



Stereolithography of poly(ethylene glycol) hydrogels produces micro-containers for cell culture and micro-channels for vascular networks

Zhang, Rujing; Martínez, Rodrigo Guzmán; Juul, Mikkel H.; Larsen, Niels Bent

Publication date:
2015

Document Version
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):

Zhang, R., Martínez, R. G., Juul, M. H., & Larsen, N. B. (2015). *Stereolithography of poly(ethylene glycol) hydrogels produces micro-containers for cell culture and micro-channels for vascular networks*. Abstract from Biofabrication 2015, Utrecht, Netherlands.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Poster session 10: Scaffold based biofabrication approaches

P10.1

Stereolithography of poly(ethylene glycol) hydrogels produces micro-containers for cell culture and micro-channels for vascular networks.

Rujing Zhang, Rodrigo Guzmán, Mikkel H. Juul, Niels B. Larsen
Technical University of Denmark, Copenhagen, Denmark

Three-dimensional (3D) soft biomaterial scaffolds for long-term cell culture are critical components in tissue engineering and regenerative medicine. However it is still challenging to construct such scaffolds with desired structural stability and resolution using soft hydrogel. We've developed a method to fabricate 3D biocompatible hydrogel scaffolds at sub-200 μm resolution using projection-based stereolithography to address the biomedical challenges of stem cell culture and synthetic vasculature. Poly(ethylene glycol) (PEG) hydrogels were 3D printed by spatially controlled light-induced solidification of an aqueous pre-polymer solution (PEG-diacrylate 700 Da and 5000 Da lithium acylphosphinate photoinitiator Quinoline Yellow as absorber) using a modified commercial stereolithography printing system (envisionTec Micro 405 nm illumination). Optimization of the optical properties (proximity effects) and material properties (composition of pre-polymer solution) allowed for printing of pyramid-shaped micro-containers for long-term 3D stem cell culture and cuboids with internal channels approaching arteriole dimensions (100 μm cross-section). Human mesenchymal stem cell (hMSC) culture on the pyramidal micro-containers showed that hMSC spheroids formed spontaneously after 24 h incubation and high cell viability (> 80%) was sustained in the stable cultured spheroids for 7 days of incubation. Compared to the technically delicate state-of-the-art hanging drop methodology used for spheroid formation our time- and work-efficient approach in 3D printed low cell adhesion hydrogels provides improved control of hMSC spheroid size and shape. As synthetic arteriole and venule analogs our internal channel structures could be freely designed and constructed inside a hydrogel volume at sub-200 μm resolution in a single automated process (100 μm X 100 μm square channels and $<\varnothing$ 200 μm circular channels) a resolution few methods can achieve in soft hydrogels with full design freedom in all three dimensions. The aim of printing micro-channels within bulk hydrogels is to further fabricate 3D microvascular scaffolds for tissue engineering since vascularization is generally considered as the most important obstacle in the field. On-going cell culture experiments show high compatibility of the printed micro-channel structures to an endothelial cell line (CRL2922) to be employed for endothelialization of the printed vascular network analogs.

Founding Source: DTU Nanotech

