Politechnika Śląska

ROZPRAWA DOKTORSKA

Badania nad poprawą właściwości wytrzymałościowych tworzyw na osnowie biopolimerów

Research on improving the mechanical properties of bio-polymer-based materials

WERONIKA JANIK

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Promotor: dr hab. inż. Gabriela Dudek / profesor uczelni
Wydział Chemiczny/ Katedra Fizykochemii
i Technologii Polimerów
Politechnika Śląska

Opiekun pomocniczy: dr hab. Stanisław Kudła
Sieć Badawcza Łukasiewicz – Instytut Ciężkiej
Syntezy Organicznej "Blachownia"

Streszczenie w języku angielskim

The doctoral dissertation *Research on improving the mechanical properties of bio-polymer-based materials* consists of a series of five articles (**I – V**) and raises the problem of poor mechanical properties of polysaccharide-based materials along with its solution. The aim of the work was to develop innovative polysaccharide-based materials with potential applications in the packaging industry through modifications that improve their mechanical properties. For this purpose, a comprehensive analysis of fourteen groups of materials based on modified polysaccharides was carried out.

The obtained polysaccharide-based materials were tested for their mechanical properties (tensile strength and elongation at break), hydrophilic properties (moisture content, swelling degree, total soluble matter and contact angle), barrier properties (for oxygen, carbon dioxide and water vapor), morphology, antibacterial properties, thermal analysis (TGA and DSC), chemical structure by FTIR, surface charge by zeta potential, transparency and their biodegradability. To increase the reliability of the presented results, a statistical analysis was carried out.

In paper **I**, it was shown that it is possible to obtain an extrudable material based on chitosan and starch, in which the proportion of chitosan was at least 28 wt.%. On the other hand, in paper **II** it was proved that thanks to the applied modifications, consisting primarily in the use of chestnut extract, it is possible to obtain an antibacterial material based on starch, sodium alginate, chitosan and their blends, whose solubility in water was lower or comparable to the commercially available PLA film. In paper **III**, it was confirmed that it is possible to synthesize alternative biomodifiers that not only improve the properties of chitosan-based materials, but also ensure their stability over time. The synthesized biomodifiers showed also a positive effect on the mechanical properties of sodium alginate-based materials **IV**, increasing at the same time the antibacterial properties of the material. The final paper **V** showed that it is possible to obtain a hydrophobic chitosan-based material with improved mechanical and antibacterial properties, and proved that it is possible to determine the time after which the properties of the biopolymer stabilize.

Keywords: starch, sodium alginate, chitosan, polysaccharides, modifiers, biomodifiers, modifications