Investigating PEG-Polyurethane for Biomedical Applications

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Research Hypothesis

It is hypothesized that through the characterization of synthesized polyurethane polymers, the structure, function and key properties of this polymer can be optimized for use of bone regeneration.

Background

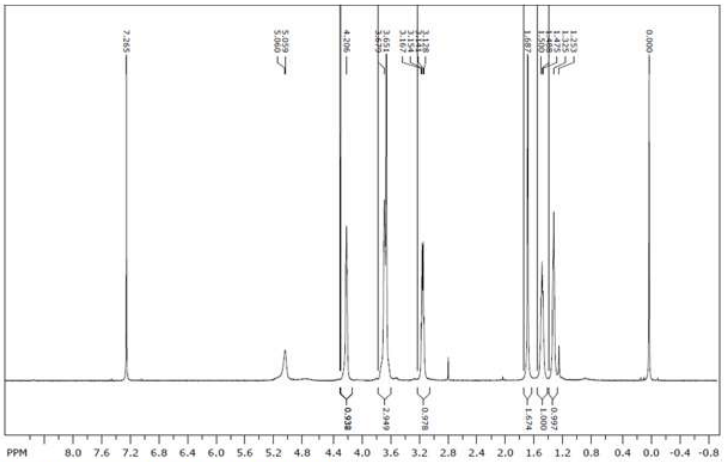
- PEG-Polyurethane is being used for biomedical applications such as in catheters, heart valves and in tissue regeneration including bone.
- Polyurethane holds advantages due to its variable degradability and injectability and its promise in surface modification, grafting and blood biocompatibility [8]
- Improvements in PEG-Polyurethane properties are needed to specifically facilitate different types of clinical needs [1]

Methods

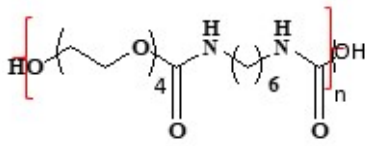
- Investigated Poly(ethylene glycol) (PEG)-polyurethane polymer

- Synthesis of polymer
- Characterization
  - H Nuclear Magnetic Resonance(H-NMR)
  - Accelerated Degradation
  - Swelling Capacity Evaluations
  - Tensile Testing
  - DSC Thermal Analysis

Results



Proton	Chemical Shift
$C(O)NCH_2$	3.128
NCH_2CH_2	1.5/1.687
$NCH_2CH_2CH_2$	1.253
$C(O)OCH_2$	4.206
OCH_2CH_2	3.651



Representative H^1 NMR: Product of hexadecyl isocyanate and tetraethylene glycol (1:1)

[1] Yu, J, Xia, H, Teramoto, A, Ni, Q-Q. 2017. Fabrication and characterization of shape memory polyurethane porous scaffold for bone tissue engineering. *J Biomed Mater Res Part A* 2017: 105A: 1132– 1137.
[8] Ghassemi, Toktam, et al. "Current Concepts in Scaffolding for Bone Tissue Engineering." The Archives of Bone and Joint Surgery, Archives of Bone and Joint Surgery Co., Mar. 2018,

Discussion

- The 4-hour synthesis batch of polymer had a large swelling capacity, but degraded in less than two weeks
- A 24-hour batch was synthesized to increase molecular weight to withstand degradation
- Tensile testing, a DSC thermal analysis and a new accelerated degradation study with the 24-hour batch are currently underway

Future Work

- Next steps include synthesizing multiple polymers with variable ureido, ester and anhydride linkages using different ratios of monomer to identify the ideal batch for the application

Acknowledgements

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