

Swelling Studies of PEG/PPG-Polyurethane for Medical Applications

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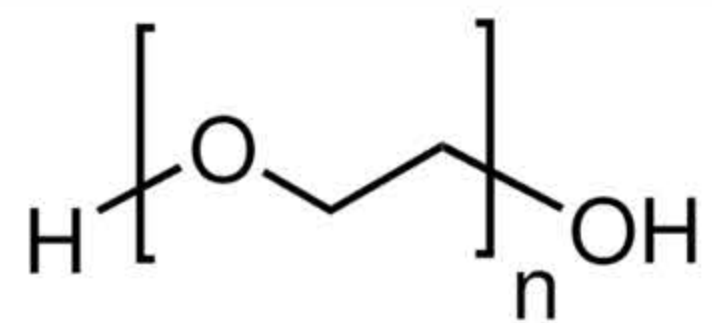
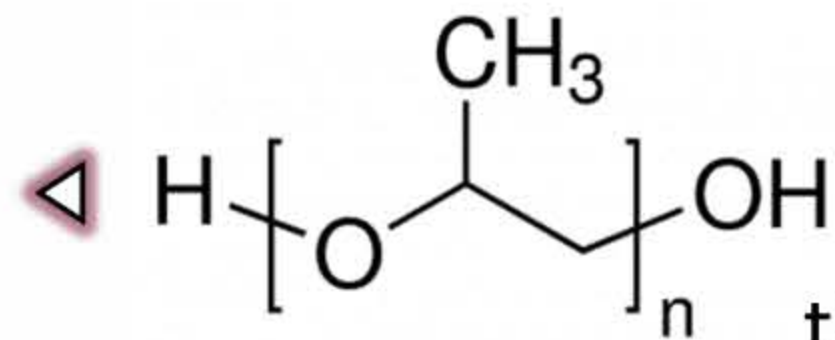
Research Question

How will polyurethanes made with different ratios of polypropylene glycol (PPG) and poly-ethylene glycol (PEG) affect on the swelling properties for biomedical applications?

Background

Polymers are any substances that are comprised of chains of macromolecules. They can either be synthetically made like nylon or naturally made like DNA. The polymers for this study are comprised of Polypropylene glycol (PPG) and Poly-ethylene glycol (PEG)

PPG macromolecule structure



PEG macromolecule structure

Methods

This study examines the water intake of polyurethane (PPU).

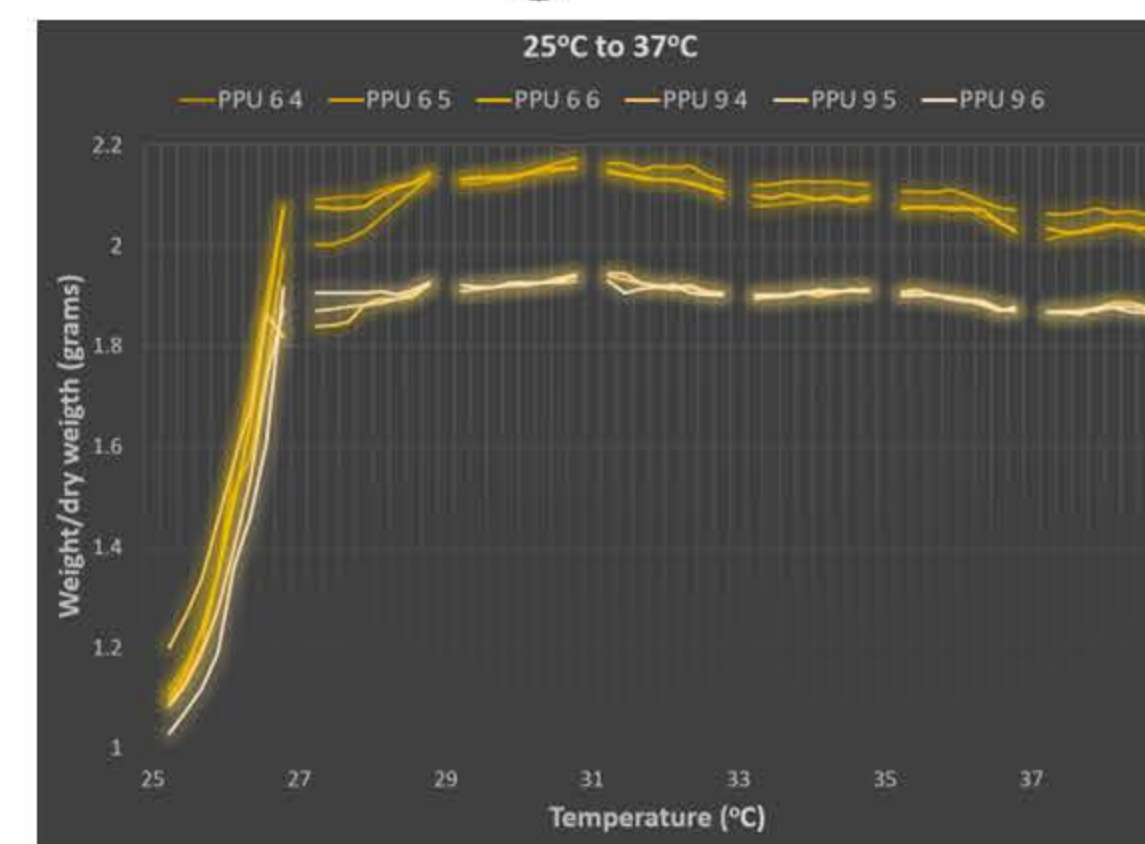
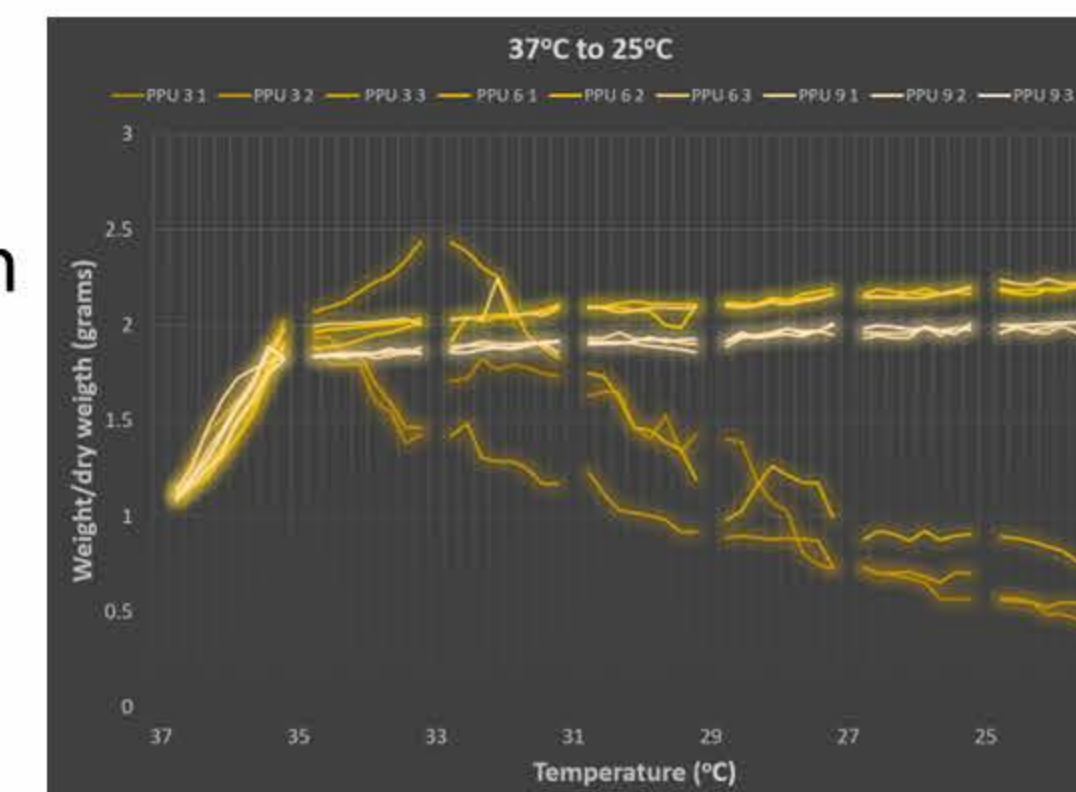
1. Three different synthesis run to create polymer samples
 - I. Created using constant molar ratios of PPG, diisocyanate, water, and a catalyst with varying quantities of PEG

PPU type	PEG	PPG
PPU 3	1	1
PPU 6	2	1
PPU 9	3	1

2. Three of each polymer sample were placed into small test vials
 - I. Each vial was fill with water at the starting temperature and place into a block heater and the water inside vials and temperature was changed by two degrees every hour.
 - II. The mass was taken at each temperature at the time increments 1, 2, 5, 10-, 15-, 30-, and 60-minute increments

Results

these graphs have a slope of the weight measured divided by its dry weight before the study. When going from 37°C to 25°C shows characteristics of a logarithmic graph. With the weights increase at a decreasing rate.



When going from 25°C to 37°C the graph almost looks like a logarithmic graph but towards the higher temperatures the samples start to decrease in weight and curve back down

Conclusion

When it comes to polyurethane single layered films with constant water and Polypropylene glycol ratio, as the molar ratio of poly-ethylene glycol is increased the polymer film becomes more rigid and has a decreased swelling compacity. PPU 3 samples showed great swelling compacity and after 1 to 2 changes in temperature would complete break apart into many small pieces almost disintegrating over time. This is the reason PPU 3 was not included in the 25 °C to 37 °C chart as after 2 changes in temperature the polymer had broken to the point, I could not reliably take its weight.

Future Work

Future studies could go in several directions including:

- ▶ Degradation study or swelling study on polyurethanes of increasing PPG molar ratio
- ▶ Modeling drug release of diffusion coefficient for films
- ▶ Measuring drug release of PPU films of different monomer ratios

References



▶ References QR code