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Impact of Incorporated Antibiotic Agents on the Morphological Characteristics of Chitosan/PLA Nanofibers

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INTRODUCTION & AIM

Electrospinning is a versatile technique for producing nanofibers with tunable properties.
Chitosan and poly(lactic acid) (PLA) are biocompatible, biodegradable, and mechanically suitable polymers widely used in biomedical applications, including wound healing, tissue engineering, and drug delivery.
Incorporating antibiotics into nanofibers enables localized infection control and improved healing, but also alters the electrospinning solution and fiber morphology.
Understanding antibiotic–polymer interactions is essential for optimizing scaffold structure, drug loading, and release profiles.

METHOD

- **Polymers:** 22% PLA (chloroform) + 0.02% chitosan (90% acetic acid)
- **Solution ratio:** 1:1 (chitosan/PLA)
- **Antibiotics:** Ciprofloxacin and Gentamicin (0.1% into polymer solution)
- **Technique:** Electrospinning

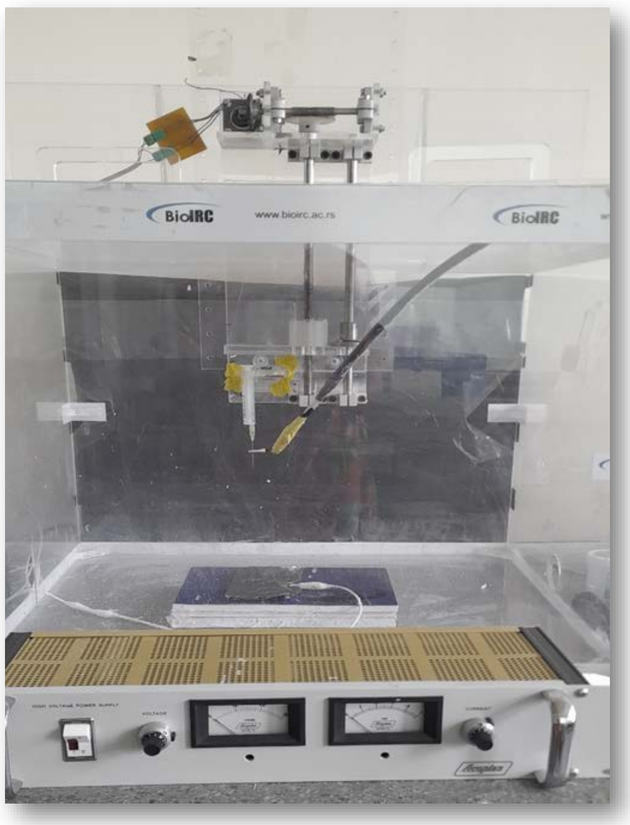

Figure 1. Home-made electrospinning setup

RESULTS & DISCUSSION

The incorporation of antibiotics led to noticeable changes in fiber diameter and distribution (**Table 1**).

Sample	Avg. Fiber Diameter (nm)
Pure Chitosan/PLA	511.39 ± 150.19
+ Ciprofloxacin	675.35 ± 142.30
+ Gentamicin	596.60 ± 164.91

Table 1. Average fiber diameters depending on the antibiotic agents

- ✓ **Ciprofloxacin:** Thicker, more heterogeneous fibers
- ✓ **Gentamicin:** Moderate increase in diameter with less heterogeneity

These findings are consistent with prior studies, which report that the incorporation of hydrophilic or charged therapeutic agents modifies the electrospinning process, influencing fiber thickness, porosity, and homogeneity. Such morphological changes can impact not only the mechanical properties of the nanofiber mats but also the drug release profiles, since fiber diameter and porosity are critical determinants of release kinetics.

CONCLUSION

- ✓ Antibiotic incorporation significantly modifies nanofiber morphology.
- ✓ Ciprofloxacin leads to a greater diameter increase than gentamicin.
- ✓ Understanding these effects is essential for optimizing nanofiber scaffolds for controlled antibiotic delivery in biomedical applications.