Core-centered, porous ceramic granules employ bio-agent delivery system for enhanced bone repair/regeneration

Ceramic granules serve as scaffolds for new bone cell formation in bone repair treatments. Current ceramic granules, however, are limited by poor integration into the surrounding tissue and poor healing after treatment. This technology is a ceramic granule fabricated with a centralized macro-sized core and micro pores throughout the outer walls. The central core increases the surface area of the granule, which enhances cell attachment and proliferation. The micro pores increase fluid flow throughout the structure, allowing nutrients and other vital factors to reach new bone cells. Additionally, biodegradable polymeric microspheres can be immobilized onto the granule to deliver bio-agents such as antibiotics or growth factors that can help prevent infection and promote bone repair. As such, this technology may enhance the bone healing process and be used to treat bone defects in orthopedic, dental, and craniofacial applications.

Cost-effective, ceramic granules with drug delivery capabilities for faster and more effective bone repair

This technology enhances the bone repair process with a multi-structure ceramic granule, consisting of both macro and micro pores. The macro pores (300-700 um) create the central core of the granules, and the micro pores (2-10 um) are fabricated throughout the granule structure and surface. The central core increases the surface area for new bone cells to adhere to, and the micro pores increase fluid flow to the surrounding tissue. Together, the pores increase cell proliferation, cell attachment, and improve integration of the granules into the surrounding tissues, resulting in reduced bone healing time. This technology can also be used with biodegradable polymeric microspheres to deliver bio-agents at the site of bone repair. The microspheres can be loaded with bio-agents of interest (such as antibiotics or growth factors), and attached onto the ceramic granules in order to locally deliver the bio-agents to the surrounding tissues. Combining the core-centered, porous ceramic granule with the bio-agents delivery system creates a versatile and powerful system for bone repair treatments.

Cell viability assays and cross-section studies demonstrated greater cell proliferation and cell attachment in the technology’s multi-structured granules compared to currently used granules.

Lead Inventor:

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Applications:

• Repair bone defects with increased granule integration into surrounding tissue
• Bio-agents delivery system for bone related injuries/defects/disorders
• Orthopedic applications (e.g., bone void filler, Scoliosis treatment, spine cage, etc.)
• Dental/craniofacial applications (e.g., tooth socket treatment, Periodontal disease treatment, Sinus lift, etc.)

Advantages:

• Large surface area for greater cell attachment and proliferation
• Central core reduces the amount of material used for granules
• Cost-effective protocol for fabrication of core-centered porous granule
• Core-centered, porous granule can be used as a bone filler as well as a carrier for therapeutic agents
• Prevents early stage infection through the release of antibiotics into a bone defect site
• Reduces healing time by promoting cell attachment and proliferation and releasing growth factors into the bone defect site

Patent information:

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Related Publications:


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