Silk Microspheres for Joint Lubrication

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Technology description

Summary
Researchers at Tufts University have developed an injectable silk biopolymer device to treat joint disease which incorporates the 1,2-Dioleoyl-sn-glycero-3-phosphocholine (DOPC). This new biomaterial consists of silk fibroin microspheres which demonstrate excellent lubrication in friction tests. This silk device is biocompatable, biodegradable, and will have the ability to dramatically raise the level of care for patients suffering from OA and other chronic joint diseases.
Background
Joint lubrication is a new therapeutic option for osteoarthritis (OA), by which a biomaterial is injected into damaged joints to reduce the friction between cartilage surfaces, thus relieving the symptoms such as pain and inflammation. A natural polymer material, hyaluronic acid, has been previously used for this purpose but its effectiveness is debatable. Phospholipids are the major surface-active component in synovial fluid (SF) that is beneficial to joint lubrication. However, clinical use of phospholipids as a biolubricant is not possible unless combined with a mechanically robust biocompatible polymer material, such as silk fibroin.
Invention
Silk microspheres prepared via either DOPC template or polyvinyl alcohol (PVA) phase separation methods were coated with DOPC. The coating was achieved either during the microsphere preparation for the DOPC template method or post preparation for the PVA-based method. Both coated microspheres showed excellent lubrication effects in in vitro friction tests. The friction coefficient reduced from 2-3 for silk microspheres alone to 0.03-0.04 for coated microspheres, which is even lower than that of DOPC liposomes alone (0.055). It was found that larger microspheres (1-5 μm) were superior to sub-micron particles in facilitating lubrication, probably due to an effect of rolling friction. Compared to the DOPC liposomes alone, the DOPC-coated silk microspheres effectively prevented the contacted surfaces from wearing during the tests.

Advantages

Silk is a revolutionary material that can outperform plastics, inorganic polymers, foams, and glass and add unforeseen functions to technologies where conventional materials are used.
- It is the strongest natural fiber available
- It is biocompatible, with controllable biodegradability

- It can be manufactured in a variety of shapes and sizes
- It is injectable directly into the joint space for non-invasive treatment
- Therapeutic and DOPC release from silk biomaterials is highly controled and well-validated

Institution

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