Detachable Polymeric Films for Applications in Drug Delivery

Samantha Gates, Anita Shukla
Center for Biomedical Engineering, School of Engineering, Brown University

Statement of Purpose: Wound dressings play a crucial role in preventing infections. These dressings can be especially critical in military settings where it is estimated that 25 to 40% of wounds become infected (Murray CK. J Trauma. 2008; 64; S232-238). An ideal wound dressing must be able to protect irregular wounds, while acting as a drug delivery system for first-round antibiotics, until clinical care is provided. Localized drug delivery, unlike intravenous delivery, can limit systemic antibiotic exposure, potentially helping to reduce the global rise in bacterial drug resistance.

In this study, we have sought to use the versatile layer-by-layer (LbL) self-assembly approach to engineer an advanced multilayer wound dressing, possessing the capability for drug loading and release. LbL films were assembled by sequentially introducing a substrate into complementary polymer baths. A nanometer to micron scale multilayer film was assembled based on a variety of molecular interactions (e.g. electrostatic, hydrogen bonding, etc.). LbL film growth depends on pH, solvent, dip time, temperature, and concentration, among many other factors (Shukla A. WIREs Nanomed. 2014; 6; 411-421). Our LbL film was assembled using Food and Drug Administration (FDA) approved chitosan (CHI) and poly(acrylic acid) (PAA). CHI is a biocompatible, abundant polymer with intrinsic antimicrobial properties that has already been widely used for a variety of biomaterials. It also carries a positive charge at physiological pH, which complements PAA