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$PDMS_{star}$-PEG hybrid scaffolds for bone tissue engineering

Melissa A. Grunlan[1], Brennan M. Bailey[1], Dany Munoz-Pinto[2] and Mariah S. Hahn[2]
[1]Texas A&M University, USA
[2]Rensselaer Polytechnic Institute, USA

The utility of poly (ethylene glycol) diacrylate (PEG-DA) hydrogels for bone regeneration would be enhanced with improved osteoinductivity (i.e. stimulating differentiation of multipotent cells into bone-forming lineages) and bioactivity (i.e. promoting integration/bonding with surrounding bone tissue and the attachment and differentiation of osteogenic cells). Hydrophobic, inorganic materials are known to be osteoinductive and bioactive. Rather than utilizing bioactive glasses with these properties, we have incorporated inorganic, hydrophobic methacrylated star polydimethylsiloxane ($PDMS_{star}$-MA) into PEG-DA-based hydrogels. Scaffolds were prepared with different weight% ratios of $PDMS_{star}$:PEG. Furthermore, PDMS distribution as well as scaffold pore size was tailored via alteration to the fabrication protocol. Specifically, $PDMS_{star}$-PEG hydrogels were fabricated from aqueous precursor solutions as well as via "solvent induced phase separation, SIPS" by fabrication in dichloromethane followed by subsequent drying and hydration. SIPS $PDMS_{star}$-PEG hydrogels exhibited different moduli (i.e. stiffness) versus the corresponding "conventional" hydrogels fabricated from aqueous precursor solutions. Thus, in our initial studies, we have demonstrated that $PDMS_{star}$-MA broadens PEG-DA scaffold properties (e.g. modulus), induces the formation of hydroxyapatite (i.e. is bioactive) and promotes MSC lineage progression toward osteoblast-like fates (i.e. is osteoinductive) in proportion to its concentration within the scaffold.

Biography

Melissa Grunlan is an Associate Professor of Biomedical Engineering at Texas A&M University. She is also a faculty member of the Materials Science & Engineering Program. Prof. Grunlan obtained her Ph.D. in Chemistry from the University of Southern California. She is the director of the "Silicon-Containing Polymeric Biomaterials Group". Her research interests include anti-fouling coatings, self-cleaning membranes as well as hydrogels and shape memory polymer foams as scaffolds useful in osteochondral and bone healing.

mgrunlan@tamu.edu