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Development of PLA/PVA Composite Scaffolds Reinforced with Hydroxyapatite for Bone Tissue Engineering Applications

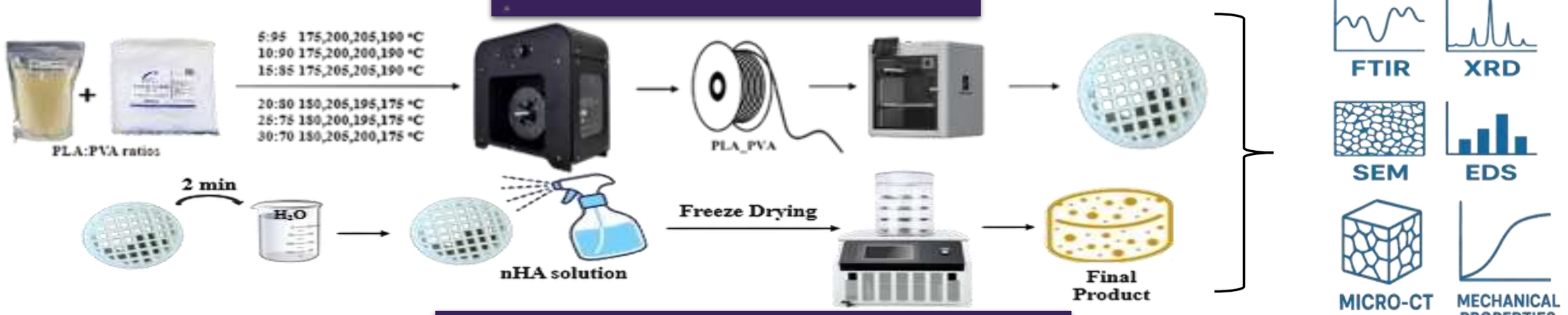
Sotiria Eginloglou, Ioanna Koumentakou, Sofia Kavafaki, Ramonna I. Kosheleva, George Z. Kyzas

Hephaestus Laboratory, Department of Chemistry, Democritus University of Thrace, St. Lucas 65404, Kavala, Greece

INTRODUCTION & AIM

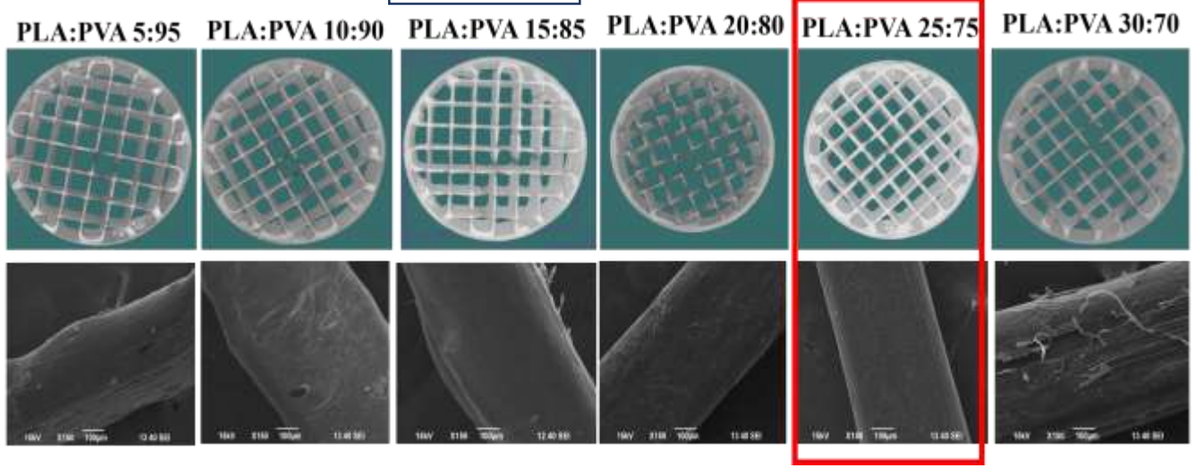
Bone tissue is the second tissue to be replaced. Tissue engineering is an alternative to autologous grafts. Its application requires three- dimensional multifunctional scaffolds that mimic the environment of the human body [1]. The latest generation of scaffolds must not only be biocompatible, but also bioactive, promoting osteoconductivity. In this study, poly(lactic acid) (PLA) [2], a bio-based, mechanically strong yet hydrophobic polymer, was blended with poly(vinyl alcohol) (PVA) [3], a biodegradable, hydrophilic polymer with lower mechanical strength, to fabricate composite filaments. However, bone tissue has a highly organized structure which contains mainly inorganic components, so to improve bioactivity, scaffolds were surface-coated with hydroxyapatite (HA), a naturally occurring bone mineral [4].

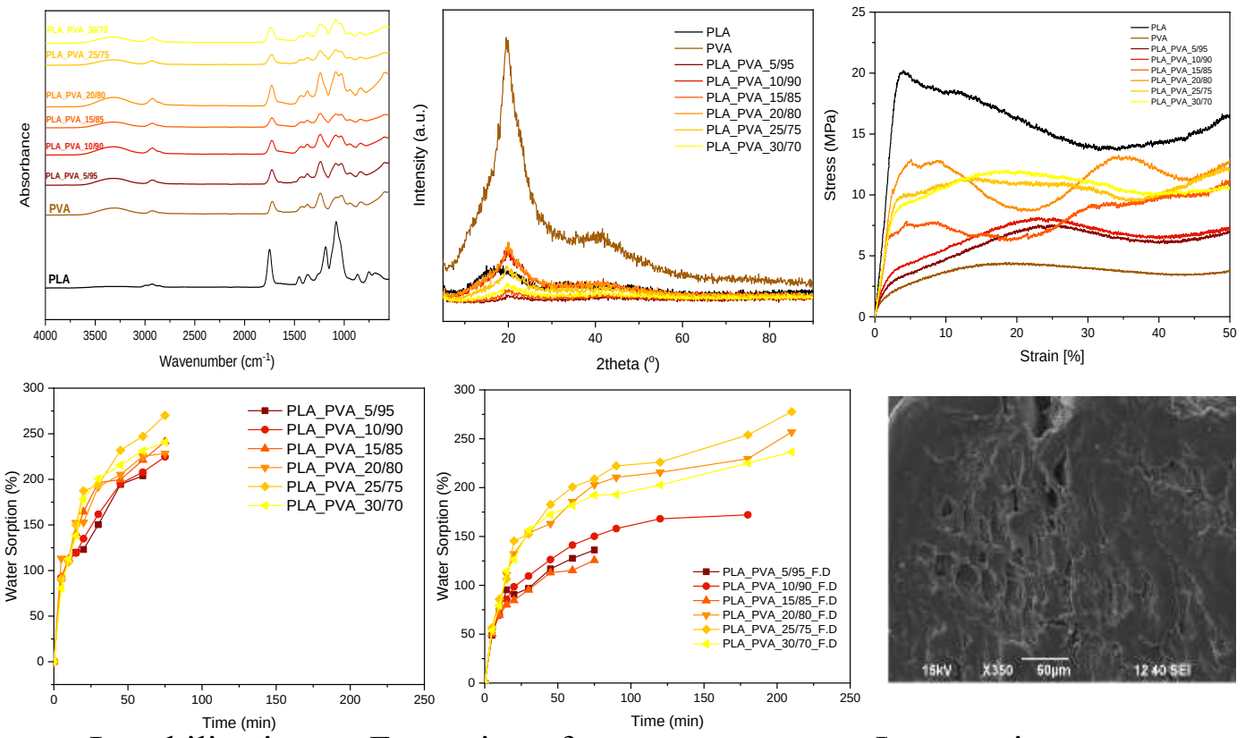
METHOD



RESULTS & DISCUSSION

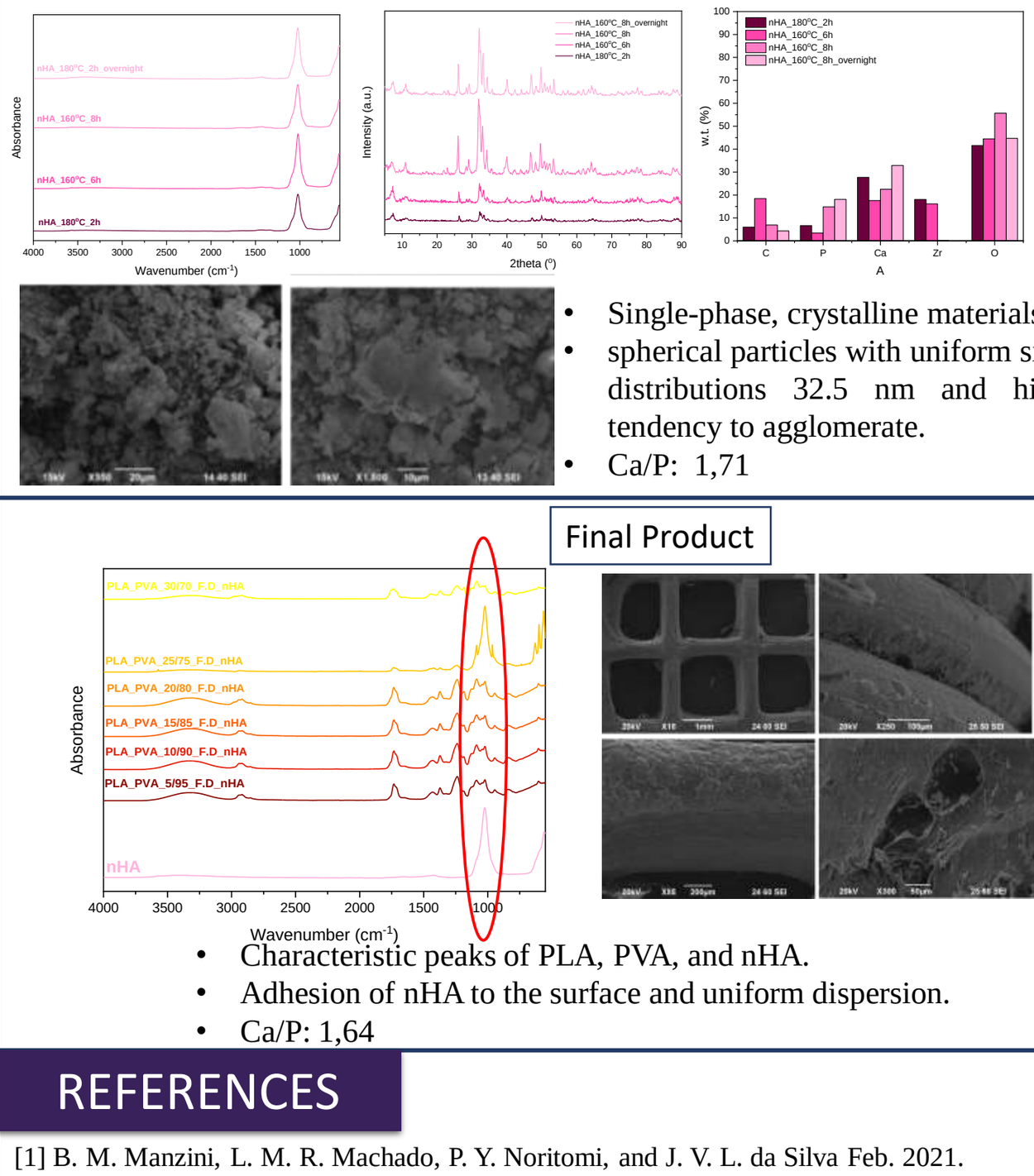
Scaffolds





Lyophilization → Formation of porous structure →Increase in water adsorption capacity.

nano-Hydroxyapatite (nHA)



- Single-phase, crystalline materials.
- spherical particles with uniform size distributions 32.5 nm and high tendency to agglomerate.
- Ca/P: 1,71

Final Product

- Characteristic peaks of PLA, PVA, and nHA.
- Adhesion of nHA to the surface and uniform dispersion.
- Ca/P: 1,64

CONCLUSION

The freeze-dried PLA:PVA (25:75) scaffold coated with hydroxyapatite demonstrated an optimal balance of mechanical strength, high water absorption, and enhanced bioactivity. Its structural integrity and osteoconductive surface make it a strong, sustainable candidate for bone tissue engineering. These results highlight its potential for future bone regeneration applications.

REFERENCES

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