

Poly lactide/Nanohydroxyapatite Composite Films: Physicochemical Properties and Biocompatibility for Regenerative Medicine Applications

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INTRODUCTION & AIM

Piezoelectric biomaterials are of significant interest for regenerative medicine due to their ability to stimulate cell proliferation and differentiation. Polylactide (PLA) is a bioresorbable piezoelectric polymer classified by the FDA as GRAS, but its bioactivity is limited. Nanohydroxyapatite (nHA) has excellent osteoinductivity and biocompatibility. The aim of the study was to develop a PLA/nHA composite and comprehensively evaluate the effect of nHA addition on physico-chemical properties and biocompatibility.

METHOD

nHA particles were synthesized by chemical precipitation at pH 9–11. The precipitate was washed and dried at 120°C. Composite materials in the form of films were obtained by irrigation from a solution. Granules of PLA weighing 0.5 g were dissolved in 14.3 ml of methylene chloride, after that 10 wt.% nHA was added, and the resulting suspension was poured into a Petri dish and naturally dried. The obtained films were characterized by FTIR, XPS, and DSC methods, and the wetting angle was measured. Biocompatibility was assessed using a resazurin test on osteosarcoma MG-63 cells for 24, 48, and 72 hours.

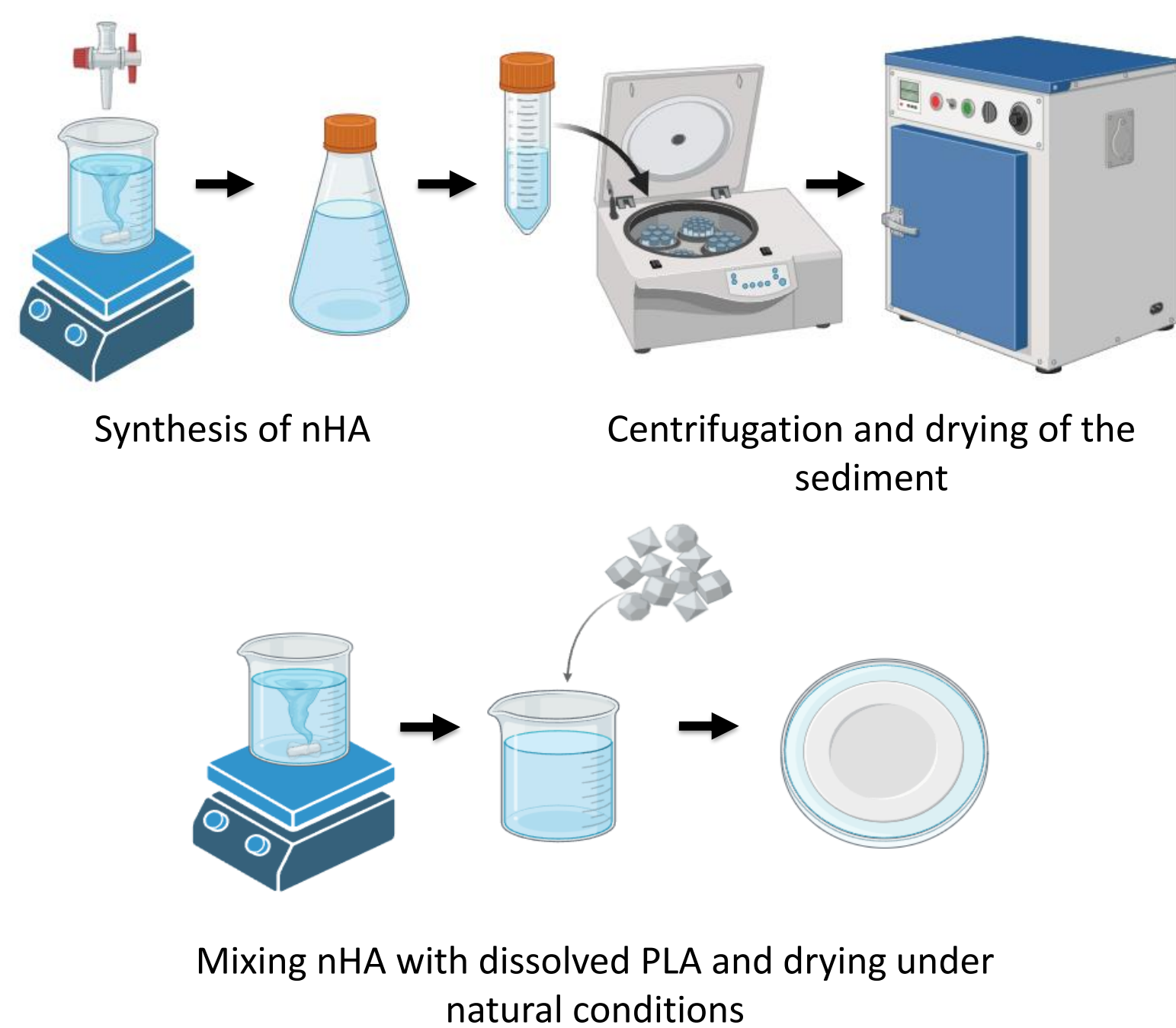


Figure 1. Scheme for the production of PLA/nHA films

CONCLUSION

PLA/nHA composite films have been successfully obtained. The addition of nHA improves the hydrophilicity of the surface and provides high biocompatibility, which is of interest for use in tissue engineering.

RESULTS & DISCUSSION

FTIR spectra confirmed the successful incorporation of nHA into the PLA matrix by the characteristic bands of phosphate groups at 560, 600, and 1020 cm⁻¹. The DSC analysis showed that the addition of nHA slightly changes the thermophysical properties. XPS analysis revealed C-O, C=O, C-C, and O=C-O bonds in pure PLA, while Ca and P were not detected on the surface of PLA/nHA. With the introduction of nHA, the wetting angle decreased from 84.9° to 71.2°. The resazurin test demonstrated the biocompatibility of PLA and PLA/nHA, with the viability of MG-63 cells > 70% at all time points.

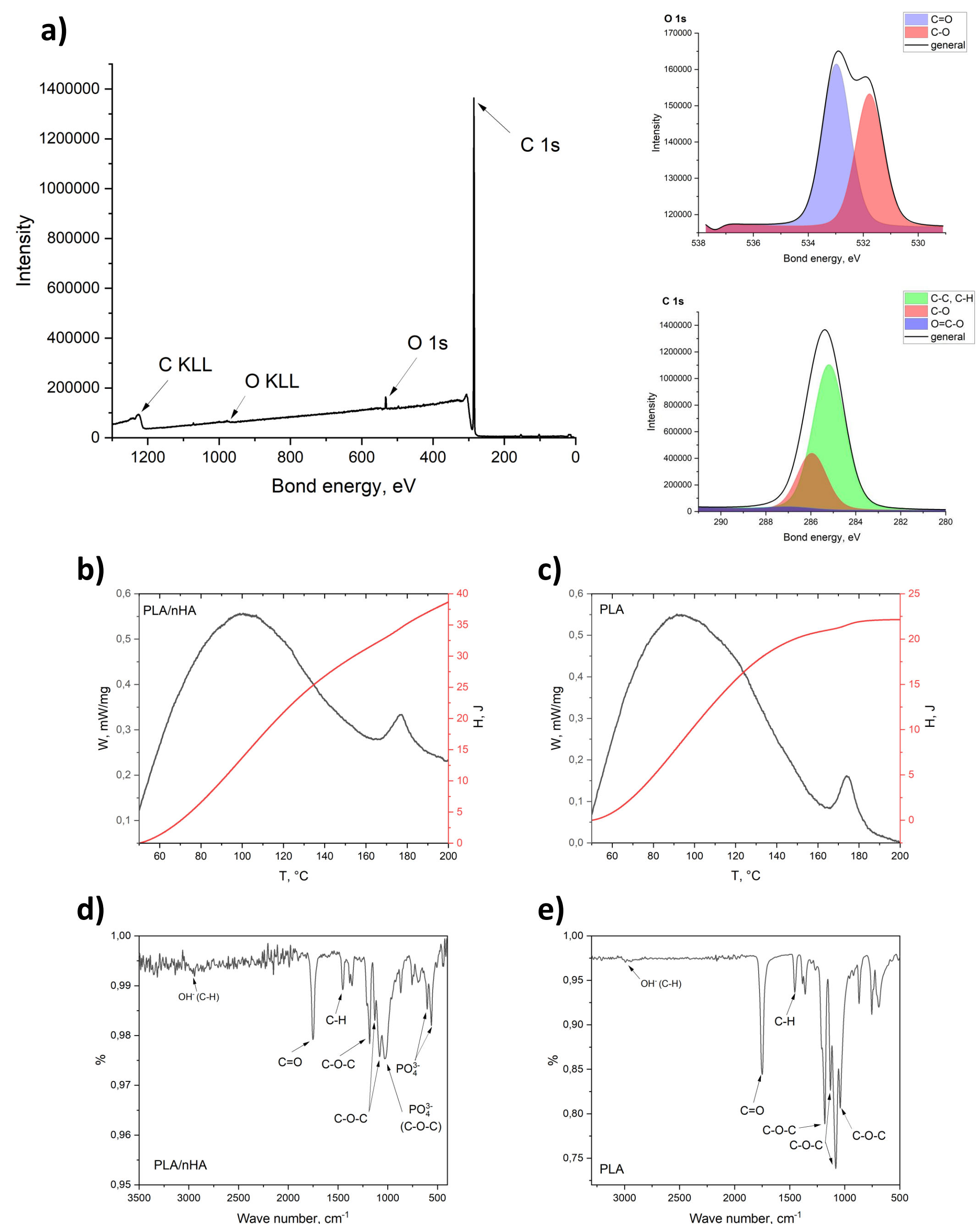


Figure 2. (a) XPS analysis of PLA; DSC analysis of (b) PLA/nHA and (c) PLA; FTIR spectra of (d) PLA/nHA and (e) PLA