Studien- / Masterarbeit

Surface Coating of 3D-Printed Calcium Phosphate Cements Scaffolds with Electrospun Nanofibers for Enhanced Antibacterial Properties

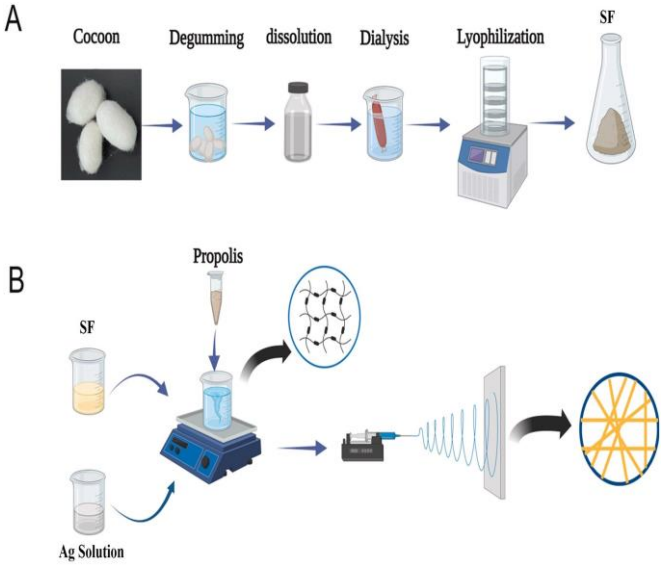
Field of study: Biomedical Engineering/Mechanical Engineering

Short description:

3D-printed bone scaffolds are primarily used to fill bone gaps after surgical removal due to tumors, trauma, or infection, where poor healing can lead to non-union fractures, cancer resurgence, or reinfection. Although, emerging 3D printing of on-demand bone graft biomaterials can provide personalized solutions and significant benefits over biological counterparts, it is highly probable that bacterial infections occur during surgical procedures or on scaffolds. Therefore, it is of great significance to obtain scaffolds with integrative antibacterial and osteogenic functions to treat bone scaffold-associated infections and promote bone repair. Among several scaffolding and coating techniques, electrospinning has been recognized for its ability to produce nanofibrous mats in a scalable and low-cost manner. These electrospun mats can mimic the nanotopographies of bone ECM nanofibers (such as collagen) and play a crucial role in cell attachment and proliferation.

Among natural polymers, Bombyx mori silk fibroin (SF) is one of the most commonly used biopolymeric materials due to its desirable properties such as biocompatibility, biodegradability, nontoxicity, low immunogenicity, and good mechanical strength. Additionally, various therapeutic components, such as growth factors, ions, oligonucleotides, peptides, proteins, and small molecules, can be incorporated into SF nanofibrous sheets/mats fabricated by electrospinning.

On the other hand, Propolis is a gelatinous solid substance formed from resin or other secretions collected by worker bees from tree trunks or plant shoots. Propolis, compared with many other natural substances, has several biological activities such as antioxidant and antibacterial properties.



Continuing an ongoing project, this study aims to evaluate the feasibility of electrospinning Propolis-enriched SF/Ag+ nanofibers to be used as coating mats on the surface of 3D-printed CPC scaffolds, with the goal of enhancing their antibacterial property. Various characterization techniques will be applied to analyze the structure, morphology, compressive strength, antibacterial activity, and ion release rate of the different fabricated scaffolds.

Type of work: Theoretical/experimental
Begin: As soon as possible

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Please do not hesitate to contact me if you have any questions or require further information.