Hydrogels are formed from porous networks of hydrophilic polymeric chains and possess high water content, tunable degradation rate, adjustable mechanical characteristics. As a result of these interesting characteristics, hydrogels have attracted the attention of researchers for various bioengineering applications ranging from tissue engineering and drug delivery to biofuel production. Fiber-based techniques including direct writing and textile technologies are promising for the fabrication of 3D hydrogel constructs. However, the fabrication of hydrogel fibers usually requires sophisticated designs and equipments. Here, we utilize alginate-based hydrogels to create micro-organism-laden structures and evaluate their effectiveness for applications including tissue engineering and biofuel production. In addition to create fibers from various polymers, we mix alginate with another pre-polymer and use it to form a template for making fibers. A secondary crosslinking step creates an independent network of the polymers with the same geometry. Alginate can then be removed, leaving behind a fiber formed from the targeted polymer. By adjusting the ratio of the prepolymer to alginate, the viscosity of the solution, the injection flow rate, and the size of the needle tip, the fiber diameter can be controlled. Alginate can improve the mechanical properties of the fabricated fibers which facilitates their assembling. Our biological analysis suggests that a low concentration of alginate can help template formation and improve the mechanical properties without affecting the biological properties of the mixed polymer. The fabricated interpenetrating polymer network (IPN) hydrogel fibers are assembled using manual stacking and textile techniques such as weaving and braiding.

Biography

Ali Tamayol is a Postdoctoral fellow in Harvard-MIT Division of Health Science and Technology at Massachusetts Institute of Technology and Harvard Medical School. He received his PhD from Simon Fraser University in 2011 and prior to starting his current appointment, he was a Postdoctoral fellow at McGill University. His research involves design, fabrication, and characterization of microsystems and fibrous materials for emerging engineering applications such as biofuel production, sustainable energy conversion systems, and tissue engineering. He has published 33 journal papers, 1 book chapter, and 1 patent. In addition, he has given over 40 seminars at various conferences and academic institutions. He has been the recipient of several awards including NSERC Postdoctoral Fellowship, BCIC Scholar Award, and the Alinasab Prize of ISME.