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Properties of hydrochloric chitosan multifilament fibers modified with nano-calcium phosphate complex

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The socioeconomic situation of the modern world has raised the interest in renewable materials to use in regenerative medicine. Biomaterials as an artificial bone are classified into surface-active materials such as hydroxyapatite (HAp), and resorbable materials such as ß-tricalcium phosphate (ß-TCP) and bioactive and biodegradable material as a chitosan and its derivatives. The composition of biomaterials as ceramics, polymers and/or composite materials, with all advantages and drawbacks, are developed to be used for bone problems. When all these properties of polymers, ceramics are considered producing composite materials have a reasonable approach. In this studies composition of chitosan and/or calcium phosphates are derived from the junction of two or more different materials, containing organic and inorganic materials, including characteristics like bioactivity and biodegradability and biocompatibility with human tissues. The chemical characteristics of chitosan and nano B-TCP/HAp complex are showed by FTIR studies and can be seen the main peaks of energy vibration of both components organic/inorganic exist in the material complex, also can be seen a good stability of the nano-ceramic formation in the chitosan salt solution by potential zeta and ceramic particles size range from 12.8 to 58 nm. In this study also is showed a new method of preparation of calcium phosphates ceramics from micro size to nano size using a common commercial calcium phosphate and describes a method for preparing chitosan fibers modified with hydroxyapatite (HAp), tricalcium phosphate (β-TCP), and HAp/β-TCP nanoparticles. Fiber-grade chitosan derived from the northern shrimp (Pandalus borealis) and nanoparticles of tricalcium phosphate (β-TCP) and hydroxyapatite (HAp) suspended in a diluted chitosan solution were used in the investigation. Diluted chitosan solution containing nanoparticles of Hap/β-TCP was introduced to a 5.16 wt% solution of chitosan in 3.0 wt% hydrochloric acid. The properties of the spinning solutions were examined. Chitosan fibers modified with nanoparticles of HAp/β-TCP were characterized by a level of tenacity and calcium content one hundred times higher than that of regular chitosan fibers. These materials can be used in future for medical applications as a base for scaffolds production and as implants in regenerative medicine.

Biography

Pighinelli L is currently an Associate Professor of Toxicology and Genetics Research Program in Lutheran University of Brazil and Assistant Professor of research program in materials engineering at the same university. He has completed his Doctorate in Biomaterials area for regenerative medicine and tissue engineering at the University of Innsbruck, Austria, in cooperation with the Institute of Biopolymers and Chemical Fibers in Lodz, Poland, by Marie Skłodowska-Curie Actions-Research Fellowship Program. He has several papers and patents in the field of regenerative medicine, tissue engineering and radiotherapy. Currently, he is developing research in biomaterials area and biodegradation of polymers used in regenerative medicine and drug-delivery. His research fields include Biomaterials and Tissue Engineering: bioactive ceramics; scaffolds for bone and tissue repair; musculoskeletal tissue engineering: bone, cartilage, articular joints, calcium phosphate-based drug delivery devices and ceramics for orthopedics.

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