COLLEGE OF ENGINEERING AND COMPUTER SCIENCE
FLORIDA ATLANTIC UNIVERSITY

Announces the Ph.D. Dissertation Defense of

Negar Firoozi

for the degree of Doctor of Philosophy (Ph.D.)

"A Novel Elastic and Auto-fluorescent Poly(xylitol-dodecanedioic acid)(PXDDA) as a Growth Factor-Loaded Drug Delivery System"

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Engineering West, Room 101
777 Glades Road
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DEPARTMENT:

Ocean and Mechanical Engineering

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ABSTRACT OF DISSERTATION
A novel elastic and auto-fluorescent poly(xylitol-dodecanedioic acid)(PXDDA) as a growth factor-loaded drug delivery system

In spite of the vast research on polymer-based tissue regeneration, extensive studies to develop an elastic and cell-promoting polymer biomaterial are still ongoing. However, using a renewable resource and a simple, environment-friendly synthesis route to synthesize an elastic polymer has not been succeeded yet. The objective of this work was to develop an elastic polymer for tissue engineering and drug delivery applications by using non-toxic, inexpensive and renewable monomers. A new nature-derived renewable material, xylitol, was used to synthesize an elastic polymer with the presence of a crosslinking agent, dodecanedioic acid. Here a simple melt condensation polymerization method was used to synthesize the poly(xylitol-dodecanedioic acid)(PXDDA). The physicochemical and biological properties of the new PXDDA polymer were characterized. Fourier transform infrared (FTIR) confirmed the formation of ester bonding in the polymer structure, and thermal analysis demonstrated that the polymer was completely amorphous. The polymer shows high elasticity. Increasing the molar ratio of dodecanedioic acid resulted in higher hydrophobicity and lower glass transition temperature. Further, the polymer degradation and in vitro dye release studies revealed that the degradation and dye release from the polymer became slower when the amount of dodecanedioic acid in the composite increased. Biocompatibility studies showed that both

the polymeric materials and the degraded products from the polymer did not show any toxicity. Interestingly, the PXDDA polymer significantly improved the cell adhesion and promoted cell proliferation compared to a widely-used polymer, poly(lactic acid), and tissue-culture plates. The dopamine coating and growth factor immobilizing results also demonstrated that using dopamine as a coating material is a great, efficient, and simple way for conjugating the bioactive factors onto the PXDDA surface to enhance the tissue regeneration speed and efficiency. Overall, these results suggest that a new, elastic, biodegradable polymer with auto-fluorescent properties has been successfully synthesized and also has promising potential for biomedical applications in drug delivery and tissue engineering.

BIOGRAPHICAL SKETCH
Born in Shiraz, Iran
B.S., Shiraz University, Shiraz, Fars, Iran, 2011
M.S., University of Tehran, Tehran, Tehran, Iran, 2014
Ph.D., Florida Atlantic University, Boca Raton, Florida, 2019

CONCERNING PERIOD OF PREPARATION
& QUALIFYING EXAMINATION

Time in Preparation: 2016 – 2019

Qualifying Examination Passed: Fall 2016

Published Papers:

1. N. Firoozi, Y. Kang, "A highly elastic and auto-fluorescent poly (xylitol-dodecanedioic acid) for tissue engineering," ACS Biomaterials Science & Engineering, 2019

2. M. Lin, N. Firoozi, C.T. Tsai, M.B. Wallace, Y. Kang, "3D-printed flexible polymer stents for potential applications in inoperable esophageal malignancies," Acta Biomaterialia, 2019

3. K. Moschouris, N. Firoozi, Y. Kang, "The application of cell sheet engineering in the vascularization of tissue regeneration," Regenerative medicine, 2016

4. N. Firoozi, Y. Kang, "Synthesis and characterization of an elastic and biodegradable poly(xylitol-dodecanedioic acid) for biomedical engineering applications," Society for Biomaterials 2019 Annual Meeting and Exposition, Seattle, WA, USA

5. M. Mastiani, N. Firoozi, N. Petrozzi, S. Seo, M. Kim, "Polymer-Salt Aqueous Two-Phase System (ATPS) Micro-Droplets for Cell Encapsulation," Lab on a Chip, (Under Review)

6. M. Lin, N. Firoozi, E. Qian, X. Wang, H. Chaitin, Y. Kang, "Paclitaxel-loaded 3D-printed flexible polylactic acid/thermoplastic polyurethane stents for inoperable esophageal malignancies," (In preparation)