



# Biodegradable fibers modified with natural agents for potential applications in the treatment of wound infections

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## Introduction

Natural extracts have shown to be increasingly promising as possible alternatives to antibiotics. These compounds possess strong antibacterial profiles and strong anti-inflammatory, antioxidant and chemo-preventive activities. In order to avoid overdose, these are often incorporated into different fiber-based scaffolds. These structures increase the potential for treating wound infections due to their similarities to the fibrillar elements of the skin structure. Here, we envisioned the evaluation of the antimicrobial efficacy of four natural extracts against two bacteria commonly associated with infections: *Staphylococcus aureus* (*S. aureus*) and *Staphylococcus epidermidis* (*S. epidermidis*). Furthermore, the natural extract with better antimicrobial activity were then incorporated into structures such as polycaprolactone (PCL) fibers.

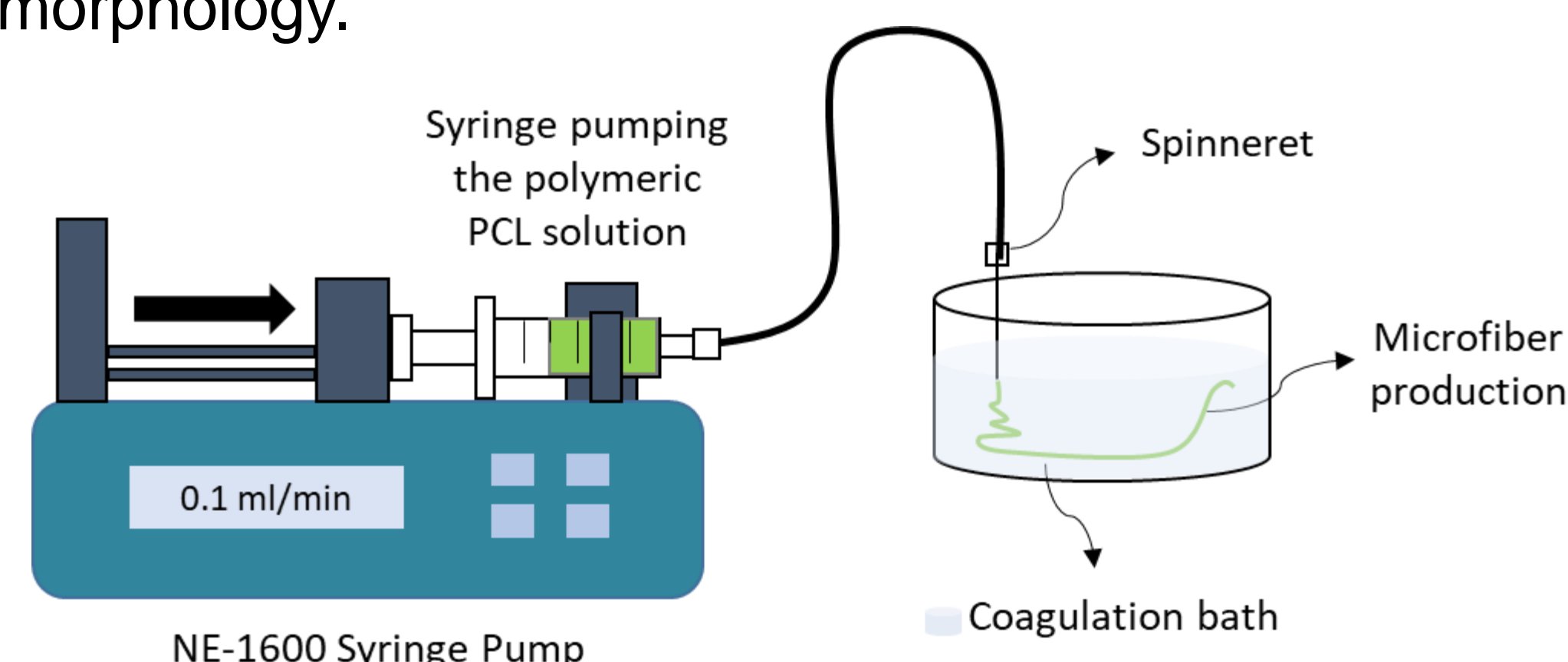
## Goal of this Research

Development of a delivery platform for natural extracts based on fiber structures for the control of infections in skin wounds.

## Materials and Methods

### Fiber production

Wet spinning is based on the non-solvent-induced phase version that allows the production of continuous polymeric microfibers with uniform morphology.



- ❖ **Polymeric solution preparation**  
PCL at 9 w/v% in dimethylformamide (DMF);  
Solubilization conditions – 1 h at 50 °C and 300 rpm.
- ❖ **Processing conditions**  
Flow Rate – 0.1 mL/min;  
Needle Gauge – 18;  
Coagulation bath – distilled water.

## Results and Discussion

### 1 Minimum Inhibitory Concentrations (MICs)

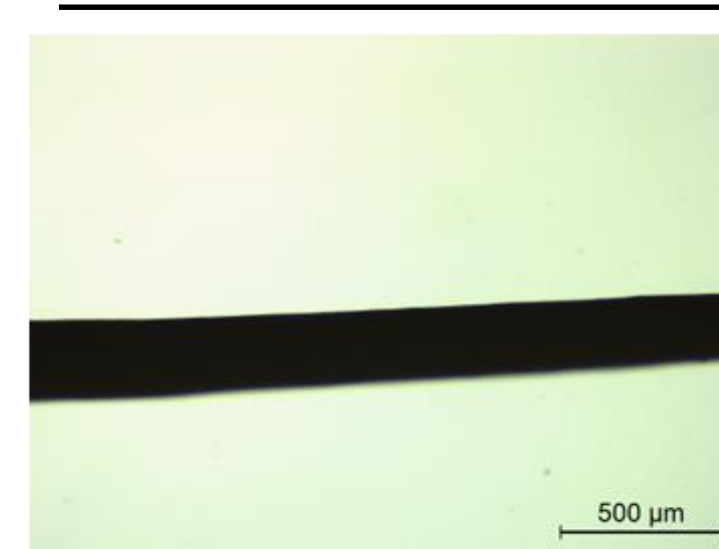
Initial Bacteria Concentration:  $5 \times 10^6$  CFUs/mL in Mueller Hinton Broth (MHB)

Natural extract	MICs (mg/mL)	
	<i>S. aureus</i>	<i>S. epidermidis</i>
Thymol	0.313	0.627
Propolis	2.560	2.560
Carvacrol	2.560	5.120
Eugenol	5.120	5.120

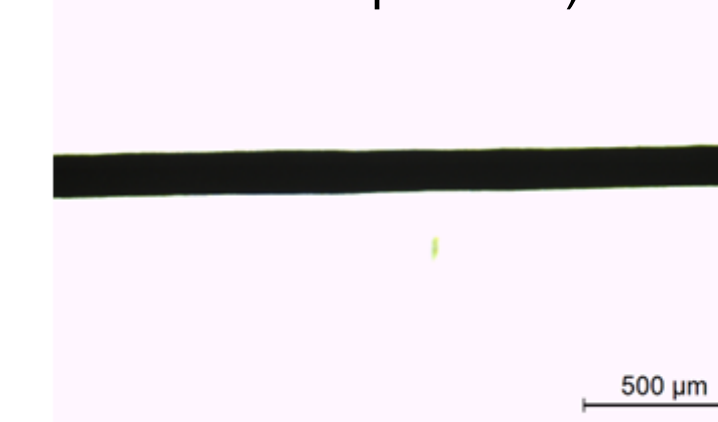
Preliminary data show that these natural extracts are effective antibacterial agents.

### 2 Fiber Morphology

PCL fibers unloaded



PCL fibers loaded with thymol  
(used in representation of the natural extracts incorporation)



Uniform and homogeneous fibers (very few defects were identified)

Parameters	Unloaded	Loaded with thymol
<b>Diameter (μm)</b>	247.49 ± 54.45	146.99 ± 11.01
<b>Elongation at break (%)</b>	159.32 ± 84.03	93.26 ± 23.62

Incorporation of thymol into PCL fibers decreased their diameters and elongation to break.

## Conclusions

- ✓ The four extracts tested were effective against the Gram-positive bacteria *S. aureus* and *S. epidermidis*.
- ✓ It was possible to produce fibers with thymol with the desired characteristics for applications in the treatment of wound infections.

### Acknowledgments

This work is financed by FEDER funds through COMPETE and by national funds through FCT via the projects POCI-01-0145-FEDER-028074 and UID/CTM/00264/2020. M.O.T. acknowledges FCT for the PhD grant with reference 2021.06906.BD.