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**In Vitro** Examination of Poly(glycerol sebacate) Degradation Kinetics: Effects of Porosity and Cure Temperature

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**ABSTRACT**

Poly(glycerol sebacate) (PGS) is a biodegradable and biocompatible elastomer that has been used in a wide range of biomedical applications, including drug delivery, microfluidic devices, and tissue engineering scaffolds. The material possesses similar mechanical properties to those of soft body tissues and is mechanically tunable by altering cure temperature. An increased cure temperature correlates to an increased amount of cross-linking, resulting in a greater elastic modulus. While a porous format is preferred for scaffolds, to allow cell ingrowth, PGS degradation has been primarily studied in a nonporous format. The purpose of this research was to investigate the degradation of porous PGS at three frequently used cure temperatures: 120°C, 140°C, and 165°C. The thermal, chemical, mechanical, and morphological changes were examined using thermogravimetric analysis, differential scanning calorimetry, Fourier transform infrared spectroscopy, compression testing, and scanning electron microscopy. Over the course of the 16-week degradation study, the samples' pores collapsed. The specimens cured at 120°C demonstrated the most degradation and became gel-like after 16 weeks. Thermal changes were most evident in the 120°C and 140°C cure specimens, as shifts in the melting and recrystallization temperatures occurred. Samples cured at all three temperatures displayed a decrease in compressive modulus after 16 weeks. This *in vitro* study helped to elucidate the effects of porosity and cure temperature on the biodegradation of PGS and will be valuable for the design of future PGS scaffolds.

**INTRODUCTION**

- Tough elastomer that is both biocompatible and biodegradable
- Has been used for a variety of biomedical applications:

**SAMPLE PREPARATION**

- Prepolymer synthesis

**ABSORPTION STUDIES**

- Samples submersed in Simulated Body Fluid (SBF) for 16 weeks at 37°C

**MORPHOLOGY**

- Macroscopic images show gelation of 120°C cure after 16 weeks, reduction in size of 140°C cure, and maintained integrity of shape for 165°C cure
- SEM images show pore shrinkage by week 12 especially in 120°C cure

**CONCLUSION**

- Degradation increases with lower cure temperature.
- Greatest degradation occurs in 120°C cure with pore collapse and return to prepolymeric state while little degradation occurs in 140°C and 165°C samples.

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