Optimization of PEG-Polyurethane Polymers for Biomedical Applications

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Hypothesis
Analyzing the properties of PEG-Polyurethane through a variety of characterization techniques (molecular weight, swelling & degradation) can lead to an optimized PEG-Polyurethane polymer, able to be utilized for different biomedical applications

Introduction
• PEG-Polyurethane has advantages due to its degradability, injectability, growing traction in surface modification, grafting, and blood biocompatibility [1]
• PEG-Polyurethane is being used for biomedical applications such as in catheters, heart valves, and tissue regeneration [2]
• Optimizing PEG-Polyurethane can lead to further improvements in these clinical needs

Methods
• Poly (ethylene glycol) (PEG)-Polyurethane
• Synthesis Conditions
  -1hr & 24hr
  -60°C, 80°C, 90°C, 100°C
  -Two Catalysts: Dibutyltin dilaurate (DBTDL), 1,4-diazabicyclo[2.2.2]octane (DABCO)
• Characterization Techniques
  - H Nuclear Magnetic Resonance (H-NMR)
  - Swelling & Degradation
  - Gel Permeation Chromatography (GPC)
  - Fourier Transform IR Spectroscopy (FTIR)

Results

Discussion
• H-NMR Characterization illustrates the overall chemical structure of the PEG-Polyurethane polymer
  • 24-hour syntheses indicate greater MW when compared to 1-hour syntheses
  • Temperature and MW indicate a positive correlation
  • 90°C has the largest molecular weight, greater than 100°C
  • Largest MW (90°C, DBTDL, 24 hours): 181,307 Da
  • 90°C indicates a possible temperature sweet spot for PEG-Polyurethane synthesis
  • PEG-Polyurethane polymers swelled 50.68 ± 12.92% (n=26)
  • After 8 weeks, the polymers degraded 47.10 ± 15.42% (n=24)
  • Higher MW polymers degraded less over the 8-week period

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References