TOUGHNESS- AND DEGRADABILITY ENHANCERS FOR PHOTOPOLYMERS AS BONE REPLACEMENT MATERIALS

Barbara Dellago[a,b,c], Sandra Orman[b,c], Robert Liska[b,c], and Stefan Baudis[a,b,c]

[a]Christian Doppler Laboratory for Advanced Polymers for Biomaterials and 3D Printing
[b]Institute of Applied Synthetic Chemistry E163, TU Wien, 1060 Vienna, (Austria)
[c]Austrian Cluster for Tissue Regeneration

(Meth)acrylates are currently the state-of-the-art monomers for digital light processing stereolithography. They combine favorable reactivity and mechanical properties and are used in treatment of bone injuries. However, they show high irritancy, sometimes cytotoxicity and their degradation products (poly acids) can harm the surrounding tissue. Therefore, vinyl esters (VEs) are used to circumvent these problems. Unfortunately, they lead to a decrease of reactivity and the obtained networks lack sufficient toughness for bone graft substitutes (esp. for screwed implants). Hence, thiol-ene polymerization is used, to boost reactivity and to improve impact resistance of the final polymers [1]. Addition of high molecular weight polymers further improves the toughness of the final material. The first developed toughness enhancers were based on poly(caprolactone) (PCL) as it is already applied as a biodegradable and biocompatible polymer and was shown to be a toughness-enhancing motif [2]. In order to investigate the influence of the toughness enhancers on the final polymer, tensile tests and dynamic mechanical thermal analysis measurements were conducted. These experiments showed an increase in elongation at break without forfeiting tensile strength. It could also be proven that all T_gs are far above the body temperature. These results proof the applicability of modified PCL as toughness enhancer in polymer networks for bone replacement materials. Another important feature of bone replacement material is the degradability under acidic conditions. The common used polyesters degrade quite slow in this environment and therefore, fast degradation should be ensured by incorporation of acetals into the polymer backbone. New degradable photopolymerizable precursors, containing linear and cyclic acetals as acid labile moieties have been synthesized. Their reactivity, mechanical properties and degradation behaviour were investigated. The results proved the applicability as degradation enhancers as bone replacement material. [3]

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