Magnetically-triggered Drug Delivery System for Growth Factors and Biomacromolecules

Published date: May 14, 2019

Technology description

Allows Externally-Controlled Delivery of Large Macromolecules for Dynamic, Spatial and Temporal Release Of Biologics

This drug delivery system addresses the previously unmet need of a controlled drug-release platform for large biomolecules, such as growth factors and proteins. Controlled drug-release technology is one of the most rapidly growing technologies in human healthcare with market size projections reaching $90 billion by 2025. Increased patient compliance, reduced administration frequency, and pediatric and geriatric patient necessity are some of the factors influencing the market growth. The most common route of administering available protein therapeutics is frequent injections, since other routes, such as oral administration, exhibit low bioavailability due to enzymatic degradation. Over the last decade, multitudes of controlled-release platforms including passive- or environmentally-triggered platforms, as well as next-level remote- or externally-triggered platforms, improved patient compliance and minimized side effects. However, the need to develop delivery platforms for large biomolecules, such as growth factors and proteins, remains unmet.
Researchers at the University of Florida have designed a first-in-class magnetically-triggered drug release system for large biomolecules, such as growth factors and proteins. This externally-controlled drug delivery platform utilizes magnetic particles as a remote-control modality to trigger delivery from a carrier vesicle encapsulating the drug to the magnetic nanoparticles. The dynamic, control-based release of growth factors, based on fluctuating patient requirements, reduces the number of injections required. A wide market of numerous biological conditions requiring administration of proteins currently exists, such as insulin for diabetes, calcitonin for osteoporosis, or interferon for multiple sclerosis. This technology opens up a broad, previously untapped market for the delivery of proteins and growth factors in a spatially- and temporally-controlled manner thereby greatly augmenting their therapeutic potential.

Technology

This magnetically-triggered delivery platform for external-control-based release of growth factors and proteins encompasses composite microparticles, consisting of iron-oxide nanoparticles within a

polymer matrix, synthesized via a double-emulsion process. These microparticles are loaded with proteins, growth factors and/or other biomacromolecules. The polymer utilized here has a low melting temperature and the polymer/iron-oxide/protein complex is exposed to a radio frequency AC magnetic field of 10 kHz to 1000 kHz for up to two hours. The iron-oxide nanoparticles absorb energy from the field and dissipate it as heat, melting the polymer and releasing the protein without denaturing it. Applying this technology to any large biomolecules, such as growth factor or protein, makes it broadly applicable to multiple disease conditions.

Application area

Magnetically-triggered therapeutic delivery platform for dynamic, externally-controlled release of growth factors and proteins

Advantages

Provides dynamic spatial and temporal control, delivering drugs based on fluctuating patient requirement
Applies to wide variety of growth factors and proteins, making it applicable to several diseases such as diabetes, wound healing, arthritis, arrhythmia and many more
Provides better bioavailability of proteins than other routes of administrations, reducing the likelihood of enzymatic degradation
Alleviates the burden of frequent injections, improving patient compliance

Institution

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