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Joint event on

WORLD CONGRESS ON SMART MATERIALS AND STRUCTURES
&
3rd International Conference on
POLYMER CHEMISTRY AND MATERIALS ENGINEERING
November 21-22, 2019 | Singapore

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Engineering injectable polymeric cryogels for biomedical applications

For a number of biomedical applications, including cell therapy and tissue engineering, there is an increasing need to engineer advanced three-dimensional (3D) scaffolds to provide a structural and mechanical support for cells and guide tissue regeneration. Engineering injectable biomaterials have become a promising approach for scaffold implantation into the body while avoiding open surgery and post-surgery complications. To that end, we have recently unveiled a breakthrough technology for the delivery via conventional needle–syringe injection of large preformed macroporous hydrogels called cryogels with well-defined properties.

Our 2012 publication (Bencherif et al. PNAS) disclosing the first cryogel scaffold to be injected through a conventional small-bore needle while recapitulating aspects of the native cell niche has sparked massive interest in the field. These injectable cryogels in the form of elastic sponge-like matrices are prepared by environmentally friendly cryotropic gelation of water soluble polymers giving rise to 3D scaffolds with unique properties, including shape-memory properties and complete geometric restoration once delivered in the body. Cryogels displaying an interconnected macro porous structure can be molded to a variety of shapes and sizes, and may be optionally loaded with therapeutic agents or cells. These cryogels with unique features have created a new class of injectable materials applicable for a number of biomedical applications including tissue engineering, drug delivery, cell transplantation, cosmetics, and more recently cancer immunotherapy.

Biography

Sidi A Bencherif is the Director of the Laboratory for Advanced and Multifunctional Polymeric Biomaterials and an Assistant Professor in the Department of Chemical Engineering at Northeastern University. He is also appointed as an Associate at Harvard University. In 2009, he received a PhD in Chemistry from Carnegie Mellon University. Following his PhD, he was initially appointed as a postdoctoral researcher and then later as a researcher associate at Harvard University and the Wyss Institute for Biologically Inspired Engineering. He has authored and coauthored in top journals (Science, PNAS, Nature Materials, Nature Communications, etc.), international conference proceedings, reviews and patent applications, and he is the recipient of several fellowships, honors and awards, including the prestigious National Science Foundation CAREER award. He has over 50 publications that have been cited over 4000 times, and his H-index is 24 and has been serving as an editorial board member of reputed Journals.

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