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# Gelatin-Coated Melt-Electrowriting PCL Scaffolds Functionalized with Biosynthesized Iron Oxide Nanoparticles for Biomedical Applications

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## Introduction

Polycaprolactone (PCL) is a biodegradable, biocompatible and mechanically stable polymer widely used in tissue engineering [1]. Melt electrowriting (MEW) produces fibrous scaffolds with well-controlled pore geometry [2]. However, PCL hydrophobicity limits cell adhesion [3,4]. Gelatin coatings increase hydrophilicity, and iron oxide nanoparticles (IONPs) can modulate surface and biological properties.

## Objectives

To compare biosynthesized (Bio-IONPs) and chemically synthesized (Chem-IONPs) iron oxide nanoparticles in gelatin-coated MEW PCL scaffolds, assessing how the synthesis route affects wettability, bacterial adhesion and cell viability.

## Methodology

1. **MEW printing:** PCL scaffolds with controlled pore geometry
2. **Gelatin coating:** plain, or with Bio-IONPs or Chem-IONPs (10 g Fe $L^{-1}$ in the gelatin solution)
3. **Crosslinking:** microbial transglutaminase (Ajinomoto)
4. **Characterization:** SEM, water contact angle, *S. aureus* adhesion (48 h) and MTT viability with NIH3T3 fibroblasts (1 day)

**Experimental groups**

PCL | PCL_Gel | PCL_Bio-IONPs | PCL_Chem-IONPs

## Results and Discussion

- Gelatin lowered the contact angle from ~110° to ~40°. Bio-IONPs reduced it further (~30°), whereas Chem-IONPs raised it (~80°).
- Both IONPs groups reduced *S. aureus* colonization to PCL-like levels.
- Bio-IONPs raised viability to ~240%, likely due to their biomolecule-rich corona.

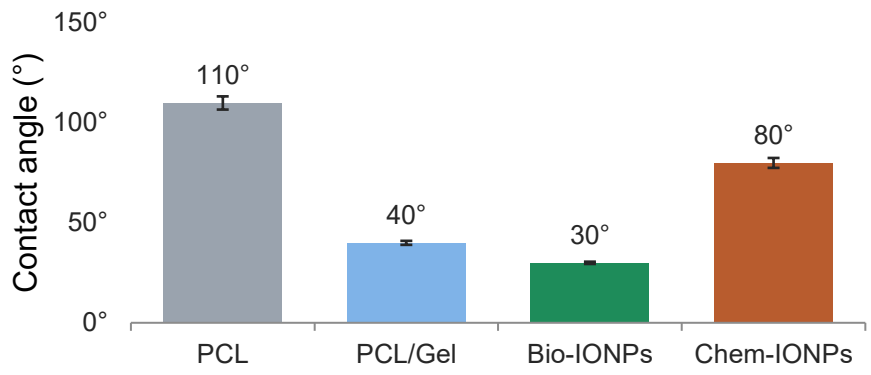



**Figure 1.** Water contact angle of the MEW scaffolds.

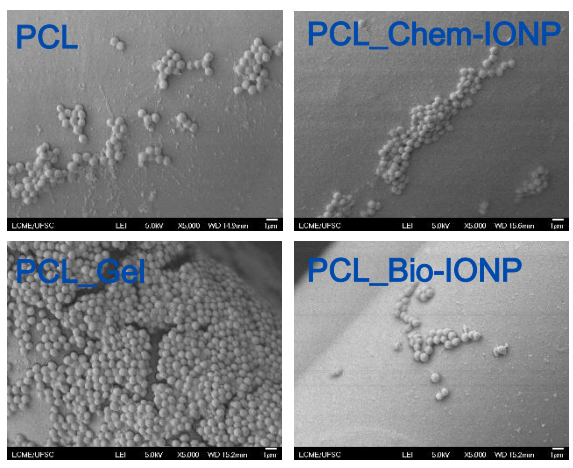



**Figure 2.** SEM of *S. aureus* on the surface of MEW scaffolds.

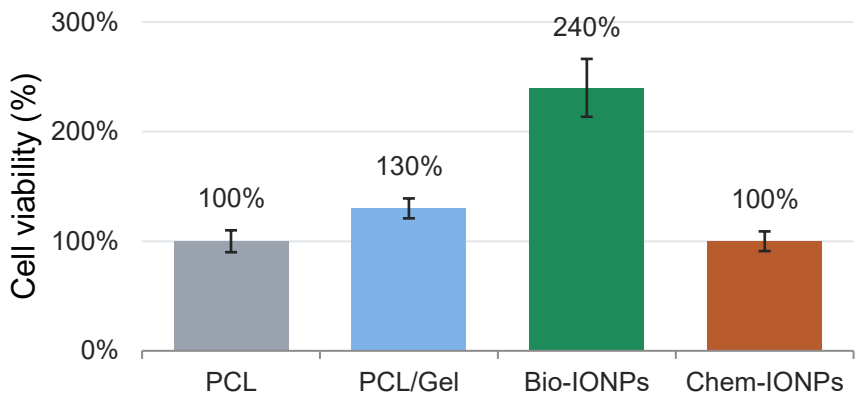



**Figure 3.** NIH3T3 fibroblast viability (MTT, 1 day), relative to PCL.

## Conclusions

MEW-printed PCL scaffolds were successfully functionalized with gelatin and IONPs. Gelatin improved hydrophilicity and cytocompatibility, while IONPs reduced *S. aureus* adhesion. Bio-IONP-coated scaffolds offered the best balance between cytocompatibility and antibacterial performance, highlighting biogenic IONPs as a promising strategy for wound-healing scaffolds.

## References and Acknowledgements