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ABSTRACTS & PROCEEDINGS

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Production of a Hybrid Structure Consisting of Polycaprolactone Electrospun Nanofiber and Poly(2-Hydroxyethyl Methacrylate)-Based Cryogel for 5-Fluorouracil Release

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Cryogels are a subclass of hydrogels made up of networks of polymer chains that have a high capacity to absorb water while maintaining structural integrity. Hence, cryogels offer a hydrophilic surface which enhances the biological response of the cells. On the other hand, electrospun nanofibers are materials exhibiting higher mechanical strength compared to hydrogels and cryogels. Antineoplastic drug 5-fluorouracil (5-FU) is utilized to treat solid tumors that cause carcinomas in the gastrointestinal tract, breast, liver, brain, and other organs through chemotherapy. Poly(hydroxyethyl methacrylate) is one of the most widely used polymers in various biomedical applications such as drug delivery systems (DDSs), contact lenses tissue engineering, and so on because of its advantageous traits like high water content, high tissue- and blood-compatibility, and low toxicity. The objective of this study is to develop DDSs based on the electrospinning of polycaprolactone (PCL) and copolymerization of 2-hydroxyethyl methacrylate (HEMA) and vinyl imidazole (VIM). The advantages of electrospun nanofibers and cryogels were combined in this DDS as a hybrid structure to increase the mechanical properties of cryogels and enhance the biocompatibility and hydrophilicity of PCL

nanofibers. VIM is used as a copper ion chelating ligand to supply metal-ion mediated drug loading. The physical and chemical properties of hybrid DDSs were investigated using various characterization methods including gelation yield and swelling studies, field emission scanning electron microscopy, Fourier-transform infrared spectroscopy, water contact angle measurements, and so on. In vitro release studies were carried out to analyze the effects of medium pH and temperature, and drug content on release rate. The cryogel layer of the hybrid DDS has a macroporous structure while the nanofiber layer has relatively small pores. In the release profiles of the electrospun nanofiber/cryogel hybrid DDS, a biphasic release was observed, first a burst release followed by a slower and sustained release. The cumulative release rate of 5-FU from hybrid DDS was higher at more acidic conditions. Since the release rate of 5-FU changed by changing the medium pH because the Cu(II) ion acts as a Lewis acid, and the drug molecule, i.e. 5-FU acts as a Lewis base resulting in pH-responsive release for the hybrid DDS.

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Keywords: Cryogelation, drug delivery systems, electrospinning, nanofibers, in vitro release, 5-fluorouracil

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