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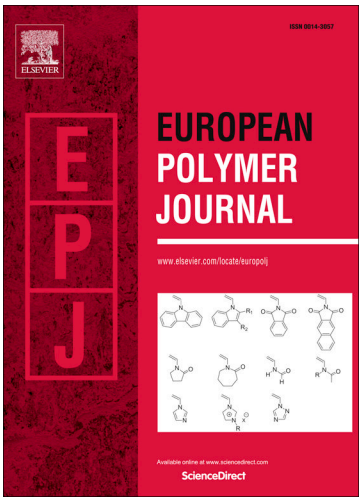

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Influence of PDMS molecular weight on transparency and mechanical properties of soft polysiloxane-urea-elastomers for intraocular lens application

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Abstract

Soft thermoplastic polysiloxane-urea-elastomers (PSUs) were prepared for the application as a biomaterial to replace the human natural lens after cataract surgery. PSUs were synthesized from amino-terminated polydimethylsiloxanes (PDMS), 4,4'-Methylenebis(cyclohexylisocyanate) (H_{12}MDI) and 1,3-Bis(3-aminopropyl)-1,1,3,3-tetramethyldisiloxane (APTMDS) by a two-step polyaddition route. Such a material has to be highly transparent and must exhibit a low Young's Modulus and excellent dimensional stability. Polydimethylsiloxanes in the range of 3,000 to 33,000 g·mol^{-1} were therefore prepared by ring-chain-equilibration of octamethylcyclotetrasiloxane (D_4) and APTMDS in order to study the influence of the soft segment molecular weight on the mechanical properties and the transparency of the PSU-elastomers. 2,4,6,8-Tetramethyl-2,4,6,8-tetraphenylcyclotetrasiloxane ($D_4^{Me,Ph}$) was co-polymerized with D_4 in order to adjust the refractive index of the polydimethyl-methyl-phenyl-siloxane-copolymers to a value equivalent to a young human natural lens. Very elastic PSUs with Elongation at Break values higher than 700 % were prepared. PSU-elastomers, synthesized from PDMS of molecular weights up to 18,000 g·mol^{-1}, showed transmittance values of over 90 % within the visible spectrum range. The soft segment refractive index was increased through the incorporation of 14 mol % of methyl-phenyl-siloxane from 1.4011 to 1.4346 (37 °C). Young's Moduli of PSU-elastomers were around 1 MPa and lower at PDMS molecular weights up to 15,000 g·mol^{-1}. 10-cycle hysteresis measurements were applied to evaluate the mechanical stability of the PSUs at repeated stress. Hysteresis values at 100 % strain decreased from 32 % to 2 % (10th cycle) with increasing PDMS molecular weight. Furthermore, hysteresis at 5 % strain was only detected in PSU-elastomers with low PDMS molecular weights. Finally, preliminary results of *in vitro* cytotoxicity tests on a PSU-elastomer showed no toxic effects on HaCaT-cells.