Accepted Manuscript

Amino acid-based Poly(ester urea) copolymer films for hernia-repair applications

Nathan Z. Dreger, Zhaobo Fan, Zachary K. Zander, Chinnapatch Tantisuwanno, Molly C. Haines, Morgan Waggoner, Trenton Parsell, Claus S. Søndergaard, Michael Hiles, Christopher Premanandan, Matthew L. Becker

PII: S0142-9612(18)30557-X

DOI: 10.1016/j.biomaterials.2018.08.003

Reference: JBMT 18809

To appear in: *Biomaterials*

Received Date: 28 June 2018

Revised Date: 1 August 2018

Accepted Date: 1 August 2018

Please cite this article as: Dreger NZ, Fan Z, Zander ZK, Tantisuwanno C, Haines MC, Waggoner M, Parsell T, Søndergaard CS, Hiles M, Premanandan C, Becker ML, Amino acid-based Poly(ester urea) copolymer films for hernia-repair applications, *Biomaterials* (2018), doi: 10.1016/j.biomaterials.2018.08.003.

Amino Acid-Based Poly(ester urea) Copolymer Films for Hernia-Repair Applications

Nathan Z. Dreger,[a] Zhaobo Fan,[a] Zachary K. Zander,[a] Chinnapatch Tantisuwanno,[a] Molly C. Haines,[a] Morgan Waggoner,[a] Trenton Parsell,[c] Claus S. Søndergaard,[c] Michael Hiles,[c] Christopher Premanandan,[d] and Matthew L. Becker [ab]*

[a] Department of Polymer Science, and [b] Biomedical Engineering, The University of Akron, Akron, OH 44325, United States of America

[c] Cook Biotech Incorporated, West Lafayette, IN 47906, United States of America

[d] Department of Veterinary Biosciences, College of Veterinary Medicine, The Ohio State University, Columbus, OH 43210, United States

KEYWORDS: Poly(ester urea), polypropylene, extracellular matrix, hernia, elastic modulus, burst force, soft-tissue.

ABSTRACT: The use of degradable materials is required to address current performance and functionality shortcomings from biologically-derived tissues and non-resorbable synthetic materials used for hernia mesh repair applications. Herein a series of degradable *L*-valine-*co*-*L*-phenylalanine poly(ester urea) (PEU) copolymers were investigated for soft-tissue repair. Poly[(1-VAL-8)$_{0.7}$-*co*-(1-PHE-6)$_{0.3}$] showed the highest uniaxial mechanical properties (332.5 ± 3.5 MPa). Additionally, *L*-valine-co-*L*-phenylalanine poly(ester urea)s were blade coated on small intestine submucosa extracellular matrix (SIS-ECM) and found to enhance the burst test mechanical properties of SIS-ECM in composite films (force at break between 102.6 ± 6.5 – 151.4 ± 11.3 N). Free standing films of *L*-valine-*co*-*L*-phenylalanine PEUs were found to have superior extension at break when compared to SIS-ECM (averages between 1.2-1.9 cm and 1.2 cm respectively). Cellular spreading and proliferation were observed *in vitro* with a reduced inflammatory response for poly[(1-VAL-8)$_{0.7}$-*co*-(1-PHE-6)$_{0.3}$] when compared to polypropylene in an *in vivo* hernia rat model. These results support the use of PEU copolymers as free-standing films or as composite materials in soft-tissue applications for hernia-repair.