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Synthesis and Characterization of Unsaturated Polyesters Modified with Malic Acid and PDMS for Tissue Engineering Applications

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Tissue engineering focuses on replacing damaged or diseased tissue by combining chemistry, engineering and biological sciences. To achieve this goal, tissue engineering must use 3D scaffold for cells to grow on and differentiate properly [1]. It is important for scaffold to be biocompatible, biodegradable and have certain mechanical properties for the tissue it needs to replace [2]. Scaffolds can be made out of metal, ceramic or polymer. Polyesters are biodegradable, biocompatible and mechanical properties can be tuned [3]. Polydimethylsiloxane (PDMS) is used in biomedical applications since it is nontoxic and transparent. But PDMS applications are limited due to hydrophobicity and poor mechanical properties [4]. These disadvantages can be decreased by modification of polyesters with PDMS and malic acid which is found in living organisms [5].

In this study, polyester was synthesized by polycondensation reaction between azelaic acid, maleic acid anhydride, diethylene glycol, PDMS and malic acid. Structure of polyester has been proven by NMR and FT-IR spectroscopy. Films from modified polyesters were produced by adding curing agents: glycidyl methacrylate, butyl methacrylate, acrylamide or bisacrylamide together with photo initiator 2,2-dimethoxy-2-phenylacetophenone and curing under UV light. Solubility and degree of swelling in three different solvents: hexane, ethanol and water were determined for all produced films. Thermal stability and degradation of films was investigated by thermogravimetric analysis. The Young's module and elongation at break of films were evaluated. The films exhibit good mechanical properties. It was obtained that the contact angle of water on films was lower and at the same the surface of films was more hydrophilic to compare with PDMS.

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