3D Printing of PEG Hydrogel Scaffolds Using Novel Low Toxicity Photoinitiator

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ABSTRACT

With the introduction of the concept of biological manufacturing, the application of 3D printing technology in tissue engineering and cell culture is a relevant topic.

3D printing biomaterials require biocompatibility, porosity, biodegradability and good adhesion [1]. PEG hydrogels meet these specifications, and in particular PEG acrylate (PEG-ACLT) derivatives are widely applied in hydrogel formation via photopolymerization [2.3]. Currently, small molecule photoinitiators have a certain level of cytotoxicity, and low water solubility.

We have developed a novel photoinitiator (M-QTX) that exhibits good water solubility and low cytotoxicity. Using this photoinitiator, PEG-ACLT hydrogels can be 3D printed through stereolithography into well-defined transparent three-dimensional stereograms with low toxicity and good biocompatibility.

MATERIALS AND METHODS

M-QTX and 8arm PEG Acrylate with tripentaerythritol core (8ARM(TP)-ACLT-10K, MW 10000 were provided by JenKem Technology.

Photo-crosslinkable PEG Acrylate derivative was first dissolved in deionized water, followed by the addition of photoinitiator. After thorough mixing, the polymer precursor solution was held for two hours protected from light until the bubbles disappeared.

3D Printing hydrogels were then formed from the photopolymer solution based on Stereolithography using a Formlabs 3D printer-Form 2.

RESULTS

A well-defined hydrogel pattern was 3D printed successfully on a Form2 3D printer using PEG-ACLT precursor and the novel M-QTX photoinitiator.

The resulting 3D PEG hydrogel scaffold was transparent with a well-defined shape.

RESULTS

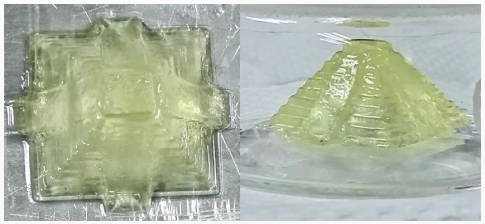

Figure 1: 3D PEG hydrogel printed from precursor solution of JenKem® 8ARM(TP)-ACLT-10K, and M-QTX.

CONCLUSIONS

M-QTX, a novel photoinitiator with good biocompatibility, high photoinitiation efficiency and good thermal stability was developed for 3D printing of well-defined hydrogel stereograms using PEG-ACLT.

This hydrogel scaffold with low cytotoxicity and good biocompatibility is suitable for 3D cell culture, tissue engineering, and organ manufacturing.

REFERENCES

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