

## **Characterization of Hydroxyapatite Synthesized from Commonly Available *Saccostrea cucullata* (Rock Oyster) Shells in Sri Lanka: Identification of a Commercial Application of Bivalve Shells**

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Biological shells with simple components result in outstanding properties compared to the man-made materials. Bivalve shells can be reused as a low-cost raw material for different industrial applications. This study was focused on the characterization of *Saccostrea cucullata* (Rock Oyster) shells collected from the Southern coastal zone in Sri Lanka and identification the potential of synthesizing commercial products from oyster shells. Collected oyster shells from Dickwella coastal belt were subjected to prepare shell powder after sieving the crushed shells using a metal sieve with 600 micron of mesh size. Shell powder samples were sintered at 1000°C for two hours in the muffle furnace for removal of moisture, gases, and other remnants. Raw oyster shells and prepared shell powder samples were characterized using Fourier Transform Infrared Radiation (FT-IR), X-ray Diffraction (XRD) and X-Ray Fluorescence (XRF) Spectroscopy. After analysis of shell structure, functional groups, and composition, two wet precipitation techniques were employed to synthesize Hydroxyapatite (HA):  $(Ca_{10}(PO_4)_6(OH)_2)$ . The first method includes converting shell  $CaCO_3$  into CaO as starting material, reacting with Nitric acid, Phosphate provider &  $NH_4OH$  at pH 10 and sintering. The second method consists of converting calcined shell  $CaCO_3$  into  $Ca(OH)_2$ , reacting with Phosphoric acid &  $NH_4OH$  at pH 10, and sintering. Based on characterization results, the oyster shell is mainly composed of  $CaCO_3$  (98%), and extracted  $CaCO_3$  powder is compatible with properties of commercial  $CaCO_3$  product. Based on XRF, the oyster shell also consists of trace elements such as Zr, MgO,  $SO_3$ ,  $SiO_2$ , and Sr. CaO level of shell powder was 97.9 % after thermal decomposition of  $CaCO_3$  during firing. HA produced from the second method recorded characteristic peak with high intensity at 2 theta value of 31.79° by signifying the crystalline phase only for HA compound in XRD analysis. XRD and XRF results revealed that HA powder which was produced from the second method using  $Ca(OH)_2$  as starting material & sintering at a temperature of 900°C recorded similar composition ( $CaO > 77\%$ ,  $P_2O_5 > 20\%$ ) to the commercially available HA. In conclusion, rock oyster shells act as environmentally friendly, value-added by-products to manufacture HA for medical applications with the technical possibility to replace commercial HA.

**Keywords:** Bivalve shells, Shell characterization, Fourier transform infrared radiation, X-ray diffraction, X-Ray fluorescence, Industrial applications, Hydroxyapatite