Antimicrobial coating for medical device, biosensor, nanofluidic, and drug delivery applications

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Technology description

Multifunctional, chemically modified chitosan surfaces and charged polymer brushes with protection against microbes and changes in pH

Problem

Chitosan, a cationic polysaccharide, is a biocompatible and biodegradable coating material. While chitosan has been used for drug delivery, wound dressings, and tissue materials, this material has not been fully realized as a biomaterial coating due to its limited solubility at physiological conditions. At low pH, chitosan is a water-soluble cationic polyelectrolyte, while at pH above 6.5, chitosan is uncharged and becomes insoluble in water.

Solution

Researchers at Penn and TJU have developed a new formulation of chitosan by modifying the molecule with quaternary ammonium salts, enhancing solubility in water. Grafting a thin layer of this modified chitosan and immobilizing on a surface generates resistance to biofilm formation due to the material’ s enhanced microbicidal activities. Furthermore, there is a pH-dependent swelling behavior, which could be exploited to initiate drug release or control the width of channels in nanofluidic devices. The grafted chitosan has been shown to reduce bacterial colonization of S. aureus compared to silicon oxide and APTES modified silicon oxide surfaces.

Application area

- Long-term multifunctional coating of medical devices
- Ventilators, endotracheal tubes, stents, implants, nanofluidic devices
- Biosensors
- Controlled drug delivery

Advantages

- Stable coating on grafted surface from pH 3-8
- pH-dependent swelling
- Antibacterial properties
- Tunable formulation

• Inexpensive manufacturing
• Prevent patient infections from medical devices by reducing biofilm formation

Institution

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