Physicochemical properties of polysaccharides extracted from sea-origin species

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In this paper, we studied the physicochemical properties of polysaccharides - chitosan and chondroitin sulphate, such as surface and optical activity, molecular weight, degree of deacetylation, the effective radius of macromolecules.

Chitosan is an aminopolysaccharide (2-amino-2-deoxy-β-D-glucan) obtained by deacetylation of chitin. Unique characteristics of chitosan allow to use that polysaccharide widely in industry, medicine, biotechnology.

Chondroitin sulfate is a sulfated glycosaminoglycan composed of a chain of interchanging sugars (N-acetylgalactosamine and glucuronic acid). Chondroitin sulfate participates in the formation of bone tissue, ligaments, as well as in maintaining the flexibility and the elasticity of the vascular wall. Chondroitin sulfate is a widely used dietary supplement for the treatment of osteoarthritis.

Chitosan is obtained from chitin of the king crab and the antarctic shrimp. Chondroitin sulphate is obtained by the technology described in the literature (from the cartilaginous tissue of salmon) and the advanced technology using ultrafiltration columns. Molecular weight of chitosan samples were determined by viscometric method, degree of deacetylation - by potentiometric titration, optical activity – by polarimetric method. Average molecular weight of chondroitin sulphate is determined by nephelometric method, the effective radius of the macromolecules is assessed by the dispersion of light scattering, surface activity – by the relationship between the surface tension of solutions and their concentration.

In the literature there are practically no information about the optical activity of chitosan solutions and the influence of characteristics such as degree of deacetylation and molecular weight on it. Optical activity has a significant influence on the properties of chitosan. For example, it is known that the bactericidal activity of the film samples of chitosan is largely determined by the value and character of specific optical rotation. Furthermore, the change of optical activity may be evidence of the occurrence of organic reactions, for example, the reaction of hydrolysis of glycosidic bonds in polysaccharides proceeds by mixed mechanism (SN1 + SN2).

Analysis of experimental data showed that the specific rotation of the plane of polarization for the samples of chitosan with molecular weight $M_\eta = (5.5 - 8)10^4$ kDa and deacetylation degree of 69-84% is nearly the same. Therefore, the change of deacetylation degree and molecular weight in the studied range does not affects the optical activity of chitosan.

Found that the average molecular weight of chondroitin sulphate samples from salmon-origin cartilage is in the range of 50-100 kDa. It is shown that with increasing concentration of NaCl the effective radius of the macromolecules of the polysaccharide is reduced, indicating the suppression of polyelectrolytic swelling. Chondroitin sulphate, extracted from salmon cartilage, is a surface-active substance.