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SYNTHESIS AND INVESTIGATION OF BIOCOMPATIBLE FILMS FROM POLY(VINYL ALCOHOL) MODIFIED WITH EPOXY COMPOUNDS

Ž. Drabavičius[1*], T. Kochanė[1], E. Balčiūnas[2], V. Bukelskienė[2], D. Baltriukienė[2],S. Budrienė[1]

[1]Vilnius University, Faculty of Chemistry and Geosciences, Institute of Chemistry, Naugarduko 24, 03225 Vilnius, Lithuania

[2] Vilnius University, Life Sciences Center, Institute of Biochemistry, Saulėtekio av. 7, 10257 Vilnius, Lithuania

**E-mail: zdrabavicius741@gmail.com*

Insufficient amount of organ donors results in the lack of organs for transplantation. In order to solve this problem, a lot of effort has been poured into the field of tissue engineering. The aim of this field is to create biological substitutes, that repair or even improve tissue functionality [1]. Poly(dimethylsiloxane) (PDMS) is one of the most commonly used silicone based polymers in the world, because of its great properties such as biocompatibility, gas permeability, thermal stability, transparency, and general cheapness of the polymer [2]. However, because PDMS is hydrophobic it has limited use in biomedicine, and needs to be modified. Poly(vinyl alcohol) (PVA) could be used for this purpose because of its hydrophilic tendencies, biocompatibility, and non-toxicity [3]. In the past, desirable characteristics were obtained by modifying PVA with epoxy compounds such as glycidyl methacrylate (GMA) through transesterification or epoxide ring-opening mechanisms [4].

The aim of this work was to modify PVA with diepoxy-PDMS (DE-PDMS) and/or monoepoxy-PDMS (ME-PDMS), GMA and 1,4-butanediol diglycidyl ether (BGDE). Films were obtained by curing of modified PVA via photopolymerization with photoiniciator IRG651. Glycerol was used as a plasticizer, to prevent films from becoming brittle. FT-IR and scanning electron microscopy (SEM) with high current mode for EDS was used in order to validate the structure of modified PVA. Swellability of films decreased when larger amounts of BGDE were used. When adding BMA before curing, films were the most swellable, while using GMA they were least swellable. Best Young's module (4,1 MPa) and relative elongation at break (36,1 %) compared to other films were observed when using initial component ratio [PVA]:[DE-PDMS]:[ME-PDMS]:[GMA]:[BGDE]= 1:0,1:0,1:0,2:0,1. Furthermore, using this film composition the largest Si content (15 %) was obtained. Generally stronger films were obtained using DE-PDMS, because of two epoxy rings, however the flexibility improved with the addition of ME-PDMS.

In order to see if films could be used in tissue engineering, biocompatibility tests were performed on rat myogenic cells and it was observed that our films had greater compatibility than commercial PDMS.

References

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