NEWLY DEVELOPED HYDROGEL PRECURSORS AND TWO-PHOTON INITIATORS BASED ON HYALURONIC ACID

Elise Zerobin[a,c], Maximilian Tromayer[a,c], Peter Gruber[b,c], Marica Markovic[b,c], Stefan Baudis[a,c], Jürgen Stampfl[b,c], Aleksandr Ovsianikov[b,c] and Robert Liska[a,c]

[a] *Institute of Applied Synthetic Chemistry*

[b] *Institute of Materials Science and Technology TU Wien, Getreidemarkt 9/163, A - 1060 Vienna* [c] *Austrian Cluster for Tissue Regeneration*

INTRODUCTION

Hydrogel matrices made from biopolymers have recently received attention for their application in tissue engineering. Hyaluronic acid (HA), a naturally occurring polysaccharide, widespread in the connective tissue of the human body, can be used to develop a modular system for hydrogel matrices. Different modifications of HA are accessible, where either the primary alcohol of HA is modified with vinyl ester (VE) functionalities to yield in polymerizable HAVE macromers,[1] or HA can serve as a macromolecular backbone material for the development of a new two-photon initiator (HAPI).[2]

MATERIALS AND METHODS

HAVE was synthesized via a transesterification reaction of HA (tetrabutylammonium salt) with divinyl adipate. Photorheological measurements were performed in oscillatory mode (ν = 10 Hz, γ = 10%) using filtered UV light (320-500 nm). The synthesis of HAPI was performed via amidation of HA with an amino substituted cyclohexanone based two-photon initiator (2PI). Cell encapsulation experiments were performed with a Ti:sapphire laser (λ = 800 nm). Confocal 3D image stacks of the fabricated scaffolds were taken with a Zeiss Axio Observer Z1 and a LSM 700 unit.

RESULTS AND DISCUSSION

Both systems (HAVE and HAPI) were tested concerning their suitability for live cell encapsulation by two-photon polymerization (Figure 1). HAVE in combination with P2CK as 2PI showed increased biocompatibility compared to state of the art monomers, such as (meth)acrylates. Cellcompatibility was proven not only for HAVE macromers but also for HAPI in combination with methacrylamide modified gelatin (Gel-MOD). The covalent attachment of a two-photon active molecule onto HA increases the molecular weight of the 2PI and therefore reduces its migration into cell membranes and consequently its cytotoxicity.

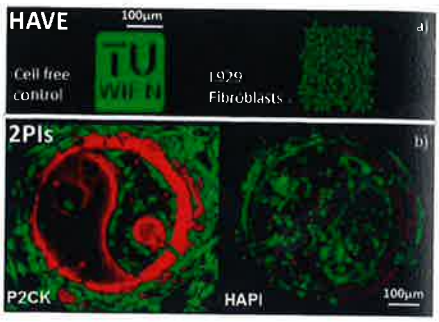

Figure 1: Live/dead stained cells within a) HAVE hydrogel with and without mouse fibroblasts and b) Gel-MOD hydrogel containing MC3T3 comparing P2CK (left) and HAPI (right) as 2PI.

CONCLUSIONS

Highly resolved hydrogel constructs were fabricated with each modification of HA. An attractive concept was found to combine highly reactive functional groups with natural biopolymers resulting in new biocompatible materials for hydrogel matrices with advanced cell compatibility.

REFERENCES

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(2) Tromayer, M., et.al., Polymer Chemistry, **2017**. 8: p. 451-460.

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