DIRECT EMULSION TEMPLATING AND THIOL-ENE PHOTOPOLYMERIZATION AS A WAY TO MACROPOROUS HYDROGELS FOR DRUG RELEASE

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Macroporous polymers have become an increasingly researched topic for biomedical applications due to their versatility and potential utilization as tissue engineering scaffolds, 3D cell culture environments, wound dressings, and drug delivery systems. A common method to obtain such materials is the emulsion templating approach leading to porous scaffolds called polyHIPEs.[1]

PolyHIPEs are synthesized by polymerizing the external phase of a high internal phase emulsion (HIPE). A HIPE contains more than 74% of the internal phase of the total volume fraction of the emulsion, leading to densely packed droplets creating an interconnected pore structure. Most polyHIPEs are created via a water-in-oil emulsion resulting in hydrophobic polymers.[2] However, hydrophilic materials are often desired for biomedical applications.

For our study, a hydrophilic polyHIPE based on poly(ethylene glycol) diacrylate (PEGDA) or poly(ethylene glycol) dimethacrylate (PEGDMA) was synthesized via an oil-in-water HIPE. Degradability and material properties were improved by adding the trifunctional, hydrophilic thiol-crosslinker ethoxylated trimethylolpropane tri (3-mercaptopropionate) (Thiocure® ETTMP 1300). The swelling ability of the synthesized materials was investigated in bovine buffered saline and reached up 1000 % by weight. A degradation study was conducted over a period of 6 weeks. The study demonstrated that materials with incorporated thiol or hydroxyethyl methacrylate possessed higher degradability than materials solely consisting of PEGDA or PEGDMA. Loading and release of salicylic acid was performed to illustrate the material's potential for drug release or as wound dressing.

[1] Dikici, B. A., Claeyssens, F. Basic Principles of Emulsion Templating and Its Use as an Emerging Manufacturing Method of Tissue Engineering Scaffolds *Frontiers in Bioengineering and Biotechnology* **2020**, 8, 875.

[2] Pulko, I., Krajnc P. High Internal Phase Emulsion Templating – A Path To Hierarchically Porous Functional Polymers, *Macromol Rapid Commun.* **2012**, *33*, 1731−1746.