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Self-Regenerating Antioxidant Catalysts for Protection of Artificial Implants (2015-023)

Prevents implant degradation by foreign body reaction, extending life and function of artificial Implants

Market Overview

These artificial implant materials are functionalized with self-regenerating antioxidants which prevent implant degradation. Artificial implants are becoming increasingly popular, with 2 in every 100 Americans having an artificial joint and over 7 million living with total hip or knee replacement. When artificial implants come in contact with the biological tissue, this can trigger an immune response called foreign body reaction (FBR) which results in chemical and mechanical degradation of artificial implants and ultimately implant failure. One method to mitigate the immune response is coating implants with antioxidants to prevent the FBR. However, once traditional antioxidants degrade oxidizing radicals non-catalytically, they are consumed by the reaction. Artificial materials functionalized with traditional antioxidants will lose the ability to protect against FBR and subsequent implant failure, creating the need for long-term protection of artificial implants against FBR. To meet this need, Clemson University researchers have developed artificial implant materials functionalized with antioxidant catalysts that degrade oxidizing radicals and prevent implant degradation by FBR. This approach will

Technical Summary

Existing antioxidants react stoichiometrically with damaging oxidants and are irreversibly consumed, which results in depletion of antioxidant capacity over time and concomitant loss of protection against foreign body reaction. Researchers at Clemson University have developed organic and inorganic artificial implant materials functionalized with self-regenerating antioxidant catalysts that catalytically degrade reactive oxygen species under physiologically relevant conditions to prevent implant degradation via FBR. Preliminary studies suggest that ruthenium complexes with heterocyclic ligands catalyze the degradation and slow the formation of radicals in aqueous buffer and can be covalently integrated into organic polymer architectures with retention of catalytic activity.

Application

Artificial implant coatings

Development Stage

Preliminary Proof of Concept

Advantages

- Extends life and function of artificial implants, decreasing need for implant replacement
- Uses material that degrade reactive oxygen species before they trigger immune response, protecting implant function and eliminating major cause of implant failure
- Reduces number and severity of side-effects, decreasing costs associated with immune response complications and revision surgeries

App Type	Country	Serial No.	Patent No.	CURF Ref. No.	Inventors
Provisional	United States	62/085,862	NA	2015-023	Dr. Andrew Tennyson Yamin Htet Anshuman Mangalum
Utility	United States	14/955,936	NA		

About the Inventor

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Dr. Andrew Tennyson earned his Ph.D. in bioinorganic chemistry from the Massachusetts Institute of Technology (MIT). Prior to joining Clemson in 2010, Dr. Tennyson was a postdoctoral fellow in organic and organometallic chemistry at the University of Texas at Austin. His research interests include multidrug resistant infectious diseases, detection of proto-inflammatory biomolecules, change pair dissociation and recombination in organic semiconductors, and bilayer interfaces and monophase composites.

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