Injectable Bottlebrush Hydrogel for Sustained Local Drug Delivery
Technology #18561

Applications

This drug delivery technology allows sustained, localized delivery of one or more drugs and has potential applications in cancer, immunotherapy, and ophthalmology therapies.

Problem Addressed

Localized drug delivery has the potential to greatly improve patient outcomes by delivering high levels of therapeutics directly to the location in need of treatment while reducing systemic side effects. However, manufacturing, drug loading, and delivery of these sustained release therapeutics remains a challenge. These inventors have designed an innovative thermo-responsive hydrogel based on bottlebrush polymers that overcomes many of the current challenges in the field of sustained release therapeutics. The synthesis is modular and scalable, with a wide range of compatibility with small molecule and biologic agents.

Technology

This technology is a thermo-responsive hydrogel built from bottlebrush polymers that are liquid at room temperature and undergo solidification into a gel at body temperature. This thermo-responsive transition from solution to gel allows straightforward injection of the hydrogel into the target location. The material then retains the encapsulated therapeutic at the target site through gelation, releasing the therapy slowly with controlled kinetics depending on the bottlebrush polymer structure. The bottlebrush copolymer consists of a backbone with many long polymeric side chains extending from the backbone. This thermo-responsive hydrogel has three primary types of polymeric side chains sequentially arranged in blocks along the backbone. The three side chain types are polyesters, which are hydrophobic and biodegradable, polyethers, which are hydrophilic, and a safe derivative of polyacrylamides, which performs the sol-gel transition. In aqueous solutions, the bottlebrush copolymers self-assemble into micelles with polyester hydrophobic cores, polyether middles that promote solubility, and polyacrylamide protrusions that facilitate the sol-gel transition. Any hydrophobic drug molecule can be loaded into the bottlebrush copolymer hydrogel, and the inventors describe successful loading of NSAIDs, antibiotics, corticosteroids, chemotherapeutics, and immune modulators. Additionally, multiple drugs can be loaded into the same hydrogel by adding combinations of drug into the aqueous assembly.

Advantages

- Innovative thermo-responsive hydrogel composed of bottlebrush copolymers for injectable sustained release therapeutics
- Simple assembly of bottlebrush copolymers
- Straightforward drug loading by aqueous self-assembly
- Capable of loading of any hydrophobic drug
Enables sustained release combination therapy

Intellectual Property

IP Type: Granted US Patent
IP Title: Bottlebrush copolymers and uses thereof
IP Number: 10,683,387

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IP Title: Bottlebrush copolymers and uses thereof
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Categories For This Invention:

Materials
Polymers (Materials)
Life Sciences
Biotechnology
Clinical Applications
Immunology
Oncology
Ophthalmology
Therapeutics
Drug Delivery

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