DEVELOPMENT OF GRAPHENE-BASED BIOSENSOR FOR MEDICAL DIAGNOSTICS

P.Sobolewski[1], K.Penkala[2], J.Podolski[3], E.Mijowska[4], M.El Fray[1]

[1]Polymer Institute, Department of Biomaterials and Microbiological Technologies, West Pomeranian University of Technology, Szczecin, Poland
[2]Faculty of Systems, Signals and Electronics Engineering, Department of Electrical Engineering, West Pomeranian University of Technology, Szczecin, Poland
[3]NZOZ Meditest Diagnostic Medicine, 14D Bronisławy Street, Szczecin, Poland
[4]Division of Nanotechnology, Department of Chemical Engineering, West Pomeranian University of Technology, Szczecin, Poland

Abstract

The explosion of information provided by the "-omics," (genomics, proteomics, etc.) has resulted in a pressing need to develop matching diagnostic technologies, so-called biosensors. Rapid, sensitive, selective, and cost-effective analysis of different biomolecules and microorganisms is crucial in clinical diagnosis and efficient treatment of patients. Further, there is a growing demand for decentralized laboratory methodologies that can be implemented in doctor's office, emergency room or in the field for the analysis of such analytes as DNA, RNA, proteins, antibodies, bacteria, viruses, small compounds etc. Lab-on-a-chip platforms and miniaturized point-of-care devices based on biosensors fulfill these demands and are foreseen to revolutionize the future of medical diagnostics. Because of excellent electric and optical properties, graphene has recently found to be highly attractive in biosensing applications and may thrust new possibilities into the field of miniaturized medical diagnostic devices. The main objective of this project is to develop a multifunctional graphene biosensor for effective electrochemical detection of specific DNA microbial targets in biological samples. Novel nanocomposites consisting of chitosan and nanoparticle-modified graphene will be combined with locked nucleic acid molecular beacons with the goal of producing "ink" for ultrasonic non-contact printing of electrical circuits. The developed technology will allow fabrication of low cost, highly sensitive biosensors for point-of-care diagnosis.

[Engineering of Biomaterials, 128-129, (2014), 83]

CHEMICAL PURITY OF NEW SEGMENTED POLYESTER BIOMATERIALS

Agnieszka Piegat, Małgorzata Walenia, Mirosława El Fray

West Pomeranian University of Technology in Szczecin, Polymer Institute, Division of Biomaterials and Microbiological Technologies, Piastow Ave 45, 70-311 Szczecin, Poland

[Engineering of Biomaterials, 128-129, (2014), 83-85]

Introduction

Chemical purity is the crucial property of polymers for biomedical applications. All materials before in vitro testing and especially clinical studies needs to be purified and characterized with respect to potential leachable substances. The characterization pathway is described in PN-EN ISO: 10993 12:2009 standard, part 12, 13 and 18 1–3 and PN-83/P-04607 4.

In this research project new multiblock copolymer are developed, as potential materials for producing elements of extracorporeal heart assisting devices. Currently used polyurethanes (PU) possess following advantages: blood compatibility, transparency and easy processing, but their main drawbacks are poor mechanical stability and number of significant chemical changes on the polymer surface 5. Due to the disadvantages of commercially available PUs we proposed new multiblock copolymer consist from poly(ethylene terephthalate) (PET) hard segments and ethylene ester of dilinoleic dimer acid as soft segments (DLA). The aim of this work was to establish purification methodology of new PET-DLA copolymer and evaluate their chemical purity ,as potential materials for blood contacting product. A detailed characterization of physical and chemical properties of aqueous and non- polar extracts, as well as the purified product was performed.

Experimental

Materials

PET-DLA copolymer with the 50:50 hard:soft segments ratio (wt%) was obtained by two step polycondensation method. Briefly, transesterification between dimethyl terephthalate and ethylene glycol was carried out at the temperature range 150-190°C, then dimer fatty acid (DLA) was added and polycondensation reaction was carried at p=0,4mbar and temperature 255-260°C. α-Tocopherol was used as natural thermal stabilizer. The intrinsic viscosity of 0,724 dl/g was measured, and the melting temperature of 198°C was determined. The proposed chemical structure is demonstrated in FIG. 1.

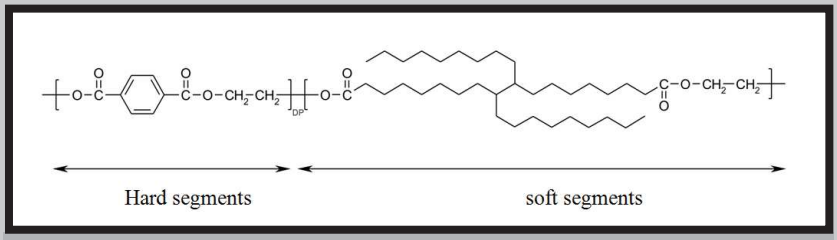

FIG. 1. Chemical structure of PET-DLA copolymer; DP - degree of polymerization for 50:50 copolymer 2,98.