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HYDRODYNAMIC OF POLIELECTROLOLITS AND REOLOGICAL PROPERTIES

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ANNOTATION

A wide range of polyelectrolyte concentrations (C), that is, changes in relative viscosity ($\eta_{нис}$) in the area from dilute solution to gel formation. The bonding graphs are curved, indicating at first that an increase in concentration leads to a sharp decrease in relative viscosity.

KEYWORDS: *rheology, gel, elasticity, polyelectrolyte, hydrodynamics, macromolecules, concentration.*

DISCUSSION

The unique properties of the molecular structures of natural polymers, including polyelectrolyte properties related to functional ionogenic groups, are demonstrated by their application in solutions. For most water-soluble biopolymers, these properties are characteristic and are observed to be an anomalous effect of concentration changes. Increased concentration results in the transition of the solution to gel. These gel nodes have a physical bonding nature that can break apart and be elastic-flexible under external stresses, including longitudinal space. Analysis of these characteristics of polyelectrolytes depending on the concentration of hydrodynamics of polymers according to the Haggins law is of great scientific and practical importance, as well as in the longitudinal field where the rheology of the gel is elastic. In the present study, such hydrodynamic and rheological properties were studied in the case of polysaccharide polyelectrolytes such as water-soluble Na-carboxymethylcellulose (Na-KMTs) and pectin (PK).

The change in relative viscosity ($\eta_{нис}$) in a wide range of polyelectrolyte concentrations (C), from liquefaction to gel formation, is illustrated in Figure 1. The bonding graphs are curved, indicating at first that an increase in concentration leads to a sharp decrease in relative viscosity. This is due to the decrease in the efficiency of electrostatic interactions with increasing polymer content in the solution. Increase in the amount of ammonia in subsequent stages indicates that macromolecular interactions are present and that gel formation in the> 15 areas has stopped. It was found that the transition to a gel state for pectin takes place at a higher concentration than Na-KMTs. This is also due to differences in the molecular structure and molecular weight of the samples.

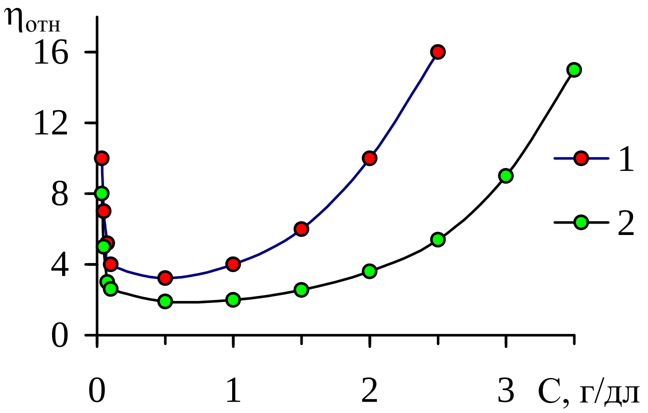
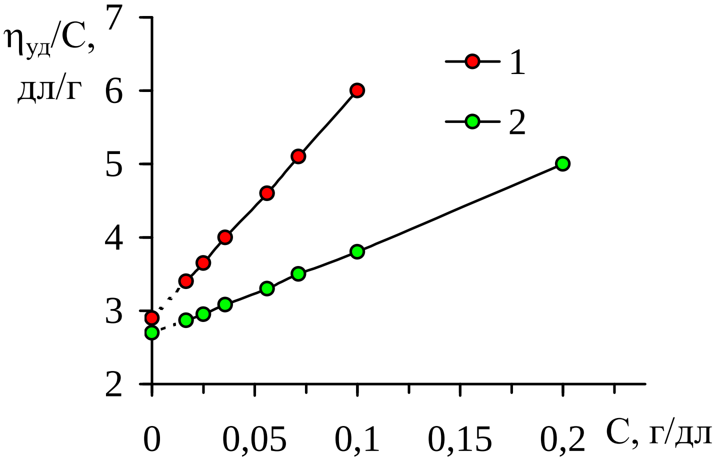


Figure 1. Depending on the relative viscosity (η) concentration (C) of the polyelectrolytes: 1 - Na-KMTs; 2 – Pectin

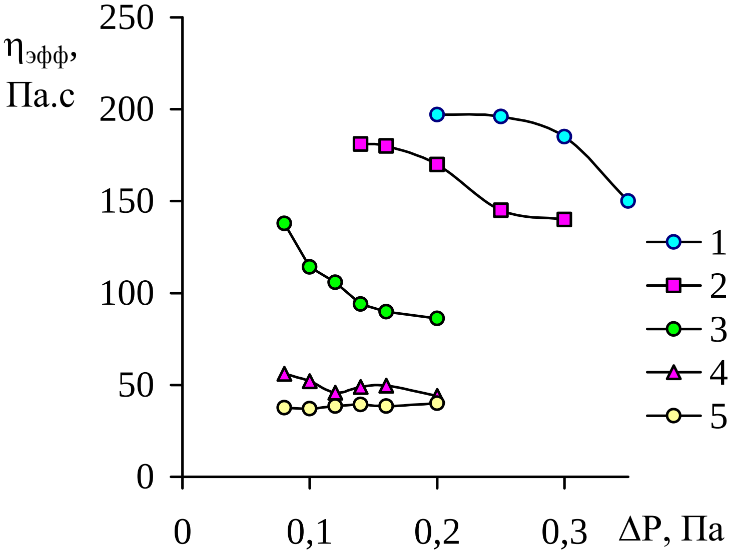
that is, the polyelectrolyte effect to determine the difference in molecular masses (M_η) is based on the viscosometrically determined viscosity ($\eta_{сол}/C$) concentration graphs of solutions eliminated by adding 2% NaCl (Figure 2). According to Haggins's law, we find the sum of viscosity [η] according to $\eta_{сол}/C = [\eta] + k[\eta]^2C$ (where k is constant): [η] = 2.9 dl / g for Na-KMTs and [η] for pectin.] = 2.7 dl / g.



Picture 2. Graph of bonding ($\eta_{сол}/C$) concentration (C): 1 - Na-KMTs; 2 – Pectin

On this basis, the Mark Kunn Hauvink equation $[\eta] = KM^a$ for Na KMTs in $M_\eta \approx ([\eta]/2,33*10^{-5})^{1/1,28} = 56700$ and for pectin $M_\eta \approx ([\eta]/1,10*10^{-5})^{1/1,22} = 26300$, that is, the molecular weight of pectin is almost 2 times smaller than that of Na-KMTs. Therefore, to convert pectin to gel, it is necessary to extract two more pectins than Na-KMTs.

The rheological properties of polyelectrolyteolite in the longitudinal field were investigated for the sample of Na-KMTs, and the results are shown in Figure 3.



Picture 3 Dependence of effective viscosity ($\eta_{\text{эфф}}$) on pressure difference (ΔP) for polyelectrolytes based on Na-KMTs: 1 - gel (3 g / dl); 2 - elastic adhesive solution (1.5 g / dl); 3 - viscous solution (0.7 g / dl); 4 - solution (0.35 g / dl); 5 - diluted solution (0.17 g / dl).

Studies were performed at different concentrations and their effective viscosity was calculated using the formula $\eta_{\text{эфф}} = 10,02\Delta Pt$ This is the time difference of ΔP and the time t is leaking in the longitudinal area. It is found that the gel (1) sample is deformed and transformed into elastic-porous state when the effect of the longitudinal field is $\Delta P \geq 0,2$ Pa while the elastic viscous solution (2), the viscous solution (3) and the solution (4) exhibited a nonionic flow, the tendency for the diluted solution (5) to reflect the characteristic of Newtonian fluids was observed.

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