Multilayered Films for the Controlled Release of Anionic Molecules, Including Nucleic Acids

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WARF: P08128US02

Inventors: David Lynn, Jingtao Zhang, Xianghui Liu

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing multilayered films for the temporally controlled release of anionic species such as anionic proteins or nucleic acids.

Overview

The ability to control the delivery of biomolecules to cells and tissues has many therapeutic and research applications. In particular, spatial and temporal control over the release of multiple biological agents is critical in applications such as tissue engineering and also may enable the development of more effective gene- and protein-based therapies.

Polyelectrolyte multilayers (PEMs) are thin plastic films or coatings composed of alternating layers of negatively charged (anionic) and positively charged (cationic) polymeric molecules. Biomolecules such as nucleic acids and proteins can be integrated into PEMs and, provided that the films can be designed to dissolve controllably under physiologically relevant conditions, these coatings provide a platform for the release of the biomolecules from surfaces.

UW–Madison researchers previously developed novel charge shifting cationic polymers that can be incorporated into PEMs for the delivery of anionic biomolecules (see WARF reference number P03393US). These polymers can be used to coat the surfaces of medical devices and develop new research agents that provide greater control over nucleic acid or protein delivery to cells and tissues.

The Invention

UW–Madison researchers now have developed PEMs that incorporate cationic charge shifting polymers to promote the controlled release of multiple different anionic molecules with distinct release profiles. The use of these charge dynamic polymers enables more sophisticated and tunable control of biomolecule release than other types of degradable layers and allows the fabrication of ultrathin films that can sustain the release of nucleic acids for variable periods of time ranging from several days to several weeks or months. For example, a single multilayered film could be used for the rapid, short-term release of a first DNA construct followed by the long-term release of a second, different DNA construct.

Applications

- Coating medical devices for the localized release of therapeutics
- Coating disposable research tools, such as cell culture substrates
- Controlled release of biomolecules, including nucleic acids, anionic proteins and drugs, for applications such as tissue engineering

Key Benefits

- Can be fabricated to sustain the release of one or more DNA constructs from surfaces over periods of time ranging from several days to several weeks or months
- Enables more tunable and sophisticated controlled release than has been achieved with other types of degradable layers

Additional Information

Related Technologies

- WARF reference number P07251US describes a method of using PEMs to deliver proteins and other small molecules into cells.
- WARF reference number P03393US describes novel charge shifting cationic polymers for the delivery of nucleic acids and other polyanions into cells.
- WARF reference number P08389US describes novel charge shifting anionic polymers for the delivery of proteins and other cationic agents into cells.

Publications

- Zhang J. and Lynn D.M. 2007. Ultrathin Multilayered Films Assembled from 'Charge-Shifting' Cationic Polymers: Extended, Long-Term Release of Plasmid DNA from Surfaces. Adv. Mater. 19, 4218-4223.
- Liu X., Zhang J. and Lynn D.M. 2008. Ultrathin Multilayered Films That Promote the Release of Two DNA Constructs with Separate and Distinct Release Profiles. Adv. Mater. 20, 4148-4153.

Tech Fields

- Drug Delivery : Other drug delivery technologies
- Medical Devices : Device coatings

For current licensing status, please contact Jennifer Gottwald at jennifer@warf.org or 608-960-9854