Presented

By

OFUDJE, EDWIN ANDREW

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From Bio-Waste to Biomaterial: A Facile Approach for the Synthesis of Hydroxyapatite

by

[1,2&4]Edwin. A. OFUDJE, [2]Abideen I. ADEOGUN, [2]Mopelola. A. IDOWU, [3]Sarafadeen O. KAREEM and [4]Deepak K. PATTANAYAK

[1]*Department of Chemical Sciences, McPherson University,* Nigeria.

[2]*Department of Chemistry, Federal University of Agriculture,* Nigeria.

[3]*Department of Microbiology, Federal University of Agriculture,* Nigeria.

[4]*CSIR- Central Electrochemical Research Institute, Karaikudi, Tamilnadu.*

INTRODUCTION

- The nature and quality of agricultural waste generated vary from one country to the other, but there is generally an increase in the amount of waste generation across the globe due to increase in population.
- When the concentration of waste of any kind in the environment is in excess, it constitute environmental pollution and becomes critical for human, animals and vegetation.
- The way out therefore is to seek for proper ways to recycle these agro-waste by converting them to useful materials.

HYDROXYAPATITE

- Hydroxyapatite (HAp), with a chemical formula of $Ca_{10}(PO_4)_6(OH)_2$, is naturally occurring mineral in human body and the main mineral component of tissue engineering.
- Synthetic HAp is suitable material for medical application due to its similarity with HAp occurring in natural bone and teeth.

WHY HYDROXYAPATITE?

- As replacement for damage bones or as coating on implants.
- As carrier in drug delivery;
- As an adsorbent in liquid chromatography, and
- As an excellent adsorbent for waste water treatment.

CHALLENGES WITH CHEMICAL SYNTHESIS

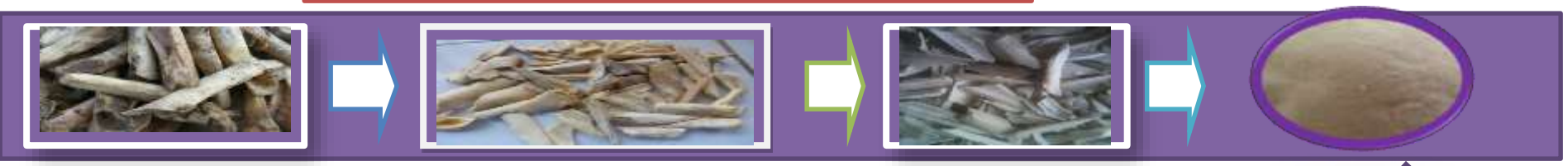
- High cost of materials;
- Synthesized HAp could be toxic;
- It often lack the presence of some trace beneficial ions such as Na^{+}, K^{+}, Mg^{2+}, Zn^{2+}, F^{-}, Cl^{-}, CO_3^{2-} etc.

OBJECTIVES

❖To synthesize and characterize pure hydroxyapatite powder from pig bone waste via thermal decomposition.

❖To add value to waste, thus reducing environmental pollution.

EXPERIMENTATION



Hot H_2O treatment

Deproteinization by NaOH and HCl

Pulverization

600°C

800°C

1000°C

Sintered

HAp powder

HAp + NH_4HCO_3

Pellets at different pressure

Sintered

Scaffold HAp

RESULTS

Fig. 1: (a) Raw pig bones, (b) pig bones after treatment with hot water, (c) after deproteinization with NaOH and HCl and (d) synthesized HAp powder at 1000 °C

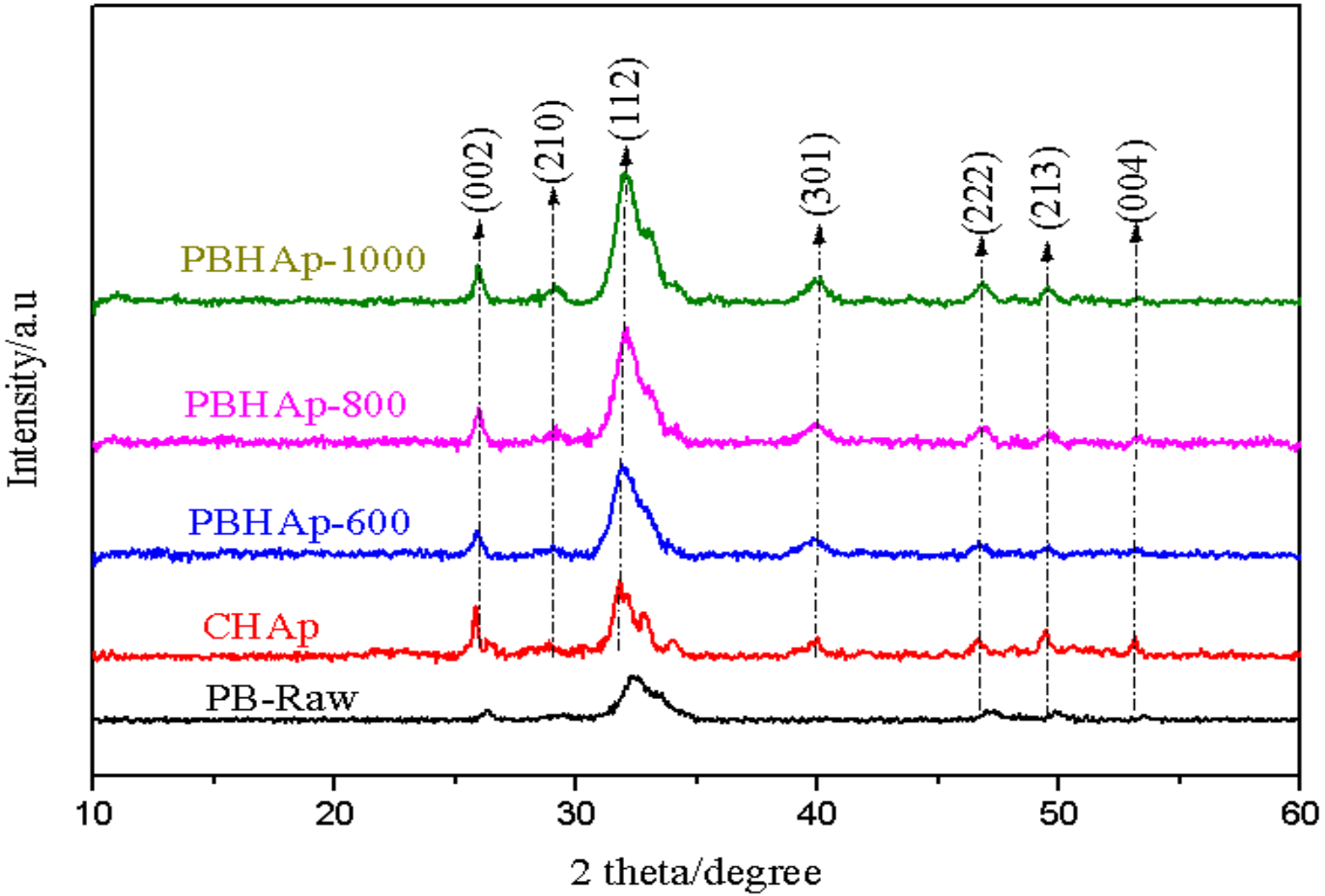


Fig. 2: XRD results showing monophasic synthesized HAp at different temperature including raw pig bone and commercial HAp.

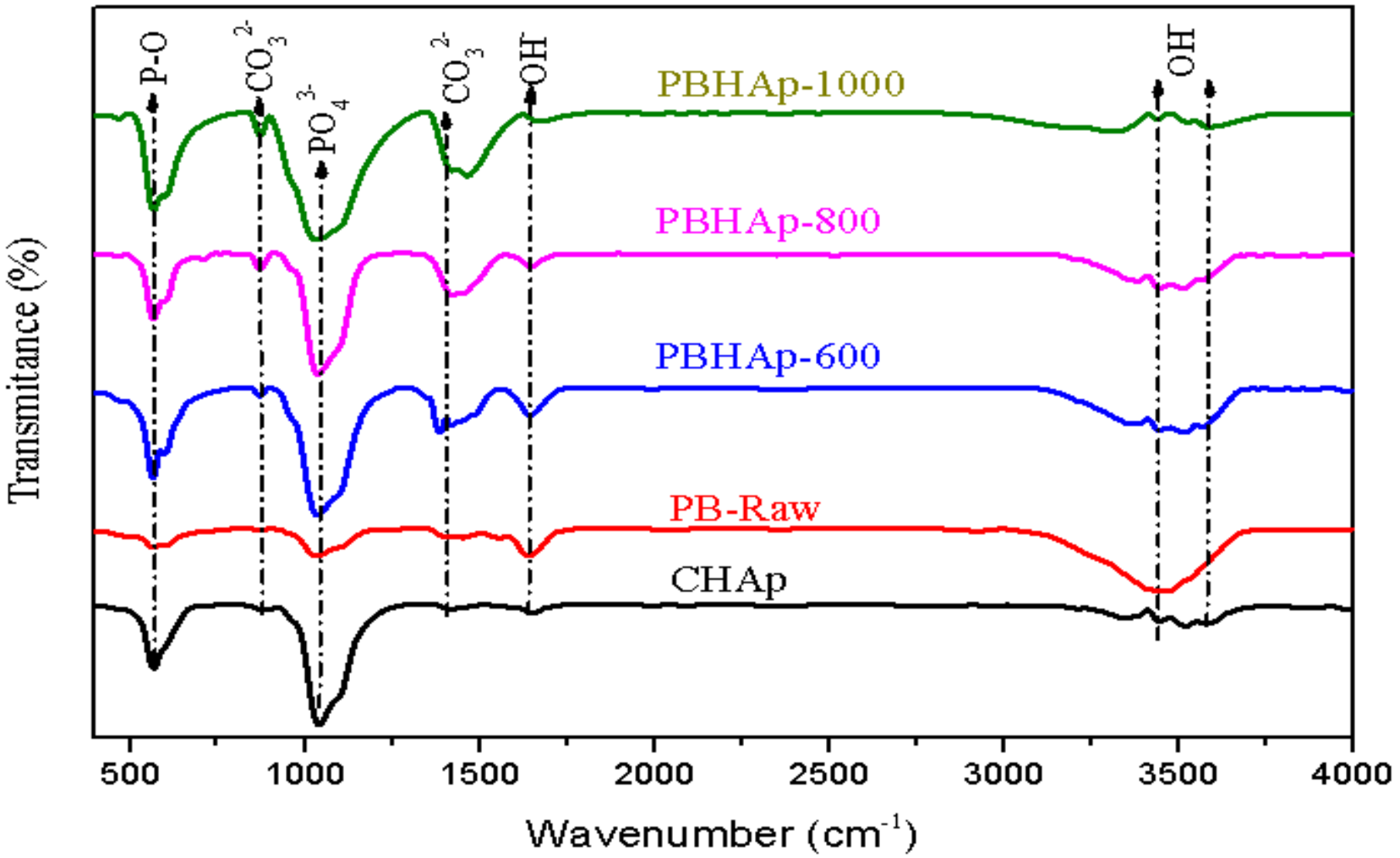
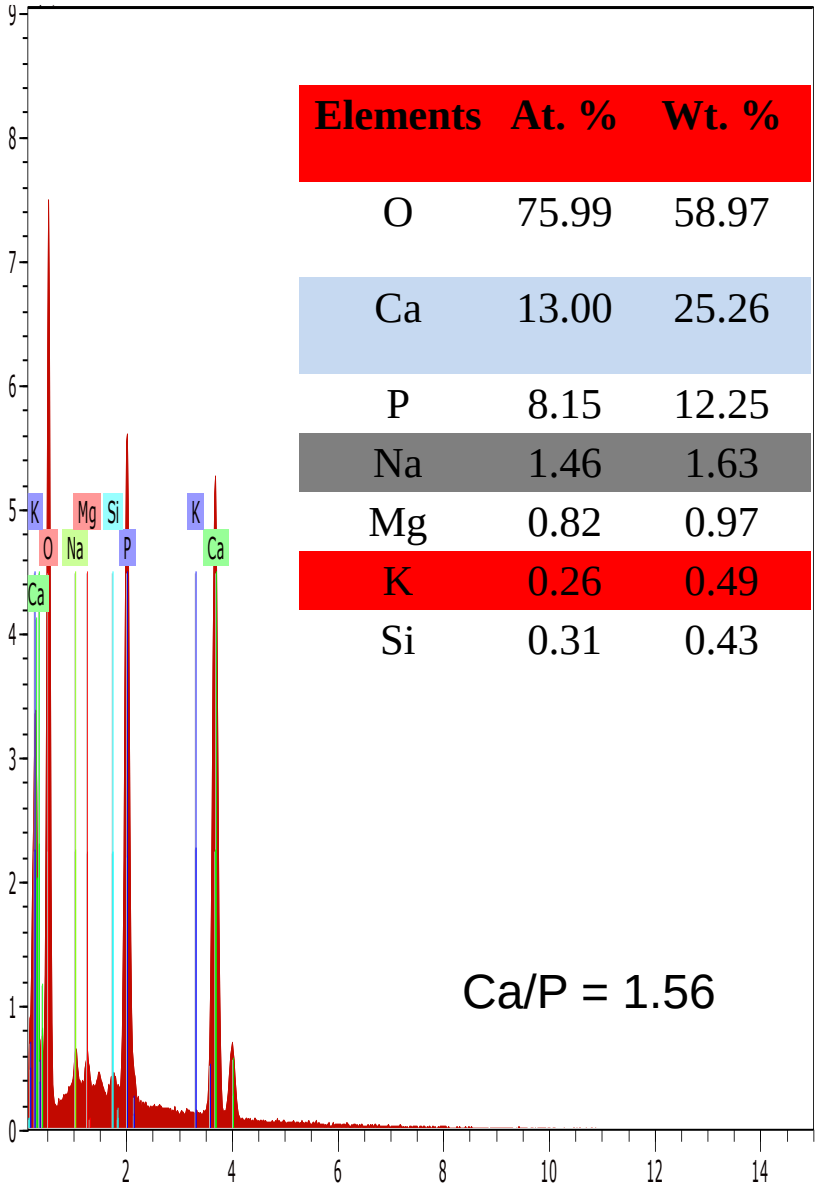
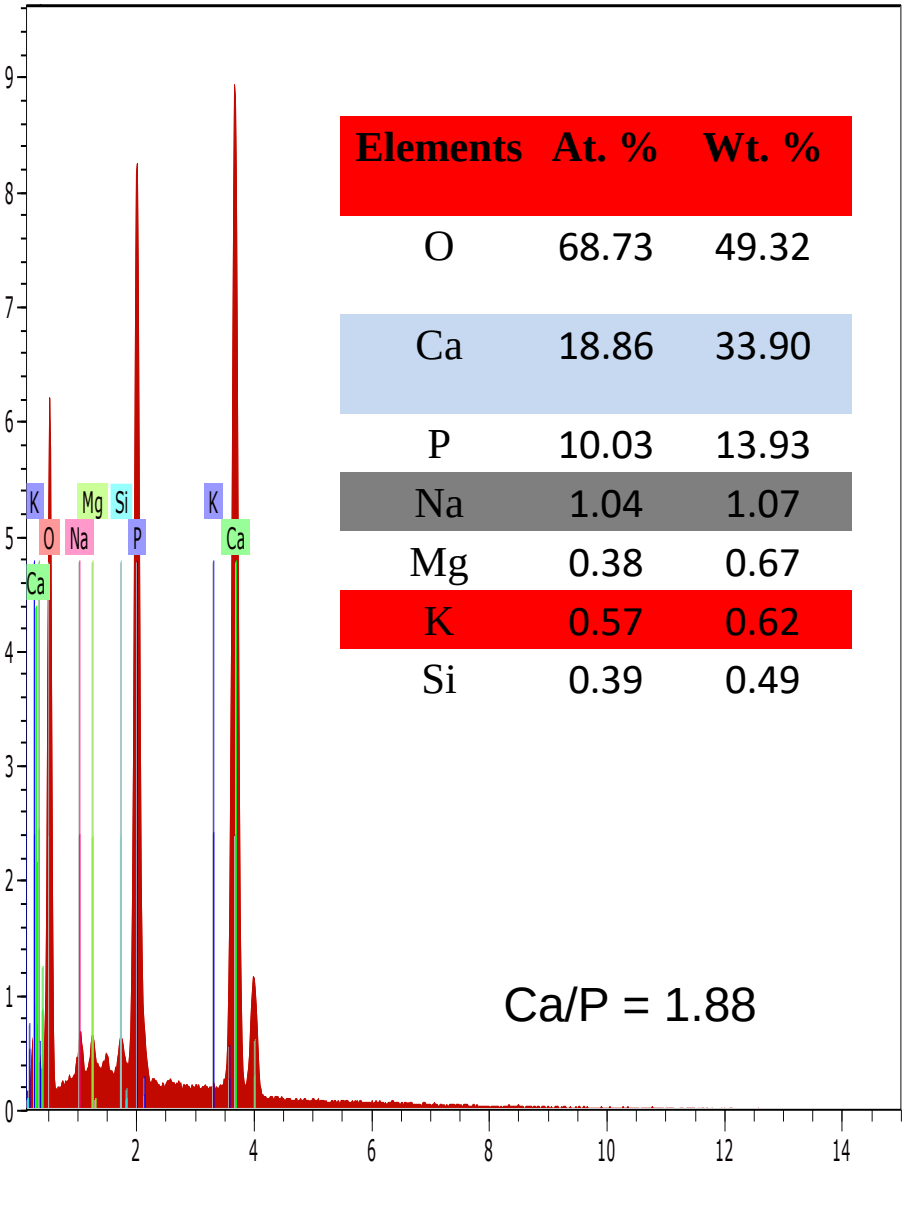


Fig.3. FT-IR spectra of commercial HAp, **raw pig bone and HAp powder synthesized at different temperature.**



Elements	At. %	Wt. %
O	75.99	58.97
Ca	13.00	25.26
P	8.15	12.25
Na	1.46	1.63
Mg	0.82	0.97
K	0.26	0.49
Si	0.31	0.43

Ca/P = 1.56



Elements	At. %	Wt. %
O	68.73	49.32
Ca	18.86	33.90
P	10.03	13.93
Na	1.04	1.07
Mg	0.38	0.67
K	0.57	0.62
Si	0.39	0.49

Ca/P = 1.88

Fig.4: Elemental composition as measured by EDX of (a) raw pig bone and (b) HAp synthesized at 1000 °C

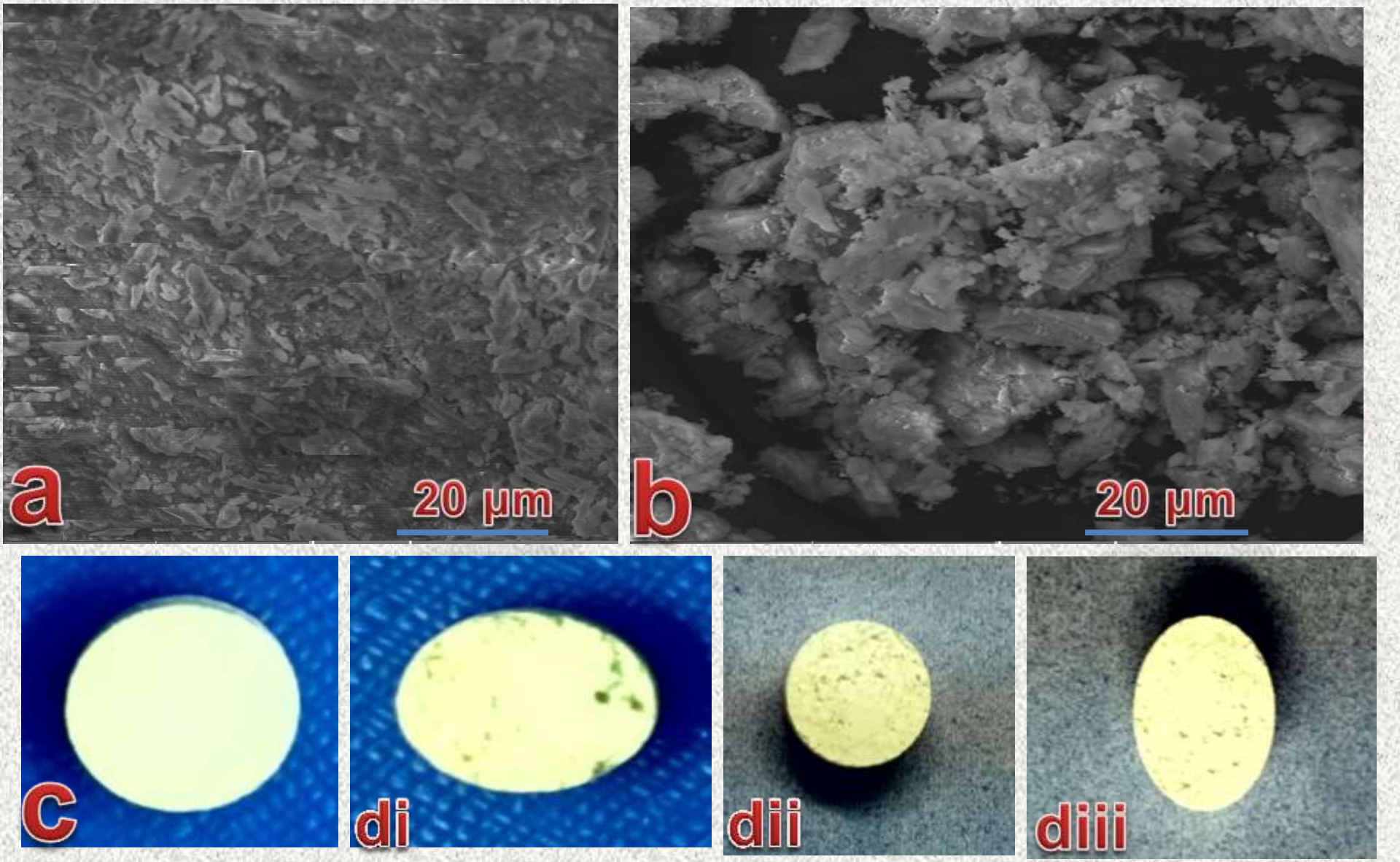
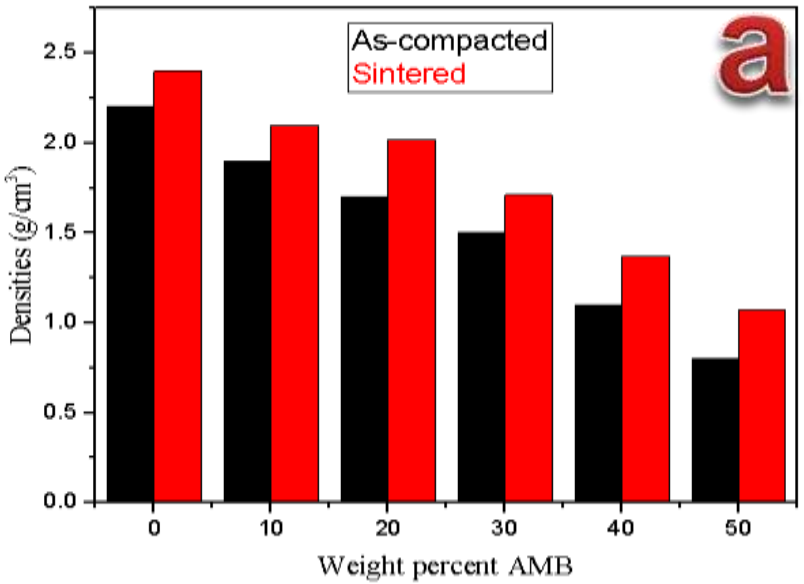
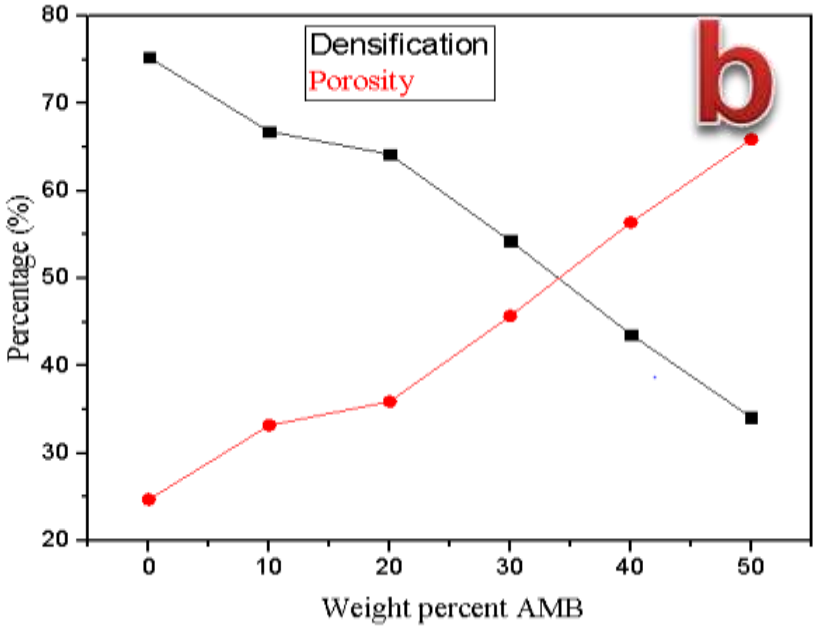
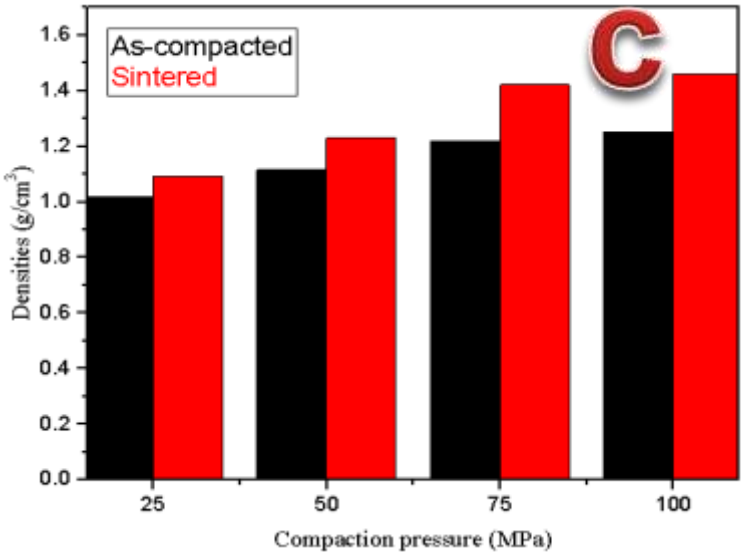


Fig. 5: SEM images of: (a) raw pig bone **(b) HAp synthesized at 1000 °C and** (c). Odinary pellet and (di-iii) Scaffold HAp







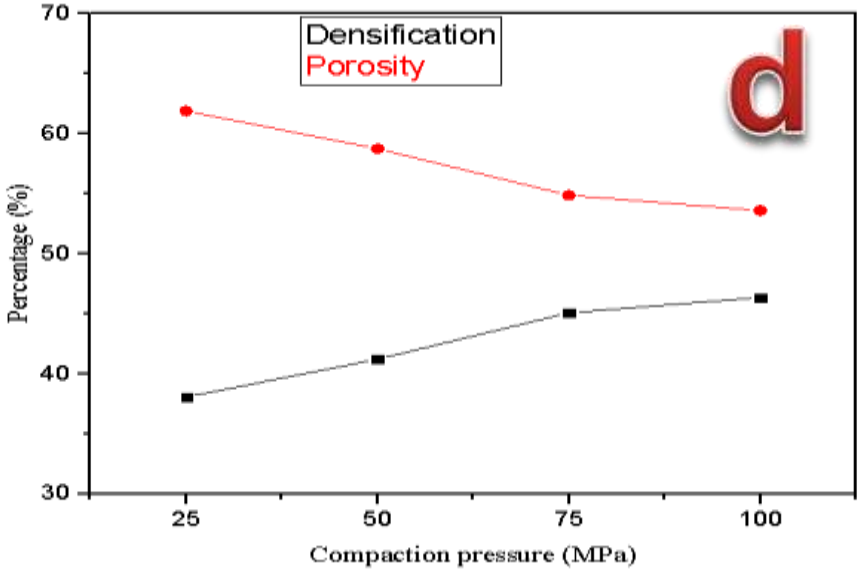


Fig. 6: Plots of (a) density, (b) porosity, (c) **compaction pressure and(d). Porosity against compaction pressure**

CONCLUSIONS

✓This research work depicts a facile approach for the synthesis of HAp powder from waste pig bone.

✓Various characterization revealed the formation of monophasic HAp.

✓Scaffold HAp was fabricated to be 56% porosity.

✓Thus, pig bone can be utilized for the synthesis of an important biomaterial such as hydroxyapatite.

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Thank you