Abstract

A hydrogel is a network of hydrophilic polymers that has the ability to absorb water. These gels have similar properties to human organs and tissues, and thus have many medical applications, such as drug transport and gene therapy. These hydrogels can act as a matrix to which biomedical nanoparticles can be attached and allow drugs to be more effectively delivered throughout the human body.

This project focused on the synthesis of semibranched polyglycidol hydrogels by functionalizing polyglycidol polymers and reacting these various derivatives with each other to form hydrogels. Semibranched polyglycidols are a new class of polymers discovered in 2012 to replace PEGylated components in proteins and hydrogels. Three different polyglycidol building blocks were synthesized: amino-oxy polyglycidol, thiol polyglycidol, and allyl ester polyglycidol. In order to characterize the properties of the derivatives that were synthesized, model reactions were conducted using 3-ethoxy-1,2-propanediol because it has similar functional groups to polyglycidol.

The three building blocks carry crucial functionalities for hydrogel formation with polyester and polycarbonate derivatives. These functionalities are essential in the preparation of innovative degradable hydrogels that are injectable or formed outside of the biological system.

Project Goals
- Functionalize the hydroxy groups on polyglycidol to form three different functionalized derivatives.
- Determine the reactivity of primary and secondary hydroxy groups by conducting model reactions with 3-ethoxy-1,2-propanediol
- React one of the functionalized polymers to form hydrogels in pilot study
- Test hydrogels for their ability to swell and degrade.

Synthesis of Polyglycidol and Functionalized Polyglycidol Building Blocks

Developed Semibranched Polyglycidol

Aminooxy Polyglycidol

Allyl Ester Polyglycidol

Thiol Polyglycidol

Synthesis of Polyglycidol Hydrogels by Oxime Click Reactions

Aminooxy Polyglycidol

OPD / Valerolactone Polymer

Hydrogel

Crosslink

References & Acknowledgments

Figure 1: Diagram showing two of the possible uses of hydrogels: drug release and tissue regeneration. Hydrogels can act as a matrix for both large macromolecules and cells by increasing their solubility in the human body.

Figure 2: 1H NMR of polyglycidol (top) and protected aminooxy polyglycidol (bottom).