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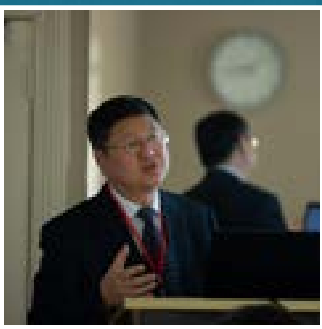

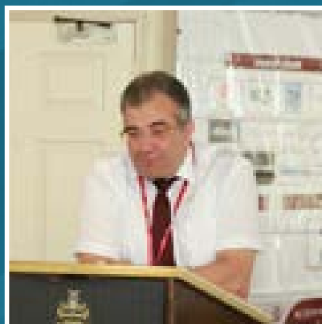

POSTER

Saida Somrani et al., Mater Sci Nanotechnol 2019, Volume 3

TO IMPROVE THE BIOACTIVITY OF THE BIOMIMETIC APATITE BASED BIOMATERIALS

Saida Somrani and **Selmi M**
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Bone is a cellular hydrated organo-mineral composite. It promises mechanical, protective and metabolic functions allowing the locomotion and maintaining body's cells alive. The major mineral phase is a Ca-P apatite. The nascent nanocrystals of this bioapatite, which are poorly nanocrystallized are distinguished by the presence of two adjacent environments. The first one is the bioapatite internal core. It is similar in structure to that of hydroxyapatite (Ca10 (PO4)6(OH) 2) built with tri-structured stable apatitic species. They are surrounded by hydrated shells containing bi-structured non apatitic species which are characterized by their ability to exchange with the body fluid entities. With age, bone mineral is the seat of many events and modifications usually named maturation process. At the beginning of its formation, bone mineral is formed with poorly nanocrystallized bioapatites which are non-hydroxylated, freely or weakly carbonated and rich in water. Despite, in the ageing, the bioapatite becomes hydroxylated and more carbonated, leading to the alteration of the bone bioactivity. In the biomaterials field, the use of the biomimetic Ca-P apatite's, that have chemical and structural characteristics emulating the mineral bone behaviors, has raised interest to assure the biocompatibility and favor the osteoconductivity of the implants. The purpose of this study is to contribute to a better understanding of bone mineral maturation process from the neoformation to ageing in order to improve biomimetic apatite based orthopedic biomaterials. A comprehensive study of two sets of biomimetic apatites was undertaken. The first series which is free carbonate is analogous to the young bioapatite while the second is similar to the mature or aged bone mineral. The experimental results were statistically treated by ANOVA univariate and bivariate regressions ($p<0.05$). The obtained data highlighted the physicochemical characteristic that enabled an early diagnosis of bone fragility to improve the characteristics of biomimetic apatites for making the orthopedic biomaterials.

BIOGRAPHY

Saida Somrani is a Professor of Chemistry in Tunis University. She is a Director of the Research Unit 'Material and Environment', at the Preparatory Institute for Engineering Studies of Tunis (IPEIT). Her research activities have been focusing in particular on nano- and bio-material sciences and bio-sourced chemistry for biological applications essentially (orthopedic and dentistry biomaterials, bone) using physicochemical and thermodynamic approaches. She is a co-author of articles and a chapter in biomaterials in Wood head publishing limited series: Bio-ceramics and their clinical applications. Selmi M has got a Diploma in Analytical Engineering from the Faculty of Sciences of Tunis. She has obtained her Master's Degree from the National Institute of Applied Sciences and Technology (INSAT). She has got her PhD which has been supervised by S Somrani at the Preparatory Institute for Engineering Studies of Tunis (IPEIT) in April 2017. She taught engineering studies in IPEIT. She has a publication in *Journal of Materials and Environmental Science*.

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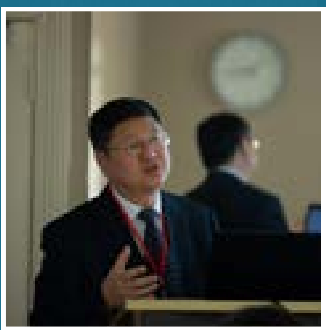

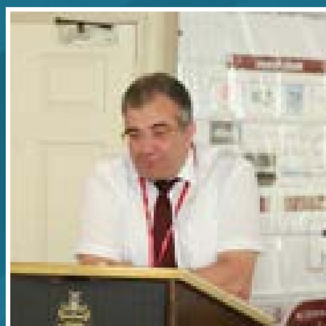

ACCEPTED ABSTRACT

Mater Sci Nanotechnol 2019, Volume 3

INTELLIGENT MULTIFUNCTIONAL ALLOY NANOPARTICLES, SYNTHESIZE, CHARACTERIZATION AND APPLICATIONS

Amirsadegh Rezazadeh Nochehdeh
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The nanotechnology has concentrated to study by scientists and researchers around the world to synthesize novelty multifunctional alloy nanoparticles which will be used in wide range of applications from industry to medicine. In the recent years, one of the most common nanomaterials in the world is an alloy nanoparticle. In addition, a Multifunctional alloy nanoparticle has been growing by scientists around the world. The various metallic, ceramic and polymeric compounds like Iron Oxides, Zinc Oxides, Iron-Cobalt, Nickel-Cobalt, Iron-Nickel, Titanium Dioxide, Ag doped gold, Copper alloys, PEG, PPA, PMMA, Chitosan, Hydroxyapatite and sort of that, will be produced by chemists, Physicists or materialist in the advanced laboratory. There are various method to synthesize alloy nanoparticles like precipitation, chemical and physical vapour deposition, thermal and plasma spray, laser deposition, mechanical alloying and so on. Because of an impressive and unique chemical, physical and an antimicrobial property of nanoparticles along with their biocompatibility; makes these materials find specific applications in various industries. Thus, alloy nanoparticles have lots of applications in manufacturing, agriculture, environment, energy, electronics, and medicine. These use as an industrial coatings, lubricant oils, catalysts, gas sensors, magnetic separators, antioxidant, break down oil, breakdown volatile organic air pollutants, fuel cell electrodes, storage materials, lithium ion batteries, semiconductor (photovoltaic cells), solar steam device, storing and packaging of agricultural produces, nutrients absorber, food flavouring, perfumes, scratch resistance eyeglasses, fluorescent biological labels, contrast imaging, bone growth, drug and gene delivery, immunoassay, bio detection of pathogens, separation and purification of biological molecules and cells, cancer diagnosis and treatment, tumours destruction via heat therapy (hyperthermia), tissue engineering and etc. So, propose of this paper is detecting the intelligent multifunctional alloy nanoparticles and evaluating wonderful characteristics which is be synthesized by various methods.

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INTERLACED SCAFFOLDS FOR TISSUE ENGINEERED HEART VALVES (TEHVS)

Rabia Nazir
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Tissue engineers have achieved limited success so far in designing an ideal scaffold for aortic valve; scaffolds lack in mechanical compatibility, appropriate degradation rate, and microstructural similarity. This paper, therefore, has demonstrated a carbodiimide-based sequential crosslinking technique to prepare aortic valve extracellular matrix mimicking (ECM) hybrid scaffolds from collagen type I and hyaluronic acid (HA), the building blocks of heart valve ECM, with tailorable crosslinking densities. Swelling studies revealed that crosslinking densities of parent networks increased with increasing the concentration of the crosslinking agents whereas crosslinking densities of hybrid scaffolds averaged from those of parent collagen and HA networks. Hybrid scaffolds also offered a wide range of pore size (66 – 126 μm) which fulfilled the criteria for valvular tissue regeneration. Scanning electron micrographs (SEM) and images of Alcian blue – Periodic acid Schiff (PAS) stained samples suggested that our crosslinking technique yielded an ECM mimicking microstructure with interlaced bands of collagen and HA in the hybrid scaffolds. The mutually reinforcing networks of collagen and HA also resulted in increased bending moduli up to 1660 kPa which spanned the range of natural aortic valves. Cardio sphere-derived cells (CDCs) from rat hearts showed that crosslinking density affected the available cell attachment sites on the surface of the scaffold. Increased bending moduli of CDCs seeded scaffolds up to two folds (2 – 6 kPa) as compared to the non-seeded scaffolds (1 kPa) suggested that an increase in crosslinking density of the scaffolds could not only increase the in-vitro bending modulus but also prevented its disintegration in the cell culture medium.

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SCAFFOLDS WITH BG 45S5 AND CROSS-LINKED SILK

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Bioglass is the first invented bioactive glass, also known as 45S5, an important family of ceramic that are used to regenerate bone tissue. Although it has been used in many cases, when it is sintered to obtain a solid piece, this glass transforms into crystal structure and it is not a glass anymore with and presents a notorious decrease of its bioactivity. In order to avoid this problem, a new approach has been developed with the inclusion of silk as a polymer in the inner structure. Silk is a widely used biomaterial that can help the proliferation of bone cells. The present study is focused in obtain scaffolds with BG 45S5 and crosslinked silk, that acts as a net holding the bioactive glass particles. To process this material, a freeze casting technique has been selected, as it is possible to create high porous scaffolds with a high interconnected porosity with this technique. The obtained samples were physically, chemically and biologically characterized, obtaining a complete recover of the bone tissue in an in vivo experiment during 10 weeks in a rabbit skull. Next steps are focused in conform this same materials scaffolds through a 3D printer, that will allow to create samples with a desired shape and size. A new start-up company is being created, Mat Print that will commercialize 3D printed ceramic samples and it is being developed from the research carried out from the Instituto de Cerámica de Galicia.

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MECHANICALLY RESISTANT, BIODEGRADABLE PVA/CA DRESSINGS FUNCTIONALIZED WITH LL37 PEPTIDE REDUCE MICROBIAL BURDEN

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Typically, acute wound healing is a well-organized process that evolves in a predictable amount of time. Chronic wounds (CW) result from gradual tissue degradation, and are characterized by defective cell matrix, high bacteria counts, prolonged inflammation and moisture imbalance. Antimicrobial dressings, that combine dressing and antibiotics, have been suggested as potential strategies to treat CW. However, the rising of antibiotic-resistant pathogens has turned these systems obsolete, revealing antimicrobial-peptides (AMPs), which display a broad spectrum of activity against pathogens and act rapidly at multiple sites within microbial cells, as viable alternatives. Methodology: In this work, poly(vinyl alcohol) (PVA) and cellulose-acetate (CA) were prepared via casting/phase-inversion method in the form of films. Different PVA/CA ratios were tested. Their mechanical, thermal and biodegradation profiles were followed. The films' capacity to absorb exudates was also determined. Films were functionalized with LL37 peptide. This AMP is endowed with immunoregulatory abilities, with great potential for wound healing, and important antimicrobial features.

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DECELLULARISATION OF HEART VALVES

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Heart failure is the end stage of heart disease and occurs when all compensatory mechanisms due to underlying heart disease are not maintaining the cardiac output. Valvular heart disease, ischemic heart disease, hypertensive heart disease and cardiomyopathy in the elderly and congenital heart disease in the children are well established factors of heart failure. A.C inhibitors, Diuretics, Beta-blocker, vasodilators and lanoxin are mainstay of medical treatment. Cardiac transplantation with immune suppressants therapy is widely accepted procedure for end stage cardiac failure that is with severe functional limitations and refractory to treatment modalities. But cardiac transplantation is not accessible for majority of the patients.

Because of higher cost and lack of sufficient technical expertisation and non-availability of number of centers alternative strategy is considered to solve the end stage heart failure with stem cell therapy. Live organ equivalent which is biocompatible is still in the experimental stage. Tissue engineering of heart valves are used with success. Decellularisation of heart valves and recellurisation of tissue engineered valves have shown promising results. Whole cardiac extracellular matrix as a scaffold and seedling of pluripotent stem cells derived cardiomyocytes after antigen removal by protein Solubilisation, sarcomeric disassembly preserved mechanical and structural properties have a role in tissue engineering and stem cell therapy. Cardiac extra matrix scaffold with stem cell recellurisation may be the answer in the future as an alternative to cardiac transplantation.