Highly soluble, biocompatible and non-fluorescent photoinitiators for multi-photon polymerization

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ABSTRACT

Multi-photon Lithography (MPL)[1] is a powerful technique for the fabrication of 3D structures, via a computer-aided design (CAD), for use in optics, metamaterials as well as in the field of biomedical applications[2]. MPL is based on the localized polymerization of photosensitive polymers induced by ultrafast (femtosecond) laser pulses. An essential component of the photosensitive system is the photoinitiator (PI), required to initiate the polymerization process by multi-photon adsorption. Whereas, a large number of organic molecules, possessing high multi-photon absorption cross-sections, have been employed as PIs, the vast majority of them suffer from poor solubility in the solvent medium combined with a low yield of radical generation. Furthermore, many of the PIs are toxic and highly fluorescent, which limit their use in biomedical applications[3]. To overcome these challenges, highly soluble, biocompatible and non-fluorescent molecules are essential for use as PIs in this field. In the present study, we report the performance of different PI molecules in 3D printing process via multi-photon polymerization.

The photophysical properties of the PIs were investigated by UV−Vis absorption and emission spectroscopy. Then, 3D structures were fabricated at different laser intensities and writing velocities via MPL technique to test their performance. Finally, the biocompatibility of the PIs was studied by investigating the adhesion, viability, and proliferation of dental Stem Cells on photopolymerized thin films, containing 1 wt% PI, after 2 and 7 days in culture.

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