Novel Charge Shifting Anionic Polymers for the Controlled Release of Cationic Agents from Surfaces

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WARF: P08389US

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing charge shifting anionic polymers that could be used to create polymeric multilayers and thin films capable of the controlled release of cationic agents, including therapeutic, diagnostic and prophylactic agents.

Overview

The ability to deliver biomolecules, such as proteins or nucleic acids, into cells has many therapeutic and research applications. Polyelectrolyte multilayers (PEMs) have been used to deliver biomolecules into cells. PEMs essentially are thin plastic films with alternating layers of negatively charged (anionic) and positively charged (cationic) polymeric coatings. Biomolecules, such as nucleic acids, can be integrated into PEMs, which can be designed to controllably dissolve under physiologically relevant conditions to release the biomolecules into cells.

UW-Madison researchers previously developed novel charge shifting cationic polymers that can be incorporated into PEMs for the delivery of nucleic acids and other polyanions (see WARF reference number P03393US). These polymers can be used to create medical devices and research agents that provide greater control and efficiency of nucleic acid delivery into cells.

The Invention

UW-Madison researchers now have developed novel compositions and methods for creating charge shifting anionic polymers. These polymers could be used to create polymeric multilayers and thin films that can controllably release cationic agents such as proteins and peptides.

The anionic polymers are prepared by the reaction of small-molecule anhydrides, such as citraconic anhydride, with primary amine side chains on a polymer backbone, such as poly(allylamine hydrochloride), a weak polyelectrolyte widely used for the fabrication of polyelectrolyte multilayers. This reaction yields an anionic, carboxylate-functionalized polymer that can undergo a dynamic change in charge state (from anionic to less anionic) to trigger the “unpackaging” of cationic molecules.

Applications

- Thin films and coatings that enable the controlled release of cationic agents, such as therapeutic proteins, from the surfaces of macroscopic, microscopic or nanoscopic objects
- Drug delivery

Key Benefits

- May be used to create PEMs that remain stable at near-neutral pH but erode and release incorporated cationic molecules when exposed to acidic environments
- Enables control over film erosion and the release of cationic agents
- Synthetic polymers are anionic and may be degradable.
- May be non-immunogenic, non-toxic or both
- Also may be biodegradable and biocompatible
- Ligands that facilitate the delivery of the polymer to a specific target may be included.

Additional Information

Related Technologies

- WARF reference number P03393US describes novel charge shifting cationic polymers for the delivery of nucleic acids and other polyanions into cells.

Related Intellectual Property

- View Divisional Patent in PDF format.

Publications

- Liu X., Zhang J. and Lynn D.M. 2008. Polyelectrolyte Multilayers Fabricated from 'Charge-Shifting' Anionic Polymers: A New Approach to Controlled Film Disruption and the Release of Cationic Agents from Surfaces. Soft Matter 4, 1688-1695.

Tech Fields

- Drug Delivery : Other drug delivery technologies

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