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Polycaprolactone/Sodium Alginate Coaxial Wet-Spun Fibers Loaded with Ceftazidime for the Treatment of Chronic Wounds

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Introduction

Chronic wounds (CW) are growing rapidly, affecting 1–2% of the world's population, imposing a huge burden on healthcare systems and (urgently) needing dressings capable of aiding a more effective healing process.

Infection is a complex problem in CW, and it is also known that wounds with intense bleeding prevent a rapid response, often resulting in patient morbidity and mortality.

Chemical, biological, physical and thermal characterizations were carried out.

Goal of this Research

In the present project, co-axial wet-spun fibers scaffolds are proposed for wound healing applications.

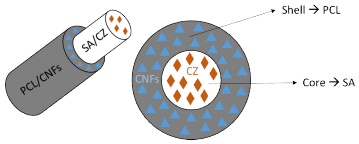
Materials and Methods

Wet-Spinning

The co-axial structures were produced by the wet-spinning technique, in which polycaprolactone (PCL) solution was modified in the shell, mixed with carbon nanofibers (CNFs). The core was composed of sodium alginate (SA) solution, loaded with Ceftazidime (CZ).

Polymeric solution preparation

Shell: PCL at 10 wt.% in dimethylformamide modified with CNFs (50, 100, 150 µg/mL).
Core: SA at 2 wt.% in water loaded with CZ (1x MBC, 128 µg/mL).



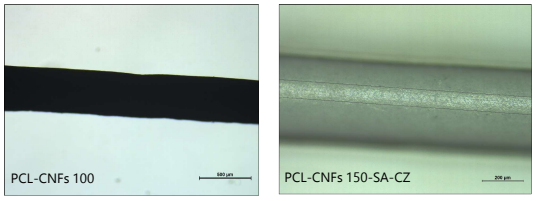
Processing conditions

Needle diameters: 18 Gauge
Flow rate: 0.10 mL/min
Coagulation bath: water or 2 wt.% $CaCl_2$

Results and Discussion

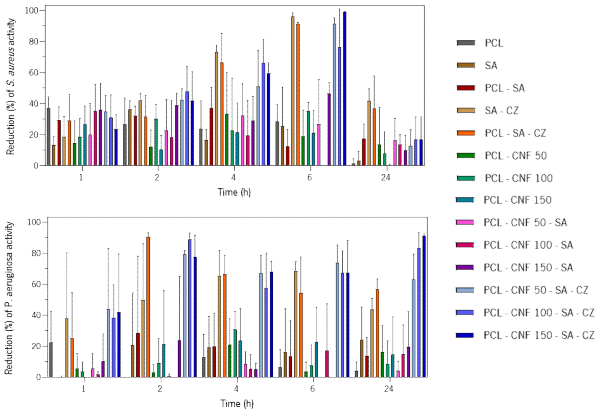
Fibers Morphology

- **Confirmation of co-axial structure**



Antimicrobial activity

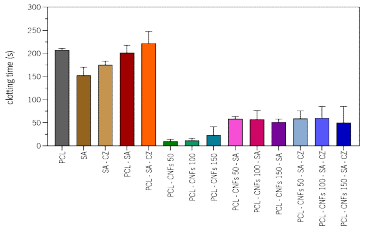
- Antimicrobial tests were carried out against ***Staphylococcus aureus*** and ***Pseudomonas aeruginosa*** revealing **great efficacy** over a period of 24h.



Clotting Time

Recalcified Human Plasma + 1M $CaCl_2$ at 20 mM (37ºC)

- **PCL-CNFs** or **PCL-CNFs-SA-CZ** accelerated clotting time above the controls (between approximately **10-60 seconds**).



Conclusions

✓ The results demonstrated that co-axial wet-spun fibers scaffolds loaded with selected antibiotics are potentially effective for CW care.

✓ In the near future, cytocompatibility tests will be characterized to ensure non-toxic profiles of the fibers when in contact with fibroblasts and keratinocytes.