Report on the First Year as PhD Student

Doctoral School of Materials Sciences and Technologies
Óbuda University

Biopolymer-hydroxiapatite for bioapplication fields

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Biopolymers

are frequently used due to their sourcing from renewable resources, widespread abundance, and cheap procurement costs.

calcium phosphate

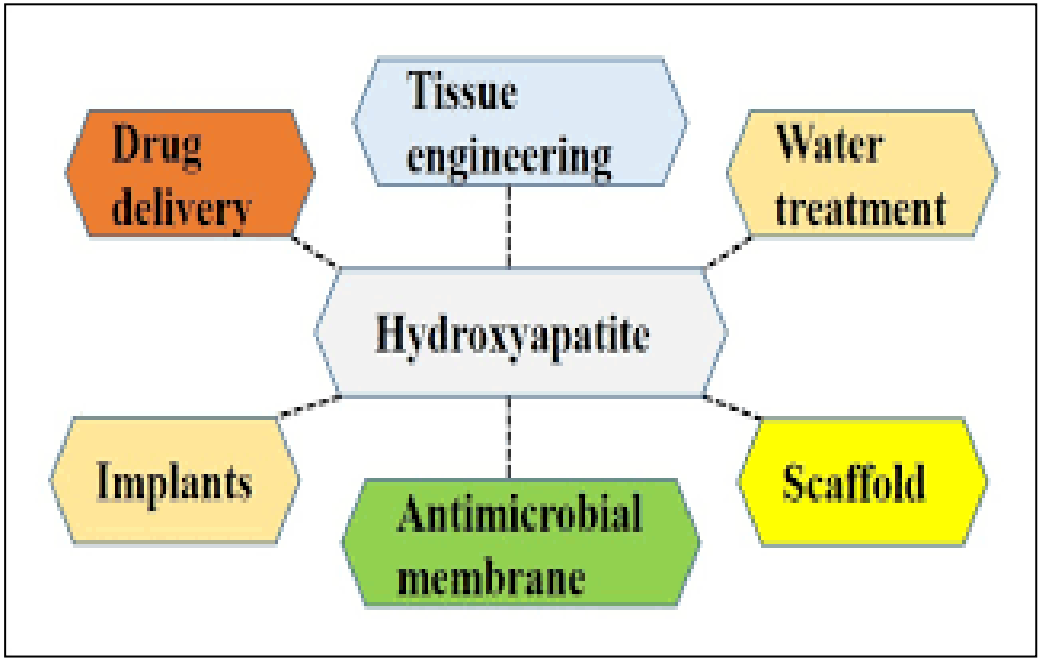
The chemical formula for pure

HAp is $Ca_{10}(PO_4)_6(OH)_2$

is classified as a highly bioactive and biocompatible inorganic material. Therefore, it is widely used in tissue engineering and bone replacement. The chemical composition and structure of hydroxyapatite is similar to mineral constituent of natural teeth and human bones.

Application of Hydroxyapatite

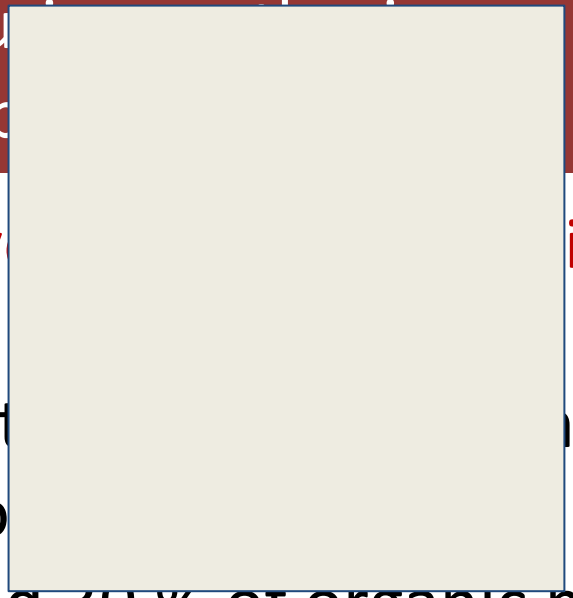
The hydroxyapatite has got a variety of applications that include:



Application of Hydroxyapatite

HAp Properties:

- high hardness
- insolubility in water
- excellent chemical and thermal
- stability, radiopacity,
- porosity control du
  and ion exchange p



HAp has been employ iomedical applications

is a well-known essent an bone composed of 70 % ino of apatite calcium phosphate and 30 % of organic materials of collagen and bone marrow cell.

HAp/polymer composites

have been developed to overcome the inferior mechanical properties

high brittleness, low stiffness a low tensile strength, a low fracture toughness and a poor impact resistance

of traditional HAp sintered ceramics (or to improve bioactivity of the polymer matrix).

which restrict their wider use in medicine

HAP are available in various physical forms:

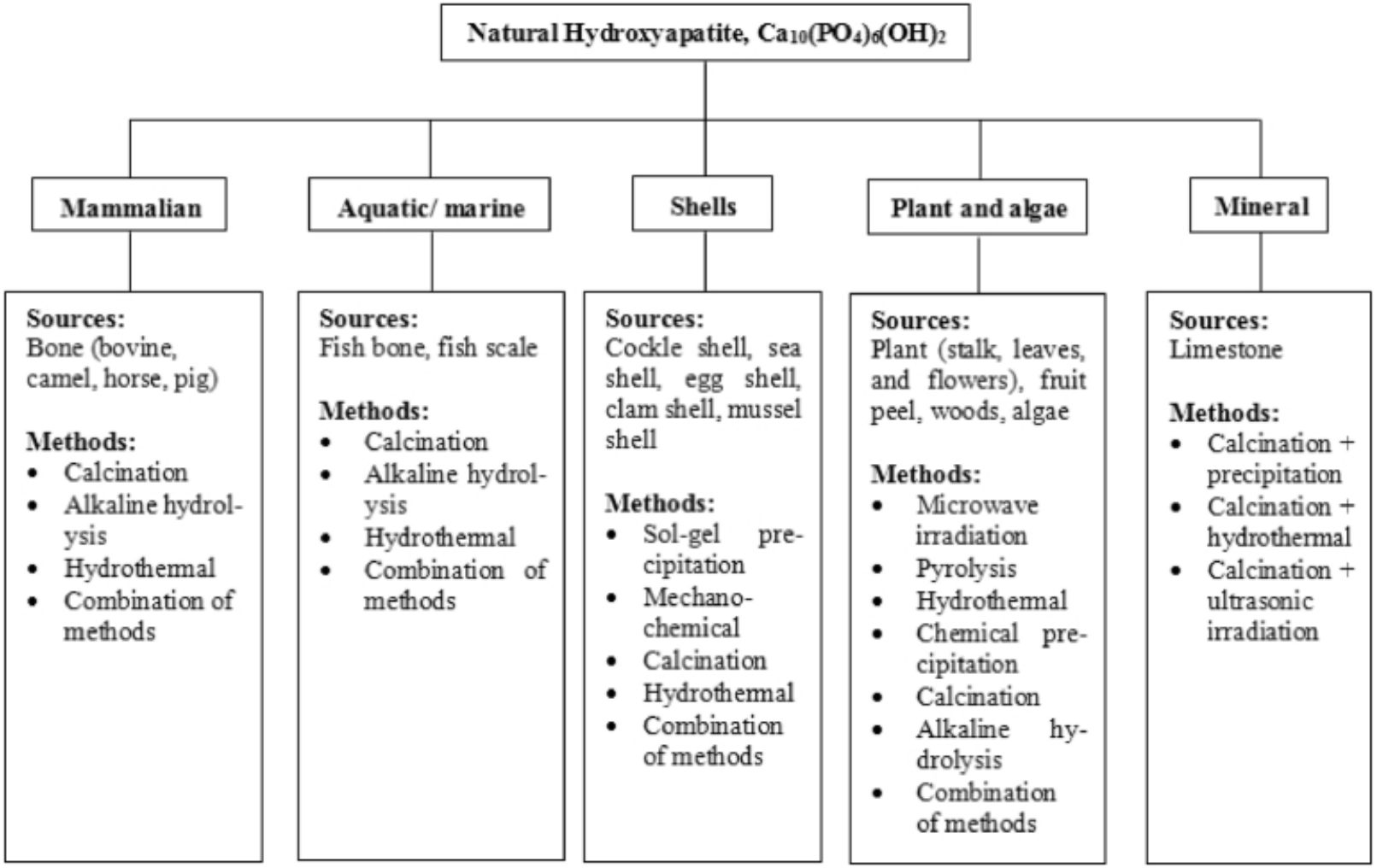
particles, blocks (dense or porous), injectable compositions, self-setting cements, coatings on metal implants, composites with polymers,

greater choice of biocompatible polymers those can be divided into two major groups:

- synthetic polymers (e.g., polyesters, PMMA, poly-ε-caprolactone) and
- polymers of biological origin (e.g., collagen, gelatin, chitosan, alginate

Natural hydroxyapatite

Natural hydroxyapatite is usually extracted from biological sources or wastes



The usage of HAp extracted from natural sources can be considered to be:

- an environmentally friendly.
- Sustainable.
- economical process to fabricate these materials.
- these materials are available in large quantities.
- This can result in positive contributions to the economy, environment, and to general health.

Various methods for synthesising synthetic and natural HAp

Different applications of HAP require different physical and chemical properties the optimum characteristics for each application should be decided before a synthesis technique is selected including

dry methods (solid-state and mechanochemical)

wet methods (chemical precipitation, hydrolysis, sol-gel, hydrothermal, emulsion, and sonochemical)

high temperature processes (combustion and pyrolysis)

Dense and Porous Hydroxyapatite

dense or porous HAp-based products can be obtained depending on the sintering method chosen

The sintering allow decreasing the grain size, thus obtaining HAp with quite high density, fine microstructures, high thermal stability and high mechanical properties

Disks of dense HAp

Porous HAp

involve the sintering of ceramic powder with specific pore-generating additives, such as:

naphthalene, paraffin, hydrogen peroxide or even a porous template (polymeric sponge), which burn-off at high temperatures leaving void spaces behind them.

Total pore volume and pore size depend on:

- the particle size distribution of raw ceramic powder.
- type of fabrication techniques used.
- type of pore-forming agent/template and sintering conditions

porous HA blocks (scaffolds)

Characterize the hydroxyapatite and its composites

- Fourier Transformed Infrared Spectroscopy (FTIR).
- X-ray diffraction (XRD).
- Thermo-gravimetric analysis (TGA).
- Transmission electron microscope (TEM).
- Scanning electron microscope (SEM).

Aim of PhD research

The objectives for the PhD research

1- preparation, characterization of HAp.

2- synthesizing the HAp via thermal, mechanical and chemical activation processes to make HAp powder from eggshell and preparation of HAP/polymer composites.

3- the feasibility of using HAp as filling materials in its nano or micro sized in polymer composites.

4- The mechanical properties of the obtained composites are importantly to being studied.

5- The polymer matrix will be chosen according its needs in industry, favorable properties like thermal properties and its biodegradability.

6- The prepared and investigated obtained materials are aimed to satisfy the requirements for biomedical applications

Courses and seminars

During the first semester I've taken the following courses.

1- Fundamentals of material science lectures given by Professor Maria Berkes (online course). Cridet (6)

2- Biomaterials for medical applications Professor Balázsi Credit (6)

Also, I've attended to seminars topics in Materials.

Conferences, presentation

Participant in International Conference of Nanotechnology Research and Innovation, November 20-24, 2023, University of Aveiro, Portugal

https://icntri2023.nmsme.org/icntri2023/

DOI https://doi.org/10.48528/347n-k434

Certificate of attendance

November 28, 2023

Certificate of Attendance

We hereby confirm that

Ms. Wasan A. Alkaron

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attended the International Conference on Nanotechnology Research and Innovation (ICNTRI-2023) with an Oral Presentation *"The effects of black tea extracts on the corrosion inhibition of mild steel in acidic solution"*, held in the University of Aveiro, Portugal from 20 to 24 November 2023.

For and on behalf of the ICNTRI-2023 Organizing Committee

Dr. Igor Bdikin
(ICNTRI-2023 Organizing Committee Co-Chair)
Department of Mechanical Engineering
University of Aveiro, Aveiro 3810-193, Portugal
Email: bdikin@ua.pt

Publication Paper

- I have paper under revision during this semester:

Title: The effects of black tea extracts on the corrosion inhibition of mild steel in acidic solution

Auther: Wasan A. Alkaron

Journal: Nanomaterials Science & Engineering, ISSN 2184-7002**.**

- I had a published paper (acceptance letter)

Title : Effect of low-pressure plasma treatment on the thermal behavior of organo- modified montmorillonite nanoclay.

Journal: Archived of Materials science and Engineering, ISSN 1897- 2764.

Authers: Alaa almansoori and Wasan Alkaron.

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Gliwice, 27.12.2023

International OCSCO World Press,
ul. Jana III Sobieskiego 12/1, 44-100 Gliwice, Poland

Certificate

The article by Alaa Almansoori, and Wasan Alkaron, titled "Effect of low-pressure plasma treatment on the thermal behavior of organo-modified montmorillonite nanoclay," has been approved for publication in the Archives of Materials Science and Engineering, ISSN 1897-2764, published by the International OCSCO World Press.

The article will be published after paying the Article Processing Charge fee.

Justyna Hajduczek-Jarka
Editorial office
JAMME/AMSE International OCSCO World Press