Announcing the Final Examination of Corbin Feit for the degree of Master of Science

Time & Location: March 26, 2019 at 1:00 PM in Engineering I 207 D
Title: Development of S-nitroso-N-acetylpenicillamine (SNAP) Impregnated Medical Grade Polyvinyl Chloride for Antimicrobial Medical Device Interfaces

In the clinical setting, polyvinyl chloride (PVC) accounts for 25% of all polymers used in medical device applications. However, medical devices fabricated with PVC suffer from thrombosis and infection. Mortality associated with HAIs exceed 100,000 deaths each year. One method to overcome these challenges is to develop bioactive polymers with nitric oxide (NO) release. Nitric oxide exhibits many physiological roles including, antibacterial, antithrombic, anti-inflammatory activity. In this study, Tygon® PVC tubing was impregnated with an NO donor molecule, Sâ€œnitrosoâ€œNâ€œacetylpenicillamine (SNAP), via a simple solventâ€œswelling method, where polymer samples were submerged in a solvent mixture (SNAP, plasticizer, methanol, acetone). An additional topcoat of a biocompatible CarboSil 2080A (CB) was applied to reduce SNAP leaching and prolong NO release. The SNAPâ€œPVCâ€œCB was characterized for NO release using chemiluminescence, leaching with UVâ€œVis, surface properties via SEM, mechanical properties, stability during storage and sterilization, and antimicrobial properties in vitro. The SNAPâ€œPVCâ€œCB released physiological levels of NO for up 14 d (incubated in PBS at 37 Å°C). The addition of CBâ€œtopcoat reduced the total SNAP leaching by 86% during incubation. Mechanical properties and surface topography remained similar to control PVC after SNAPâ€œimpregnation and application of CBâ€œtopcoat. After ethylene oxide sterilization and 1â€œmonth storage, SNAPâ€œPVCâ€œCB demonstrated excellent SNAP stability (ca. 90% SNAP remaining). In a 24 h antibacterial assay, SNAPâ€œPVCâ€œCB reduced viable bacteria colonization (ca. 1 log reduction) of S. aureus and E. coli compared to PVC controls. This novel method for SNAPâ€œimpregnation of medical grade plasticized PVC holds great potential for improving the biocompatibility of postâ€œfabricated PVC medical devices.

Major: Materials Science and Engineering

Educational Career:
Bachelor's of Chemistry, BS, 2016, University of Georgia

Committee in Charge:
Elizabeth Brisbois, Chair, Materials Science and Engineering
Raj Vaidyanathan, Materials Science and Engineering
Stephen Kuebler, Chemistry

Approved for distribution by Elizabeth Brisbois, Committee Chair, on March 17, 2019.

The public is welcome to attend.