MODIFIED COMPOSITIONS FOR ENDOPROSTHESES

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Endoprostheses replacement is a surgery in the course of which the damaged joint is eliminated from the body and replaced by artificial implant. Nowadays the most promising method of fixing parts of endoprostheses is the cementless method. According the method parts of prosthesis have porous surface consists of hydroxyapatite that allows a bone to intergrow into the implant. In order to improve existing endoprostheses it is suggested to modify them by biocompatible polymers which extend the term of service of endoprostheses and increase their mechanical strength.

Biocompatible polymer solutions - cellulose acetate OPADRY CA 500F 190001 produced by Colorcon in biocompatible solvents - N-methylpyrrolidone and dimethylsulfoxide - were selected as objects of the study. Rheoviscometric study of the solutions was conducted in a wide range of concentrations from 90 to 230 g/l and a temperature range from 15 to 45 °C. The experiments were carried out on a Brookfield DV2TLV rotary viscometer with a system of coaxial cylinders.

As a result of the experiment, the relationships of shear stress and dynamic viscosity vs shear rate were obtained. It shows that all solutions have Newtonian behavior, that allows to characterize them by the Newtonian viscosity. The temperature dependence of the viscosity obeys the Arrhenius-Frenkel-Eyring equation, which makes it possible to calculate the viscous flow energy of activation, which is from 30 to 35 kJ/mol for solutions in methylpyrrolidone and from 20 to 35 kJ/mol for solutions in dimethylsulfoxide. The energy of activation vs polymer concentration relationships indicate that the viscous flow energy of activation not that much depends on the concentration with a slight tendency to increase with increasing concentration. That indicates that the flow becomes difficult while moving to more viscous solutions. Concentration dependences of viscosity have been constructed and they can be approximated by two tangent lines forming a critical point at 170 g/l for solutions in dimethylsulfoxide and at 165 g/l for solutions in methylpyrrolidone. The optimal concentration of solutions for the next disintegration of hydroxyapatite has been determined.