PREPARATION AND INVESTIGATION OF FILMS FROM PDMS AND SORBITOL MODIFIED POLYESTERS

Konstantinas Brazinski, Saulutė Budrienė

Department of Polymer Chemistry, Vilnius University, Vilnius, Lithuania
E-mail: kostiabraz@gmail.com; saulute.budriene@chgf.vu.lt

Tissue engineering as stated by Langer and Vacanti is an interdisciplinary field that applies the principles of engineering and the life sciences to the development of biological substitutes that restore, maintain or improve the function of biological tissue or the whole organ. One of the most important goals is to create a scafold in which cells can live and multiply. Polyesters modified with various materials are used to make the scafolds. Polydimethyloxane (PDMS) is an inorganic polymer that, due to its good properties, is widely used in all fields of engineering. It is characterized by chemical stability, thermal resistance, optical transparency, gas permeability, oxidation resistance, low toxicity, and biocompatibility [1]. However, PDMS has a hydrophobicity that limits its use and therefore it can be modified. Sorbitol is a monomer derived from renewable sources and is readily available today. Sorbitol has suitable properties for tissue engineering [2]. The aim of this work is to use sorbitol and PDMS to modify unsaturated polyesters and to evaluate their effect on the resulting films.

In this work, unsaturated polyesters were synthesized from azelaic acid, maleic acid anhydride, diethylene glycol, polydimethylsiloxane and sorbitol. The structure of polyesters was confirmed by FT-IR and ^{1}H NMR. Glycidyl methacrylate, butyl methacrylate and 2-hydroxyethyl methacrylate were attached to obtained polyesters to form UV curable films. Irgacure 651 initiator and UV light were used for curing. The structure of films was confirmed by FT-IR and elemental analysis. The Si amount in cured films ranged from 1.2 % to 3.8 %. The cured films were soaked in hexane, ethanol, and water prior to testing. The films were smooth and transparent, sparingly soluble in solvents. The mechanical properties of the films were determined. The higher relative elongation at break, but the lower Young's modulus of films were obtained when higher amount of sorbitol was used for synthesis of polyesters. The addition of 2-hydroxyethyl methacrylate as curing additive improved the relative elongation, but reduced the Young's modulus. The best mechanical properties showed the films when glycidyl methacrylate and butyl methacrylate were used for curing of films. The thermogravimetric analysis showed, that films obtained from polyesters were thermally stable and their decomposition took place in the temperature range of 150-480 ºC. Differential scanning calorimetry analysis was performed to determine the glass transition temperatures of the films. The wetting angles of films obtained from unsaturated polyesters modified with PDMS and sorbitol were lower than obtained from PDMS or unmodified polyesters. The more sorbitol, the more hydrophilic films were obtained.

References

1. H. Zhang and M. Chiao. J. Med. Biol. Eng. **38,** 2015, p. 143–155.
2. V. Kavimani and V. Jaisankar. J. Phys. Sci. Appl. India. **4,** 2014, p. 507–515.