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ORGANIC DERIVED NON-STOICHIOMETRIC HYDROXYAPATITE POWDER FROM FISH SCALES

E. A. OFUDJE[1,2&3]; A. I. ADEOGUN[2]; M. A. IDOWU[2]; S. O. KAREEM[2] and D. K. PATTANAYAK[3]

[1]McPHERSON UNIVERSITY, SERIKI-SOTAYO, OGUN STATE, NIGERIA.
[2]FEDERAL UNIVERSITY OF AGRICULTURE, ABEOKUTA, OGUN STATE, NIGERIA
[3]CSIR-CENTRAL ELECTROCHEMICAL RESEARCH INSTITUTE, KARAIKUDI, INDIA

ABSTRACT

Cheap and fast thermal decomposition method was adopted for the synthesis of non-stoichiometric HAp powder from agro-waste of fish scales. XRD characterization showed that well resolved peaks corresponding to monophasic HAp was fabricated with crystallite sizes increasing with temperature, while the presence of main functional groups of HAp such as PO_4^{3-}, OH^- and CO_3^{2-} were confirmed by FT-IR analysis.

BACKGROUND

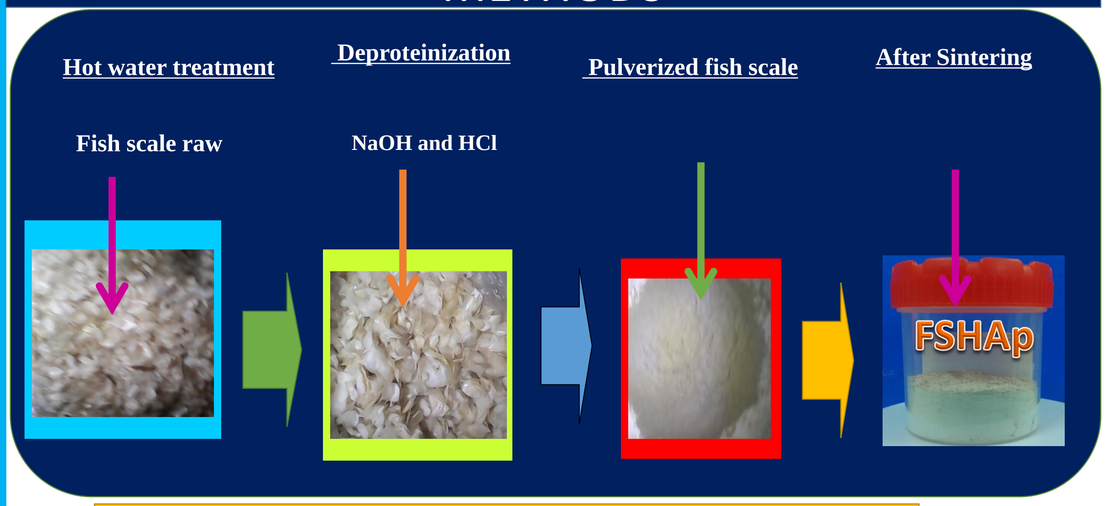
- Hydroxyapatite, $Ca_{10}(PO_4)_6(OH)_2$ is a naturally mineral that is found in human body and one of the main mineral component of tissue engineering which has received extensive attention. Synthetic HAp are stoichiometric which often lack the presence of some beneficial ions such as Na^+, K^+, Mg^{2+}, CO_3^{2-} etc.
- Biological apatite is a non-stoichiometric which is characterized by Ca^{2+} deficient but containing these beneficial ions as inherited from their biological origin.
- The CO_3^{2-} ions can replace all of the OH^- and certain PO_4^{3-} within HAp structure, termed A-type and B-type replacement.

OBJECTIVES

- To synthesize non-stoichiometric hydroxyapatite powder from waste fish scales waste through sintering .
- To characterize the hydroxyapatite using different analytical techniques such as FT-IR, XRD, SEM and EDX.
- To recycle fish scale waste into an important biomaterial for water treatment and biomedical applications.

Hip joint &teeth implants

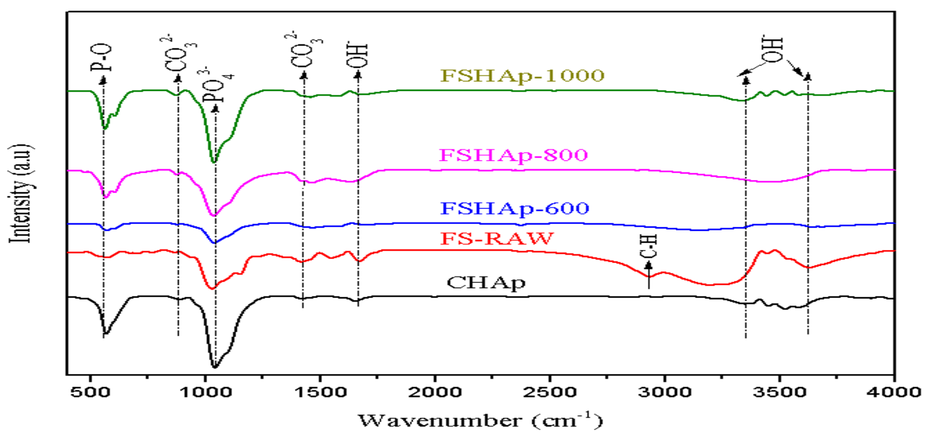
METHODS



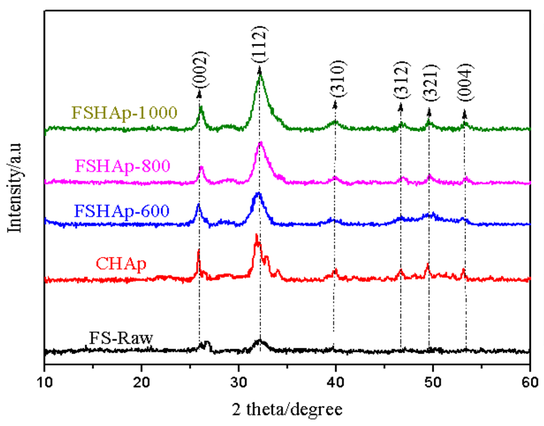
FLOW CHART OF SCAFFOLD HAp SYNTHESIS

FSHAp (100, 90, 80, 70, 60 and 50%) + Ammonium bicarbonate (0, 10, 20, 30, 40 and 50%)
→ Mixed together
→ Pellets at different pressure
→ Sintered at 1000 °C
→ Scaffold FSHAp

RESULTS



FTIR spectra of CHAp, raw fish scales and HAp synthesized from fish scales at different temperature

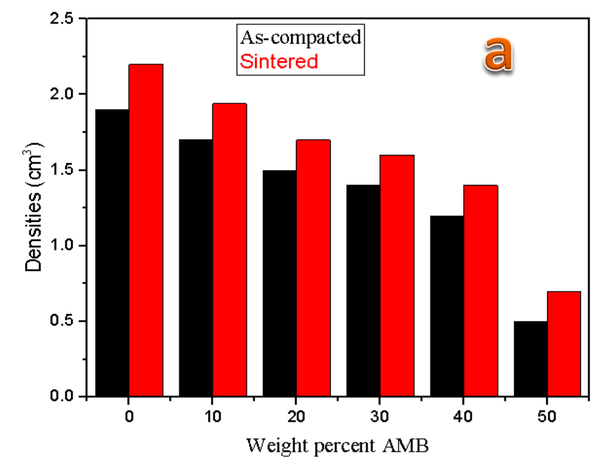


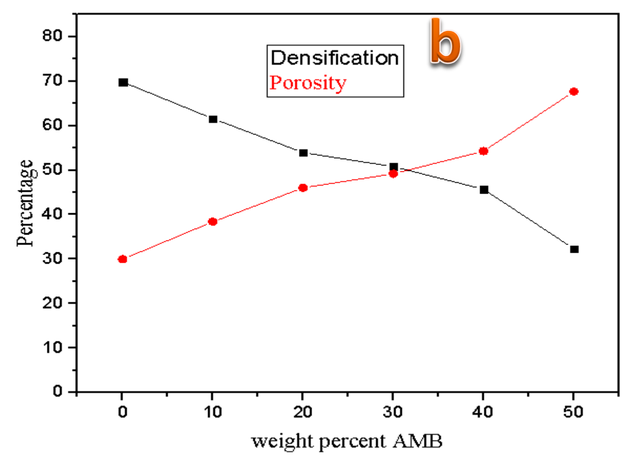
XRD of treated fish scale, commercial HAp and HAp synthesized from fish scales at different temperature

Table 1: Crystallite size (nm) at different temperature

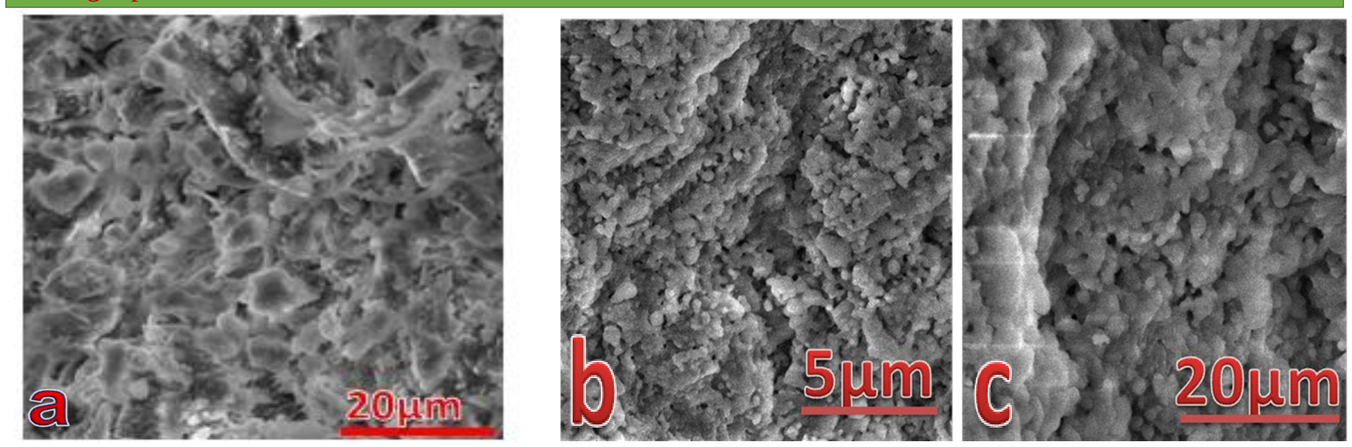
$D = \frac{k\lambda}{\beta\cos\theta}$

Temperature (°C)	Peak positions (2θ)	FWHM (2θ)	Crystallite size (nm)
600 °C	32.23	0.3214	4.69
800 °C	32.24	0.1774	8.50
1000 °C	32.26	0.1255	12.08

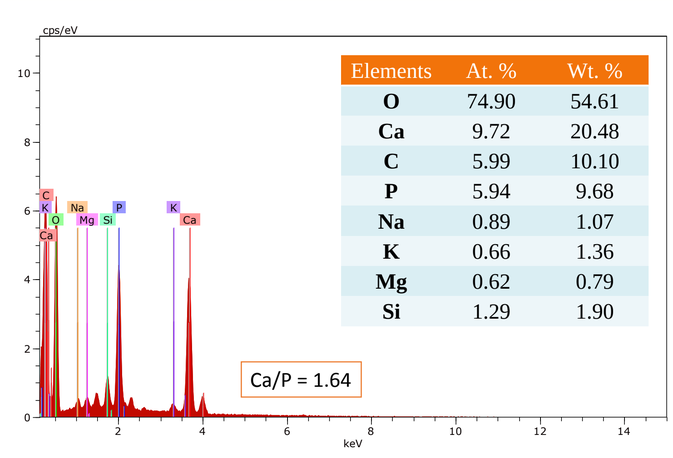




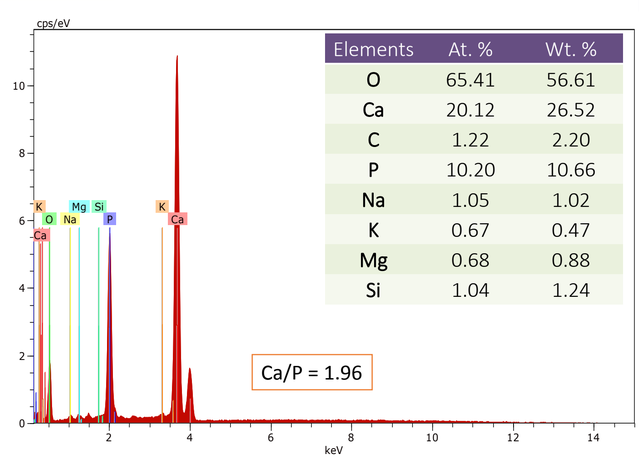
Plots (a) showing decease in densities as weight percent of AMB increases, (b) porosity increases with increase in weight percent of AMB, while densification decreases.



Secondary electron images of (a) FSHAp and (b&c) scaffolds FSHAp



Elements	At. %	Wt. %
O	74.90	54.61
Ca	9.72	20.48
C	5.99	10.10
P	5.94	9.68
Na	0.89	1.07
K	0.66	1.36
Mg	0.62	0.79
Si	1.29	1.90



Elements	At. %	Wt. %
O	65.41	56.61
Ca	20.12	26.52
C	1.22	2.20
P	10.20	10.66
Na	1.05	1.02
K	0.67	0.47
Mg	0.68	0.88
Si	1.04	1.24

EDX measurement showing the chemical compositions of treated fish scale and HAp synthesized from fish scales at 1000 °C

SUMMARY

❖**This paper presents a cheap and fast method for the synthesis of HAp from agro-waste of fish scales via thermal decomposition.**

❖Results from Characterization showed that a single-phase HAp was produced with main characteristic functional groups such as PO_4^{3-}, $CO_3^{2-}$and OH^- as well as well resolve peaks corresponding HAp.

❖**The presence of trace elements in the synthesized HAp from waste fish scales indicates the successfully synthesis of non-stoichiometric HAp.**

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