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BOOK OF ABSTRACTS

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O-40 OBTAINING OF HYDROGELS BASED ON GELLAN IN ETHANOL

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The main methods for obtaining hydrogels are chemical methods, as well as changes in such external factors as ionic strength, concentration, temperature and pH of the medium. Gelation of polymers with a change in the polarity of the solvent is a poorly studied and promising method. In this paper, gellan was used as an object of investigation for the gelling process in the presence of additives of an organic solvent. Gellan is a good gelling agent that exhibits the ability to form physical gels in the presence of various low molecular weight salts or under the influence of high temperatures. Gelation occurs by changing the conformation of gellan macromolecules from disordered coils to double helices and their further aggregation. During the research intensive gel formation of gellan was observed when ethyl alcohol was added to the gellan solution. The concentration of polymer in solution was 0.5 or 1 wt. %. The ratio of the alcohol volume to the gellan solution volume (n) was varied from 0.2 to 2.0. Within the time, the volume of the gel obtained shrinks, and the volume of the liquid phase over the gel increases. It was noticed that the greater the ratio is, the more the gel shrinks, the more the volume of the liquid phase increases. The total volume of liquid phase and gel after gel formation does not change in comparison with the initial sum of alcohol and gellan solution volumes. The liquid phase, which was released above the hydrogel, was studied by refractometry. It was shown that the refractive index n_d increases with the ratio of the ethanol volume to the polymer solution volume until the ratio $n = 1.2$ when the refractive index reaches its equilibrium value. The value of the refractive index of the liquid phase varies in the range $n_d = 1.340 - 1.364$ while the refractive index of ethanol is $n_d = 1.3611$. The obtained results allowed proposing the composition of the liquid phase – it is a mixture of water and alcohol. Using a calibration curve of the dependence of n_d on the water : alcohol ratio in the mixture, it was determined that the liquid phase contains from 2 to 9 vol. % water after the gelling process. The volume content of water in liquid phase reaches the equilibrium value after $n = 1.4$. The polymer concentration does not influence the water content value. The dynamic viscosity of the liquid phase was studied using an automatic microviscometer. The viscosity changes sharply in the range from 1 to 2.75 mPa·s till $n = 0.8$, and after takes stable values in the range 1.6-2.2 mPa·s. On the basis of the data obtained, it was assumed that there is a small fraction of gellan in the liquid phase. To confirm the presence of gellan, as well as to determine its concentration in the liquid phase, the phenol-sulfate method was used. The method is based on the determination of the polysaccharide amount by the reaction with phenol and concentrated sulfuric acid. Briefly, 1 ml of a 5% aqueous solution of phenol was poured into 1 ml of the liquid phase containing gellan, and then 5 ml of concentrated sulfuric acid was added gradually with constant stirring. The temperature of the solution was increased, and to prevent overheating, the flask with solution was cooled in cold water to room temperature. The resulting solution was studied by UV spectrophotometry at a wavelength of 483 nm. The concentration of gellan was determined using the calibration curve by extrapolating the optical density values to the abscissa axis (concentration). It was found that the liquid phase contains gellan in an amount of 0.004-0.5 wt. %. The concentration of gellan in the liquid phase decreases with increasing ratio of initial components volumes. While achieving the ratio $n = 1.4$, the concentration of gellan in the liquid phase reaches an equilibrium value. Considering all the results it can be concluded that the intensive gelation of gellan in ethyl alcohol takes place until the ratio is increased to $n = 1.4$. After this ratio, the additionally added volume of alcohol practically does not affect the process of polysaccharide gelling.