RHEOLOGICAL PROPERTIES OF CARBOXYMETHYL CHITOSAN, POLY(N-VINYLPYRROLIDONE) AND THEIR MIXTURES

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Introduction

The polymer mixture consists of two or more polymers are obtained by physical means. Mixtures are made to improve the physico-chemical properties. There are two types of mixtures, heterogeneous and homogeneous. Homogeneous mixtures are miscible. Obtaining a miscible system depends on such parameters as the proportion by weight of polymers, solvent and preparation temperature. [1,2] There are various methods of determining the miscibility, such as viscometric technique, rheological methods, thermal analysis, spectroscopy or scanning electron microscopy [2].
The aim of the study was to determine the rheological properties of the obtained carboxymethyl chitosan/ poly(N-vinylpyrrolidone) mixtures and determination of miscibility using steady shear rheological measurements [3].

Materials and Methods

Chitosan from squid was purchased from POL_AURA. Sodium hydroxide, poly(N-vinylpyrrolidone) (PVP) was supplied Sigma-Aldrich. Sodium chloride was received from POCH S.A. (Avantor, Poland).
Based on the literature, carboxymethyl chitosan (CMCS) was synthesized [4]. Then the polymers were dissolved in various solvents: water or 0.1M sodium chloride. In the next step the polymers were mixed in the following weight ratios: 20/80, 50/50, 80/20. They were stirred on a magnetic stirrer for 24 hours. The steady shear rheological measurements were carried out on a Bohlin Visco 88 rotary viscometer equipped with concentric cylinders at different temperatures (25°-40°C) and shear rates (20-1230s^{-1}). Rheological parameters from the Ostwald de Waele equation were determined and compared [3].

Results and Discussion

Steady shear measurements were performed to evaluate the rheological properties of CMCS, PVP and their mixtures at 25°-40°C. For the carboxymethyl chitosan solutions and its mixtures in distilled water and 0.1M NaCl, the apparent shear viscosity decreases and the shear rate increases, suggesting a shear thinning effect (pseudoplastic nature). In the case of the aqueous solution of CMCS/PVP mixtures, the apparent shear viscosity is higher than that for pure polymer solutions. Furthermore, all polymer solutions are well characterized using a power law model (Ostwald de Waele equation).

Conclusions

The resulting mixtures behave like non-Newtonian fluids. A significant influence of the solvent on the apparent shear viscosity of polymer mixtures and solutions was found. The CMCS/PVP mixtures are miscible systems in distilled water. The CMCS/PVP mixtures in distilled water exhibit a larger apparent viscosity than pure polymers.

References

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