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Bio-Nanocomposite for Tissue Engineering

ID# 2019044

HIGHLIGHTS

- The composite provides bone and cartilage scaffold for tissue engineering along with structural and mechanical integrity to tissue.

OPPORTUNITY

Tissue engineering requires scaffolds that can mimic the functional properties of natural bone and cartilage. Such scaffolds should be a porous biodegradable 3D structure supporting bone formation and vasculature ingrowth, and at the same time have strong mechanical properties offering structural support.

University of Alberta researchers have developed a series of novel bio-nanocomposite comprising chitosan (CS), cellulose nanocrystals (CNC), and hydroxylapatite (HA) along with methods to generate a tissue scaffold. Chitosan was chosen as a matrix of the bio-nanocomposite scaffolds, HA was employed as one of the main components in the bio-nanocomposite formulations to mimic native bone tissue, and CNC is included to provide porosity and mechanical strength. CNC forms physical cross-links within the chitosan matrix to form 3D networks. The addition of chemical crosslinks provides added strength allowing the scaffold to withstand forces generated during cell proliferation. These fabricated scaffolds provide a temporary 3D structural support during tissue repair that regulates cell proliferation, and differentiation.

COMPETITIVE ADVANTAGE

- A 7 day 2 dimensional MTT assays showed >80% cell viability.
- A 3D MTT assay showed an increase in cell proliferation of MG63 human bone cell line.
- Degradation studies indicate the scaffolds maintain pore structure but soften over days in phosphate buffered saline at 37 °C, simulating scaffold degradation *in vivo*.
- Bioactivity was indicated by the formation of apatite on the scaffold surface in a simulated physiological environment. It appears that the high surface area of CNC contributed to the adsorption of more calcium phosphate on scaffolds.

STATUS

- Patent pending.

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MORE INFORMATION

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