ECO-FRIENDLY SYNTHESIS OF HYDROXYAPATITE FROM EGGSHELL WASTE

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INTRODUCTION

Calcium phosphates represent a group of compounds with diverse applications in science and industry, including medicine, chemistry, the pharmaceutical industry and environmental protection. Hydroxyapatite (HAP, $Ca_{10}(PO_4)_6(OH)_2$) is the most stable form of calcium phosphate salt. It is used in regenerative medicine, for dental materials, for the production of fertilizers and for catalytic processes in the chemical industry, among other things. Hydroxyapatite is biologically important as it is the basic inorganic component of bone tissue and dental hard tissue, making it one of the most important biomaterials in modern medicine. Due to its highly functional apatite structure, which enables hydroxyapatite to undergo numerous ion exchanges, the range of its applications is even broader. However, conventional synthesis methods often use chemicals that can have a negative impact on the environment. In the context of sustainable development in the 21st century, increasing emphasis is being placed on environmentally friendly synthesis methods. One of the most promising sustainable approaches in HAP synthesis is the use of eggshells as a source of calcium. Every year, the food industry produces millions of tons of eggshells as waste, which poses a significant environmental problem. Ecologically synthesized hydroxyapatite has excellent physicochemical properties, including high biocompatibility, porosity and structural stability. At the same time, its production from waste materials contributes to the circular economy and to reducing the consumption of natural resources, making this strategy an important step towards green chemistry and sustainable industrial production [1].

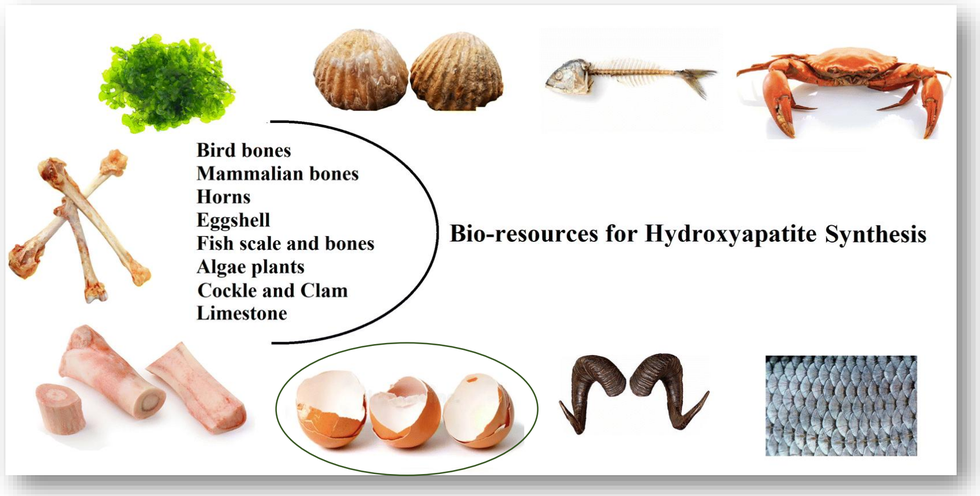


Figure 1. Natural resources for the synthesis of HAP.

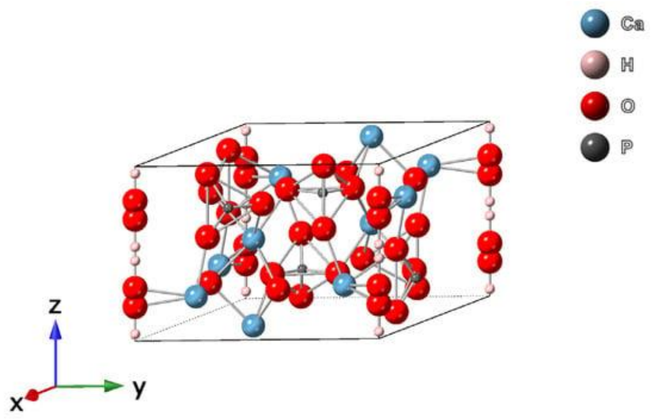
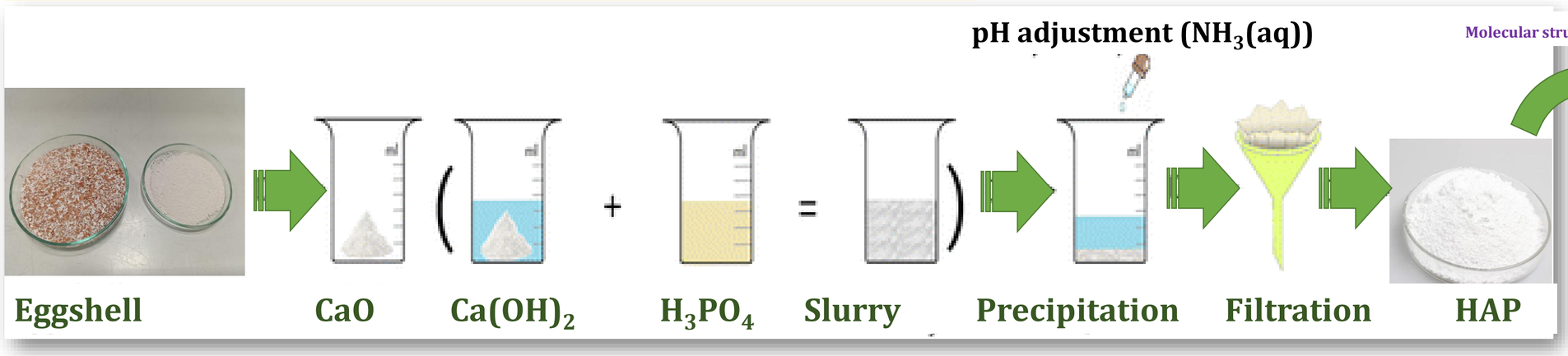
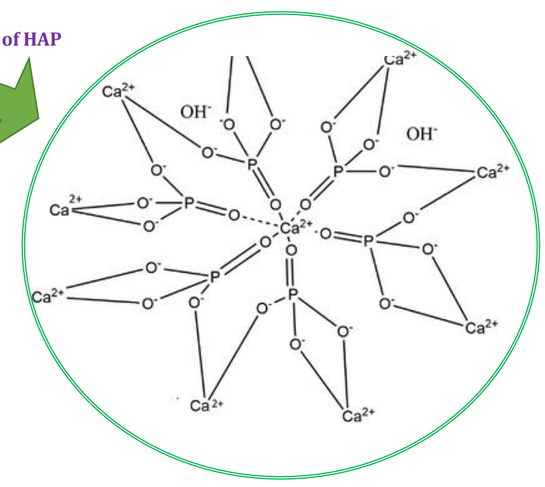


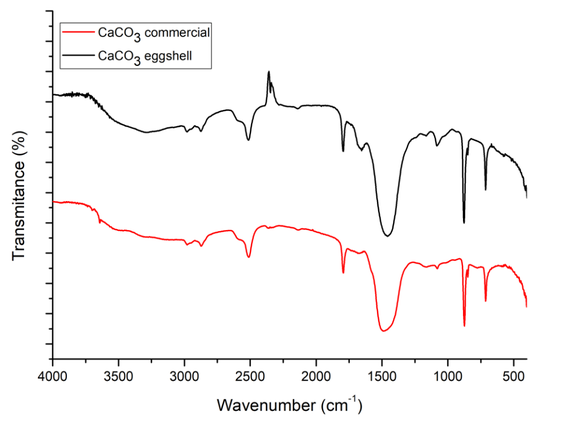
Figure 2. Crystal structure of hydroxyapatite showing the distribution of Ca : PO4 : OH with emphasis on the Ca / P ratio : 1;67 .

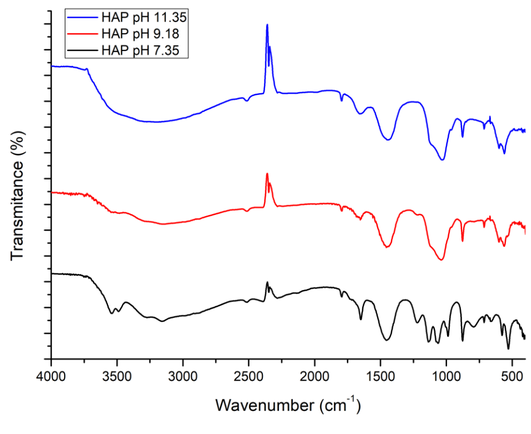
SYTNHESIS

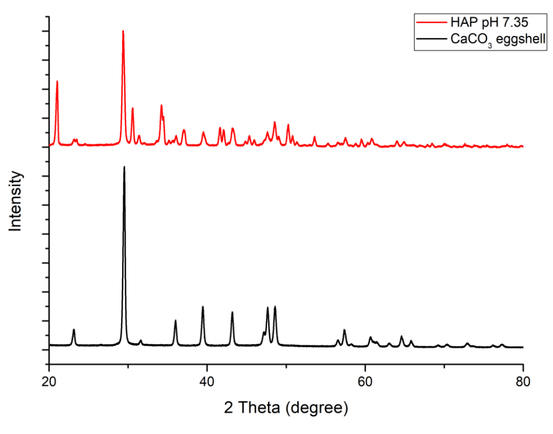


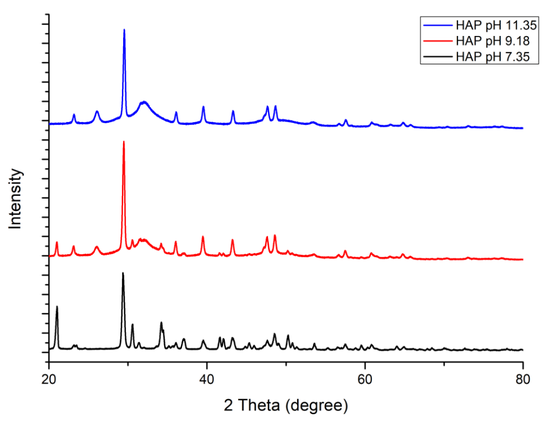


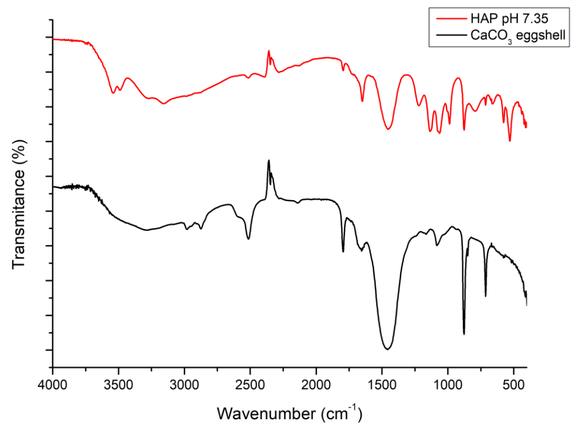
RESULTS

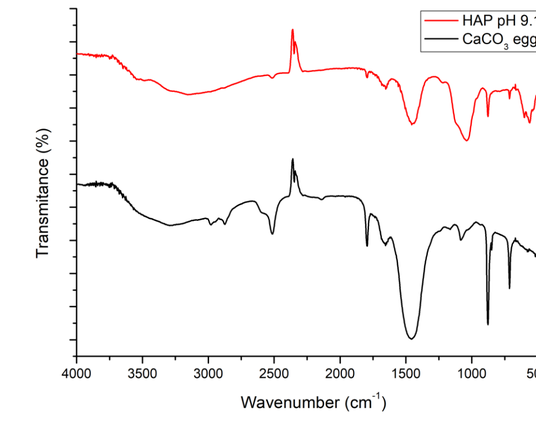


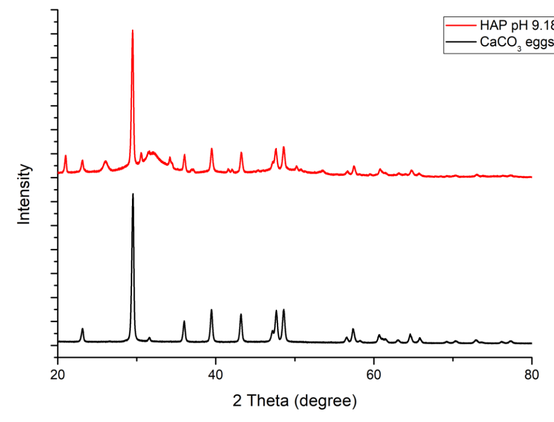


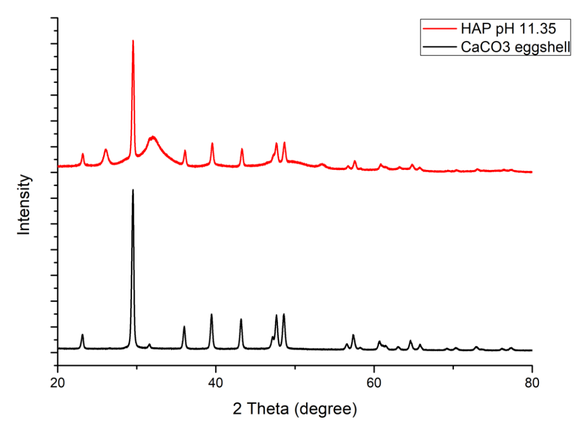


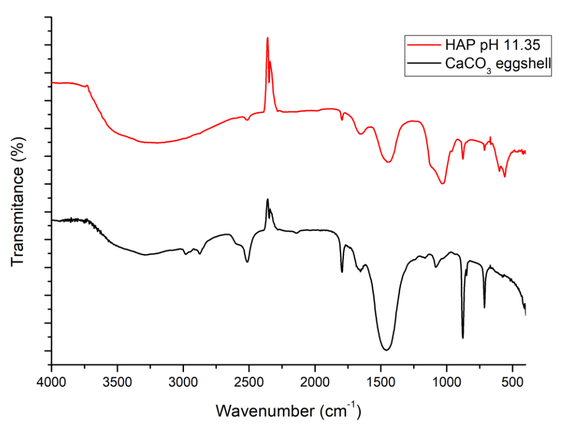


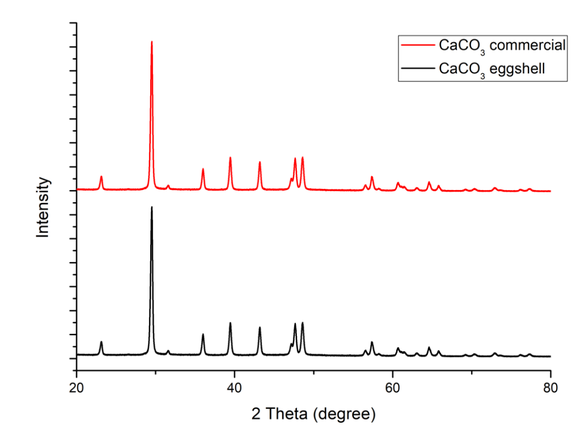












CONCLUSIONS

The synthesis of hydroxyapatite from eggshells is an environmentally friendly and cost-effective way to obtain valuable biomaterials for medicine, dentistry and bioceramics. By reusing natural waste, this method reduces pollution and supports the circular economy. Such sustainable approaches help to solve the global waste problem by integrating science, industry and environmental protection.

REFERENCE

[[1] Özcan, L., Şahin, A., Karabulut, B., & Sürük, N. (2024). Coating of the surface of 316L stainless steel with hydroxyapatite produced from eggshell using the sol-gel method. Journal of Materials and Mechatronics: A, 5(2), 214–227.

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