

Trapping of Antibacterial Agents within Hydrophobic Films of Polyphosphazene Polyelectrolytes

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Abstract

Direct layer-by-layer (LbL) assembly of cationic, small-molecule antibacterial bioactives with water-soluble, ionic polyphosphazenes (PPzs) containing trifluoroethoxy and carboxy substituents is reported. First, influence of PPzs hydrophobicity and antibiotic charge density on LbL assembly was studied via evolution of dry film thickness. We found that the use of fluorinated PPz polyelectrolytes enhanced ionic pairing within LbL coatings, and that increasing charge density of small molecules increased antibiotic uptake. This strategy was successful even in the case of gentamicin, a hydrophilic, small antibiotic with only 3 to 4 positive charges at pH 7.5. Confirmation of antibiotic presence in films was demonstrated via x-ray photoelectron spectroscopy. Importantly, LbL films of fluorinated PPz polyelectrolytes retained antibiotics in physiological conditions due to the enhanced hydrophobic interactions. In contrast, LbL films of non-fluorinated PPzs released antibiotics at low pH and in the presence of salt following the charge renormalization argument. The potential of these coatings with a biomedically relevant bacterial strain, *Staphylococcus aureus*, is discussed.