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Nowe biodegradowalne materiały polimerowe oparte o biopoliestry alifatyczne i ich syntetyczne analogi dla zastosowań w medycynie - synteza i charakterystyka

Praca doktorska

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"Novel biodegradable polymeric materials based on aliphatic bipolyesters and their synthetic analogs for applications in medicine - synthesis and characterization"

Abstract

Dynamic development of modern medicine technologies forces the progress of materials suitable for use in the new medical procedures of treatment which could replace the imperfect materials used so far.

The dissertation is focused on elaboration of new biodegradable and biocompatible polymeric materials with controlled molecular structure and required properties for potential biomedical applications, comprising structural segments derived from PHA biopolymers.

A key aspect of this research was to develop new methods of controlled degradation process of selected biopolyesters belonging to the family of PHA in order to obtain reactive macromonomers and macroinitiators with controlled chemical structure and molecular masses. Two methods of controlled degradation of PHA were developed. The first one *i.e.* the selective reduction of PHA with using of lithium borohydride LiBH4 as a reduction agent leads to PHA oligodiols. The second developed method was aimed on controlled carboxylate induced thermal degradation of P3HB4HB biopolyester which allows to obtain linear oligomers with crotonate and carboxylate end groups.

The valuable resulting substrates, were then used in the synthesis of new polymeric biomaterials. The PHA oligodiols obtained *via* selective reduction of PHBH biopolyester were used as a macromonomer in polycondensation process with sebacoyl chloride. This process allow to obtain new terpolyesters consisting structural fragment of PHBH connected *via* sebacate unit, poly(3HB-co-3HH-co-SEB). Oligomers with crotonate and carboxylic end groups were used as a macroinitiators of anionic polymerization of β-butyrolactone to obtain a new block copolyesters containing isotactic block from natural PHA and block from atactic synthetic [R,S]PHB. An essential part of this study, from the application point of view, was to characterize the structure of new polymeric materials received and determination the relationship between chemical structure and their physicochemical properties.

Finally, the attempts were carried out to apply the new polymeric materials, developed under the framework of this dissertation, in the field of regenerative medicine.