

Área: FIS

## Microstructural and Elemental Comparison of Hydroxyapatite Obtained with and without Deproteinization from *Sardinella brasiliensis* Scales by SEM-EDX

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### Highlights

SEM-EDX was used to compare hydroxyapatite morphology and composition. Deproteinized samples showed better crystal structure and Ca/P ratio. Residual organics altered proteinized sample quality.

### Resumo/Abstract

Hydroxyapatite (HAp) is a bioceramic widely used in the biomedical field due to its biocompatibility, bioactivity, and similarity to the mineral phase of bone tissue. Natural sources such as fish scales have been investigated as sustainable and low-cost alternatives for obtaining HAp, given their elemental composition comparable to that of the mineral. Furthermore, it represents a culturally neutral solution, particularly when compared to bovine-derived materials, which may pose sociocultural restrictions in certain communities. In this study, the morphology and elemental composition of hydroxyapatite extracted from *Sardinella brasiliensis* (Brazilian sardine) scales were investigated, evaluating the impact of the deproteinization process on the quality of the final material. The scales were subjected to thermal processes with and without prior chemical deproteinization, and the resulting samples were analyzed by Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray Spectroscopy (EDX). SEM images revealed significant morphological differences between the samples: the deproteinized HAp exhibited well-defined particle contours, a rough surface, and the presence of interparticle micropores, features typical of dense, potentially bioactive ceramic microstructures. In contrast, the proteinized sample presented an agglomerated morphology, lower structural organization, and visible organic residues, which hinder the crystallization of the mineral phase and compromise the formation of a structure suitable for biomedical applications. EDX analysis corroborated these findings. The proteinized sample showed a Ca/P molar ratio ranging from 1.19 to 1.32, suggesting lower calcium content and possible interference from organic residues or secondary phosphates. On the other hand, the deproteinized sample exhibited a Ca/P ratio between 1.31 and 1.51, closer to the stoichiometric hydroxyapatite ratio (Ca/P = 1.67), indicating better stabilization of the HAp phase after protein removal. The morphological and chemical differences observed confirm that the deproteinization step directly influences the quality of the final product, affecting both crystal formation and elemental composition. These findings highlight the importance of controlling raw material treatment and demonstrate the potential of fishery waste valorization in the development of sustainable bioceramics for possible application in bone tissue engineering.

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