OFFICIAL ABSTRACT and CERTIFICATION

Synthesis and Analysis of a Novel Biodegradable Polyester Fiber Scaffold Derived from Poly(glycerol sebacate)

Timothy Liu
Great Neck South High School, Great Neck, NY, US

Poly(glycerol sebacate) (PGS) is a biodegradable elastomer with elastic properties advantageous for use as a scaffold in soft tissue engineering. However, it has been unable to be electrospun into fibrous scaffolds—uncured PGS is a viscous liquid at room temperature and is therefore unable to hold any fiber shape, while cured PGS, though solid at room temperature, isn ' t easily dissolved, a requirement for electrospinning—and requires copolymerization that confers undesirable properties on the copolymer. The molecular weight of PGS has been shown to be 1110 g/mol, but fibrous structures are formed in other polymers above over 13000 g/mol.

The aim of this study was to increase the molecular weight of PGS by modification of the synthesis reaction in order to allow for electrospinning. PGS was copolymerized with 1,8-octanediol in monomer ratios of 1:1:2, 1:3:4, and 1:4:5 (glycerol:1,8-octanediol:sebacic acid) and catalyzed by the enzyme Novozym 435. The resulting poly(1,8-octanediol-glycerol sebacate) (POGS) polymers exhibited molecular weights 46 to 74.5 times greater and melting temperatures greater than PGS and above body temperature. POGS was electrospun but did not form fibers visible to the naked eye under the first set of parameters used. Altering applied voltage, the solvent, polymer concentration, or other parameters may form definitive fibers.

The improvement in molecular weight and thermal properties demonstrates potential, and as properties varied with monomer ratio, this approach could be used to fine tune the properties of the resulting polymers for the formation of elastic tissue scaffolds.

Category
Pick one only—
mark an "X" in box
at right

Animal Sciences	☐
Behavioral & Social Sciences	☐
Biochemistry	☐
Biomedical & Health Sciences	☐
Biomedical Engineering	☐
Cellular & Molecular Biology	☐
Chemistry	☐
Computational Biology & Bioinformatics	☐
Earth & Environmental Sciences	☐
Embedded Systems	☐
Energy: Chemical	☐
Energy: Physical	☐
Engineering Mechanics	☐
Environmental Engineering	☐
Materials Science	■
Mathematics	☐
Microbiology	☐
Physics & Astronomy	☐
Plant Sciences	☐
Robotics & Intelligent Machines	☐
Systems Software	☐
Translational Medical Sciences	☐

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):

   ☐ human participants ☐ potentially hazardous biological agents

   ☐ vertebrate animals ☐ microorganisms ☐ rDNA ☐ tissue

2. I/we worked or used equipment in a regulated research institution or industrial setting: ■ Yes ☐ No

3. This project is a continuation of previous research. ☐ Yes ■ No

4. My display board includes non-published photographs/visual depictions of humans (other than myself): ☐ Yes ■ No

5. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only ■ Yes ☐ No

6. I/we hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work. ■ Yes ☐ No

This stamp or embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Scientific Review Committee.