ABSTRACT

Casein is a collective term for a family of milk proteins. At present, casein is not just a dietary protein. In its properties lie the promise of new, unexpected applications in science, pharma and functional food industries. One of such is encapsulation of health-related substances in casein matrices. Work presents current state of knowledge about casein properties and its application in nano- and microencapsulation as well as results of own research. The scope of work included utilisation of casein as a matrix capable of bacteriophage immobilisation, complexation of drugs, stabilisation of labile vitamin K and conjugation with lipoic acid.

Thesis demonstrated the ability of casein to precipitate under the influence of Ca, Sr and Ba cations. Using $CaCl_2$ casein precipitates were prepared according to methodology similar to that used for alginate. The optimised method allowed obtaining smooth, round spheres. Carrier potential of such spheres was demonstrated by immobilisation of T4 bacteriophage with an efficiency of 81,93%.

The parameter determining usefulness of casein as bacteriophage carrier is its microbiological purity. Several methods for limiting microorganism count were tested in the study, of which the greatest effectiveness was demonstrated for electron beam irradiation and reference autoclave sterilisation. Contrary to the reference method, electron beam sterilisation did not cause changes in molecular weight of casein, regardless of the radiation dose used (2-25 kGy).

In the research on drug complexation, ibuprofen, paracetamol and loperamide were used as model chemical compounds that differ in molecular structure and activity, but similar in low water solubility. The developed procedure may be applicable to complexation of drugs with a low dose-to-bioactivity ratio. One of the utilised drugs, loperamide, appears to meet this requirement.

A similar procedure was applied to vitamin K2. It allowed for the binding high amounts of vitamin K2, and the formulations obtained with citric and ascorbic acid retained stability for 7 days at relative humidity of 56,2% and 6 months of storage in elevated humidity (40-60%) conditions.

In order to conjugate α-lipoic acid with casein, an acylation reaction, based on utilisation of *N*-hydroxysuccinimide active ester was used. The conjugates were subject to reduction in order to open the dithiol ring and allowed to cross-link by re-oxidation after dialysis of the reducing agent. Reaction progress was monitored by SDS-PAGE electrophoresis. The obtained results indicate formation of molecules with a very high molecular weight. The reaction carried best at pH 8, but the use of high active ester concentrations allowed it to be carried out even at pH 6.

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