

Tytuł projektu
Kompozyty biopolimerowe – opracowanie i ocena właściwości fizykochemicznych.
Project title
Biopolymer composites – development and evaluation of the physicochemical properties.
Dyscyplina /Area of science
Nauki chemiczne
PROJECT DESCRIPTION
Project goals • To use the selected ionic liquids to prepare the chitin composites as thin films and 3D porous structures • To improve thermal stability and physical properties in chitin composites • To find variants of compositions with improved physicochemical and biological properties towards selected parent compounds Outline Natural polysaccharides are widely used in the cosmetic industry, as raw materials, and hold promise for biomedical applications because of their film - forming ability, controlled bioactivity, biocompatibility and biodegradability. It is well-known that chitin, after cellulose, is the most widespread polymer in nature; however, its general insolubility makes impossible further processing. It occurs widely in the exoskeletons of crustacean and insects and in the cell walls of some fungi and other microorganisms. Chitin is chemically, mechanically and thermally stable but its particles are flat, often rectangular and nonporous. The search for new applications calls for further developments in production methods, along with investigations of the structure and degradability of polysaccharides and its composites. In this context, this project will be focused on the development and evaluation of the physicochemical properties of new composites of polysaccharides and inorganic additives. Recently, ionic liquids have been investigated as new solvents for chitin. Ionic liquids are a new generation of solvents that are called <i>green solvents</i> due to their properties. They can be regenerated and reused several times, which would decrease their environmental impact significantly. Ionic liquids may facilitate the development of new, attractive materials based on cellulose, chitin or chitosan for different industries such as medicine, pharmacy and cosmetics. Polymer composites play a very important role in the development of polymer applications. A simple approach involves blending with additional inorganic and/or

organic compounds. The specific properties can be achieved without loss of characteristic features of compounds in the composites. Therefore, the main aim of this project is the preparation and evaluation of the physicochemical properties of new composites of chitin with inorganic and/or organic additives.

Work plan

1. Preparing thin films and 3D porous structures based on α -chitin and β -chitin with organic additives using ionic liquids as solvents.
2. The evaluation of the physicochemical properties using different modern techniques such as microscopy, spectroscopy, X-ray diffraction, thermal analysis, tensile tests, swelling behaviour and calculation of surface free energy by means of contact angle measurements to get the information on the structure, morphology, wettability and surface properties.
3. Elucidating the observed changes in the composites.

Literature

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 K. Lewandowska, A. Sionkowska, et al.; Int J Biol Macromol 65 (2014) 534
 K. Lewandowska, Int J Biol Macromol 81 (2015) 159
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Required initial knowledge and skills of the PhD candidate

- ➔ Analytical thinking
- ➔ Eager to learn
- ➔ Knowledge about biopolymers and polymer chemistry
- ➔ Knowledge about research methods to characterization of biopolymers
- ➔ Understanding of basic chemistry, physics and biology/biotechnology
- ➔ Eager to work hard

Zgłaszający projekt/ Author of the project

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Proponowani promotorzy i mentorzy/prospective supervisors			
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		Wydział Chemii UMK jednostka organizacyjna	
2) promotor pomocniczy / co-supervisor			
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