BIOCOMPATIBLE NON-ISOCYANATE POLYURETHANE ELASTOMERS FOR BLOOD-CONTACTING BIOMEDICAL APPLICATIONS

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Polyurethanes (PUs) are one of the most produced types of polymers in the world each year thanks to their easy synthesis and their remarkable (and tunable) mechanical properties. Consequently, they are used in many applications, and even in the biomedical field (as catheters, cardiac-assist devices, implants, …) due to their biocompatibility. However, they are synthesized from highly toxic diisocyanate reagents that are very harmful for the environment and for health, which is therefore of particular concern in the case of the biomedical sector. To solve this issue, safer and greener alternative synthetic routes have been developed in the past years, leading to PUs called non-isocyanate polyurethanes (NIPUs), which, depending on the synthesis, can carry additional hydroxyl groups next to their urethane linkages.

In this work, we take advantage of these hydroxyl groups by functionalizing those of a polyether-based NIPU by a CO_2-based cyclic carbonate bearing a pendant unsaturation, which allows its subsequent photo-crosslinking by various crosslinking agents (polythiols) by thiol-ene reaction. NIPU elastomer networks with excellent and tunable physico-chemical properties, and especially mechanical properties, were designed. Photo-rheology experiments performed on the different formulations demonstrated short gel points (curing times), which proved their suitability for light-based 3D-printing processes. In particular, the digital light processing technology was chosen to 3D-print objects of various sizes with a resolution down to the micrometer scale. And finally, *in vitro* biocompatibility and hemocompatibility tests, performed with human fibroblasts and blood components, respectively, demonstrated the non-toxicity of these NIPUs for cardiovascular applications.

These 3D-printable polyether-NIPU elastomers are therefore suitable for the design of various personalized implants adapted to the needs of today's medicine and are very promising for future biomedical applications, including as elastic scaffolds designed for the tissue engineering of soft tissues.