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THE CHEMICAL MODIFICATION OF POLY(A-AMINO ACID)S FIBRES FOR APPLICATIONS IN TISSUE ENGINEERING

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Three-dimensional constructs based on fibres represent one of the simplest approaches to preparation of scaffolds applicable in tissue engineering. In this work we investigate preparation of biodegradable polymer fibers based on poly(γ -benzyl-L-glutamate) (PBLG). PBLG can be easily functionalized either through modification of glutamate side chains or copolymerization. Side chain nucleophilic substitution with hydroxyamines or diamines reduces the hydrophobicity of the starting polymers and consequently facilitate its enzymatic degradation. Adhesion, proliferation and differentiation of cells on polymer scaffolds thus can be modified by introduction of biospecific peptide sequences exposed on the polymer surface. We synthesized γ -benzyl-L-glutamate (BLG) homopolymers and its copolymers with more reactive 2,2,2- γ -trichlorethyl-L-glutamate (TCEG)¹, poly(γ -benzyl-L-glutamate-co-2,2,2- γ -trichlorethyl-L-glutamate) (Poly(BLG-co-TCEG)). The copolymerization parameters of respective N-carboxyanhydrides were determined according to the Fineman-Ross and Kelen-Tüdös methods. The effect of incorporation of more reactive TCEG ester groups in the polymer chain on the kinetics of its aminolysis with 2-aminoethanol and with propargylamine was studied. The conversion of aminolysis of poly(BLG-co-TCEG) fibres was calculated from elemental analysis and ¹H NMR. The poly(BLG-co-TCEG) fibres were prepared by a solution spinning method from various types of solvent. The effect of solvent on the secondary structure of fibres was study by solid-state ¹H NMR.

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NOVEL POLYMERS FOR CRYSTALLIZATION OF BIO-MACROMOLECULES

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Crystallization of bio-macromolecules is one of the most critical steps in determination of three-dimensional structure of biologic macromolecules. A limited number of polymers currently used in commercial crystallization screens calls for design and testing of novel polymers, grafted polymers, or co-polymers that could improve current state of the art.

The Protein Data Bank (PDB) provides information on hundreds of crystal structures where polymer-protein interactions were observed. These interactions were analyzed for the purpose of rational design of novel polymer precipitants with a potential to crystallize proteins and their complexes that were not yet crystallized.

A set of eight novel polymers was tested on real cases. The extracellular domain of human CD69 was crystallized; the crystals diffracted up to 1.37 Å of resolution. The crystal structure provides the most detailed information on intra- and intermolecular interactions of human CD69.

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CHARACTERIZATION OF BIOCOMPATIBLE PBS/DLA COPOLYMER IN WATER SOLUTION

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Biocompatible Poly(butylene succinate-co-dililinoleic acid) (PBS/DLA) copolymers were prepared in the presence of acetone and tetrahydrofuran. PBS was synthesized by esterification reaction of succinic acid and butan-1,4-diol in molar ratio 1:2,2 using magnesium-titanate organometallic complex (Mg-Ti) as catalyst upon programmed temperature raising from 100 °C to 200 °C with a heating rate of 1,5 °C/min. For the reaction with DLA temperature was raised up to 245-250 °C and the polycondensation reaction was carried out under pressure 0,4 hPa in the presence of Mg-Ti catalyst. PBS segment constituting the hydrophilic part while DLA segment is soft and hydrophobic. This type of copolymers can form micelles and can be used for a drug delivery as one of potential applications. Structure of dilute solutions of PBS/DLA in water and water-Mygliol® oil was studied using X-ray scattering technique. System without oil exhibits agglomerated micelles behaviour. Distance between particles (approx. 100 Å) was estimated using fitting procedure. With decreasing concentration of copolymer, the decreasing value of distance between particles was found. In the presence of the oil, possibly multilayered vesicles were observed. The Transmission Electron Microscopy (TEM) images demonstrated particles with 150 to 500 nm diameter. For the system with highest oil concentration less structured particles with the presence of crystals was observed. After drying of copolymer containing Mygliol® oil, crystalline phase of 17% was found using Wide Angle X-Ray Scattering (WAXS).