



PREPARATION OF CHITOSAN AND FIBROIN SOLUTIONS FOR ELECTROSPINNING

A.A. Kholmuminov, V.N. Rakhmanova, R.Yu. Milusheva, S.Sh. Rashidova

Institute of polymer chemistry and physics AS of Uzbekistan

kholmuminov@rambler.ru

The method of electrospinning allows to receive nanofibers from polymer solutions. The application of this method for the biopolymers, for example, chitosan and fibroin requires conducting of preliminary research on preparation of solutions, as, the given biopolymers are dissolved in the ion-containing solvents and the presence of ions complicates process electrospinning. The intensive removal of ions is the important question and in this connection in the given work was carried out the research devoted to regulation of dynamics of reduction of ions concentration in chitosan and fibroin solutions by means of electro dialysis and supervising association of circuits with transition in a oriented-regulated condition in a longitudinal flow.

Samples of chitosan with 80 % deacetylenic degree were obtained from chitin of silkworm chrysalis *Bombyx mori*. Fibroin from fibrous wastes of natural silk was extracted by washing from sericin and wax in water and propanol. As the solvent for chitosan system of 2 % CH₃COOH-water containing 2 % CH₃COONa was chosen. The solutions of fibroin have been prepared in 10.6 % (2,5 M) LiCl-DMFA at 110 °C. The experiments were conducted with moderate-concentrated solutions of the obtained samples ($C[\eta] \approx 1$, where C – is polymer concentration, $[\eta]$ – is intrinsic viscosity).

A cylindr from hydrated cellulose membrane was used as the tank for solutions at realization of ions electro dialysis under action of a constant current 50 V. Thus intensity of electro dialysis estimated by quantities of ions removed in dialysisat and deposited on coal electrodes. By short - capillary viscometer of Kuvshinskiy the longitudinal stream of solutions in the tank was generated. Above process of association of the oriented-regulated chains was supervised by using Frank-Keller polarization-optical system and and Faraday-Tindal polarization-ultramicroscope.

The realization of the electro dialysis at absence of a stream of solutions showed, that at reduction the contents of ions to about 50 % gelation of chitosan and fibroin is observed. The further removal of ions causes the coagulation of biopolymers. Thus the orientation factor of chains does not exceed $\beta \approx 0,10$, i.e. macromolecules are in the isotropic condition. At presence of longitudinal stream



brightly expressed optical anisotropy, which is exposed to phase division as a gel-fibre with reduction of the contents of ions about 40 % is observed. The value of the orientation factor for the divided phase chitosan is $\beta \approx 0,60$, and for fibroin - $\beta \approx 0,70$. It testifies association of oriented molecules in longitudinal stream of solutions as a result of removal of the certain part of ions by the electro dialysis.

On the base of methodical principles of electrospinning implemented tentative experiments has proved that electrical current applied along the stream accelerates association of protein molecules. It shows, that the received chitosan and fibroin solutions, are suitable for the electrospinning, i.e. for formation of fibrous materials on the nanodimension levels.