)	When ($-10^0 \pm 0.2\ ^0$C)		
1	Na-CMC	Yellowish mass having a peculiar smell	7.2	unstable	unstable	8-10	0.5
2	Na-CMC – UFO	White-yellowish mass, having a peculiar smell	6.8	unstable	unstable	5-8	2.25
3	Na-CMC – UFO – glycerin	White-yellowish mass, having a peculiar smell	7.6	unstable	unstable	6-8	2.5

Conclusions: Thus, the complexation of the cellulose derivative - Na-CMC with synthetic oligomers makes it possible to regulate the structure of polymeric associates and their properties. This opens up new ways of obtaining Na-CMC complexes with a given structure, and the complex formation process itself can be viewed as a way of modifying a traditional polymer and regulating its molecular dimensions, which opens up new ways of efficiently using Na-CMC. The study of molecular complexes of natural polymer derivative makes it possible to ascertain the role of intermolecular interactions in the occurrence of the special properties and structure of the complexes and the associated physicochemical phenomena.

References

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