

Tytuł projektu
Mieszanki biopolimerowe jak nowe materiały przyjazne dla środowiska.
Project title
Biopolymer blends as new environmentally friendly materials.
Dyscyplina /Area of science
Nauki chemiczne
PROJECT DESCRIPTION
<p>Project goals</p> <ul style="list-style-type: none"> • To use of water soluble chitosan derivatives to prepare the binary and ternary blends as thin films and 3D porous structures • To evaluate miscibility of used polymers • To improve thermal stability and physical properties in polymer blends • To find variants of blend compositions with improved physicochemical and biological properties towards selected parent compounds <p>Outline</p> <p>Currently, there is a growing tendency toward the use of natural polymers obtained from renewable resources, especially those from food industry waste and the agricultural and pulp and paper industries. Polymers from renewable resources have attracted an increasing amount of attention over the last two decades, predominantly owing to two major reasons: the first, environmental concerns and the second is the realization that our petroleum resources are finite. In this context, this study will be focused on the development and evaluation of the physicochemical and biological properties of new blends of water soluble chitosan derivatives and vinyl polymers. Due to its water solubility in wider pH range compared with the parent compound, chitosan derivatives are used in many biomedical applications, food processing, cosmetics etc. Furthermore, they are suitable candidates to manufacture films, 3D porous structures and nanotechnology-based systems which have the possibility for commercial production as well as industrial scale-up. The drawbacks of using polysaccharides as material are their rapid degradation and poor mechanical properties. Therefore, biologically important polymeric materials based on blends of synthetic and natural polymers are prepared and investigated. This method is usually cheaper and less time-consuming for the creation of materials with new properties than the development of new monomers and/or new</p>

polymerization routes. An additional advantage of polymer blend is that the properties of the materials can be tailored by combining component polymers and changing the blend composition. Thus, the main aim of the research project is to prepare the binary and ternary systems with better physicochemical properties compared with the parent compound that can be used in the material's potential applications in medicine, pharmacy or cosmetics.

Work plan

1. Synthesis and characterization of water soluble chitosan derivatives
2. The evaluation of the miscibility in ternary systems comprising a common low molecular weight solvent using viscometric studies and flow measurements
3. Preparing thin films and 3D porous structures based on the analysis of results from the studies in solutions
4. The evaluation of the physicochemical and biological properties by means of spectroscopy, thermal analysis, microscopic techniques, tensile tests, swelling behavior, contact angle measurements and analyzing of proliferation rate of fibroblast cells incubated with biomaterial extract using MTT assay.
5. Elucidating the observed changes in the blends.

Literature

- L. Yu, K. Dean, L. Li, *Prog. Polym. Sci.* 31 (2006) 576
M. Rinaudo, *Polym. Int.* 57 (2008) 397
K. Lewandowska, *Thermochimica Acta* 493 (2009) 42
K. Lewandowska, *Thermochimica Acta* 517 (2011) 90
R. Rebelo, M. Fernandes, R. Fangueiro, *Procedia Engineering* 200 (2017) 236
A. Hussain, K. Zia, S. Tabasum, A. Noreen, M. Ali, R. Iqbal, M. Zuber, *Int. J. Biol. Macromol.* 94 (2017) 10
K. Lewandowska, G. Furtos, *Polymer Testing*, 71 (2018) 173
Z. Shariatnia, *Int. J. Biol. Macromol.* 120 (2018) 1406

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	
dr hab. Katarzyna Lewandowska stopień/tytuł, imię, nazwisko	reol@umk.pl e-mail
	Wydział Chemii UMK jednostka organizacyjna
Proponowani promotorzy i mentorzy/prospective supervisors	
1) promotor główny/ main supervisor	
dr hab. Katarzyna Lewandowska	e-mail : reol@umk.pl
	Wydział Chemii UMK jednostka organizacyjna
2) promotor pomocniczy / co-supervisor	
-	