Application of Natural and Synthetic Polymers for Controlled Delivery of Drugs

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Various natural and synthetic polymers have been studied as drug carriers for controlled delivery application. Drugs used in the investigation were specific antituberculous drugs izoniazid and ethionamide, antibiotics kanamicin, rifampicin and florimicin, local anaestetics novocain, lidocain and trimecain, antidepressant tsefedrin and analgetic procidol. Immobilization was carried out by means of chemical interaction of reactive groups of polymers and drug, reaction of ion exchange with polyelectrolyte and compositional introduction into polymeric matrix.

Conditions of drug binding with water soluble polymers were studied, the structure of obtained complexes was determined, kinetical and thermodynamical parameters of binding process were calculated. The release of drugs into model biological medium at 37°C was studied. The correlation between release rates and binding parameters was determined. It has been shown that dosed release proceeds during 2-10 days and depends on nature of polymers, its concentration, pH of solution and ratio of components.

The biodestruction process and reaction of tissue on polymeric drugs were studied, toxicological and bacteriological tests were carried out on animals. It was established that drugs, binding with polymers by labile covalent and ionic bonds, show a high antimicrobic and tuberculostatic activity. The minimal histotoxic action of polymeric drugs on the native organism tissue was determined. A number of medical application of obtained polymeric drugs was explored. Data of medical-biological tests and clinical applications show a advantage of use of polymeric drugs in comparison with free drugs.

The interaction of drugs with natural polymers like polysaccharides was studied from the viewpoint of thermodynamic behaviour. The binding process was examined by an equilibrium dialysis method. The free drug concentration was determined from residual drug concentration and binding constants were calculated from Klotz equation. The thermodynamic parameters for the interaction between drugs and polymers were obtained from dependence of binding constants versus temperature. The data obtained show the small interaction of the drug with nonionogenic polymers such as polyvinylpyrrolidone, polyvinylalcohol and dextran. In this cause of ionogenic polymers the enthalpy and free energy had negative values and the entropy was positive. For these processes the electrostatic binding plays the significant role. In all cases the thermodynamic parameters and their temperature dependencies show the extension of hydrophobic interaction between the drugs and polymers.