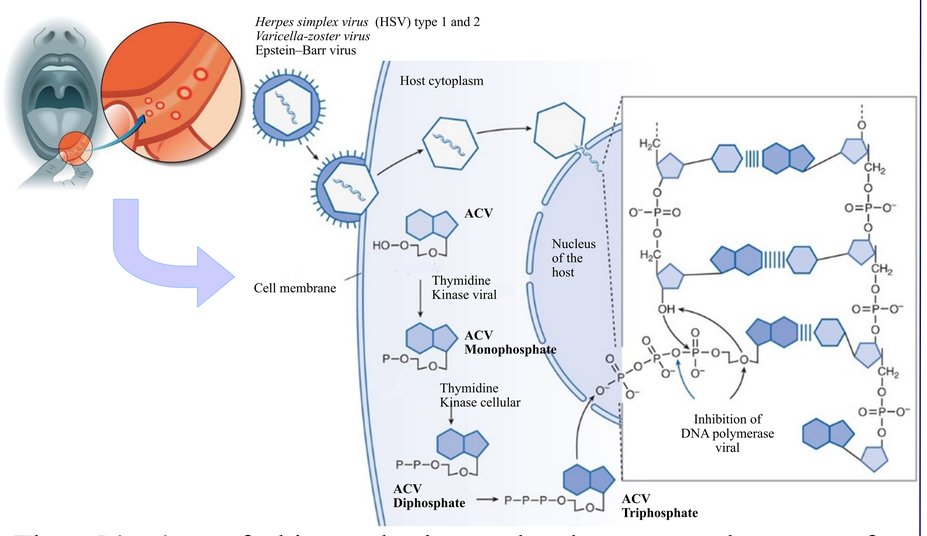
RELEASE OF ACYCLOVIR FROM POLYMERIC NANOFIBERS: COMPARING AQUEOUS VERSUS MEMBRANE-WATER INTERFACES KINETICS

University of Minho
CFUM /Physics Department

Tiago Costa[1]; Andreia Almeida [2,3]; José das Neves [2,3]; Bruno Sarmento [2,3]; Marlene Lúcio[1] and Teresa Viseu[1]

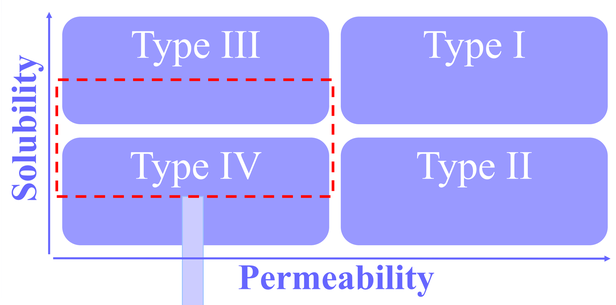
[1]*Centro de Física das Universidades do Minho e Porto (CFUM), Escola de Ciências, Campus de Gualtar, 4710-057 Braga, Portugal*
[2]*Instituto de Investigação e Inovação em Saúde (i3S) e Instituto de Engenharia Biomédica (INEB), Universidade do Porto, Rua Alfredo Allen, 208, 4200-393 Porto, Portugal*
[3]*CESPU, Instituto de Investigação e Formação Avançada em Ciências e Tecnologias da Saúde, Instituto Universitário de Ciências da Saúde, Rua Central de Gandra 1317, 4585-116 Gandra, Portugal*
E-mail: tiago-costa_3@hotmail.com; mlucio@fisica.uminho.pt

INTRODUCTION and OBJECTIVE:



The **objective** of this study is to develop a novel system for acyclovir (ACV) controlled release after cutaneous application through the encapsulation of the drug into polymeric nanofibers of policaprolactone (PCL) produced by the electrospinning technique to overcome the limitations of the conventional topical formulations.

BIOPHARMACEUTICAL CLASSIFICATION SYSTEM



ACV: intermediate/low aqueous solubility
↓ permeability in biological tissues
↓
Low bioavailability in the organism
↓
repeated administration of high doses

METHOD:

Solution Composition

[ACV] = $2x10^{-2}$ g.mL^{-1}
[PCL] = $1.2x10^{-1}$g.mL^{-1}

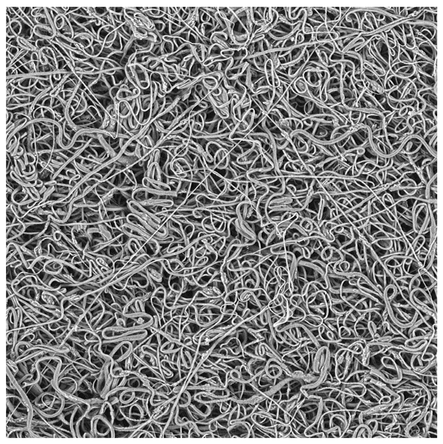
Parameters of Electrospinning

Voltage = 15 kV | Flow Rate = 0.6 mL.h^{-1}
Needle diameter 23 G | Room temperature
Distance $_{(spinneret-collector)}$ = 12 cm

Characterization Methods

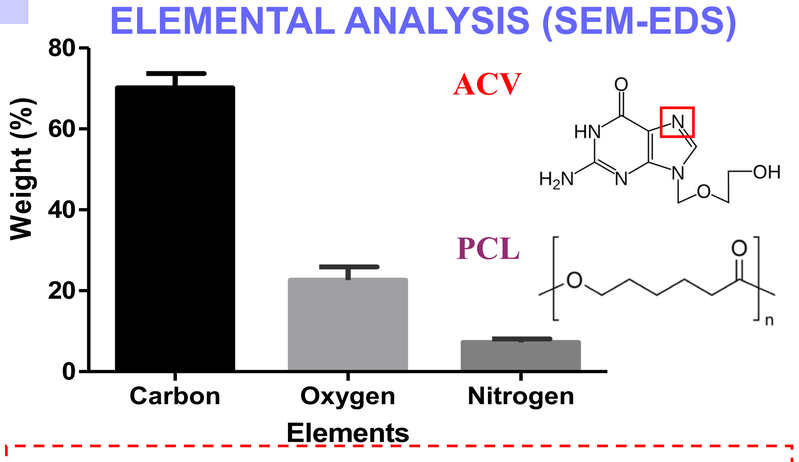
Evaluation of nanofiber morphology/composition
Cell viability assays (MTT assay)
Controlled release assays at physiological conditions (pH 5.5 and 37 ºC) in aqueous or in micellar environment (to mimic the biological interface).

RESULTS and DISCUSSION:



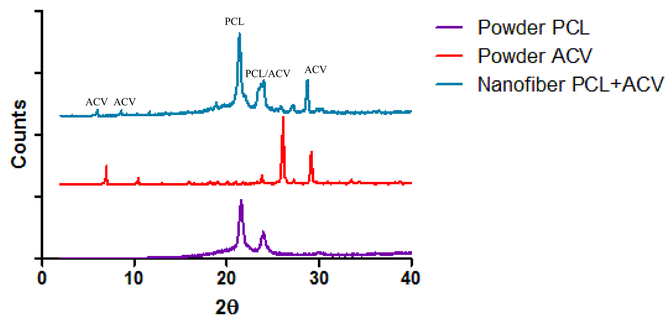
Visualization of PCL + ACV nanofibers by Scanning Electron Microscopy with Energy-Dispersive X-ray Spectroscopy (SEM-EDS) with 15 kV, dimensions 380 x 380 µm.

ELEMENTAL ANALYSIS (SEM-EDS)



The SEM-EDS shows the presence of ACV in the nanofiber. The nanofibers produced have an average size of 595 nm.

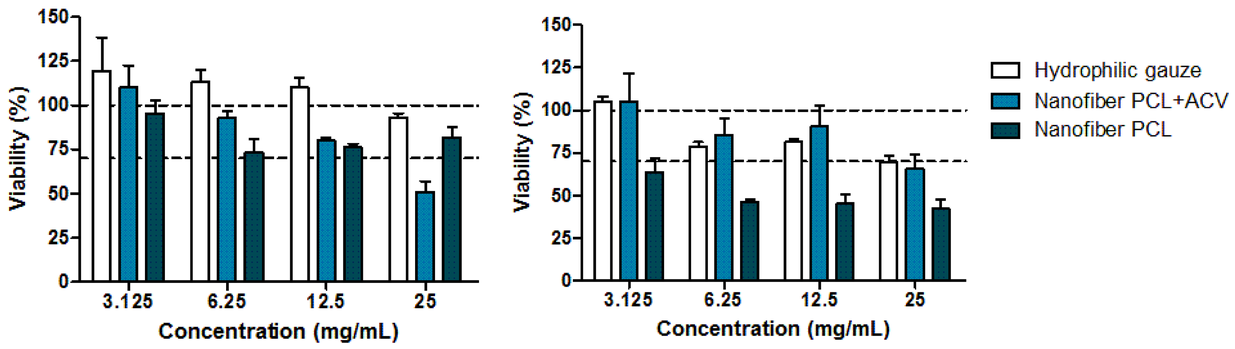
COMPOSITION OF NANOFIBER BY X-RAY DIFFRACTION



The X-ray diffraction shows the presence of ACV in the nanofiber

Diffractogram of the samples: PCL powder, ACV powder and PCL + ACV nanofibers.

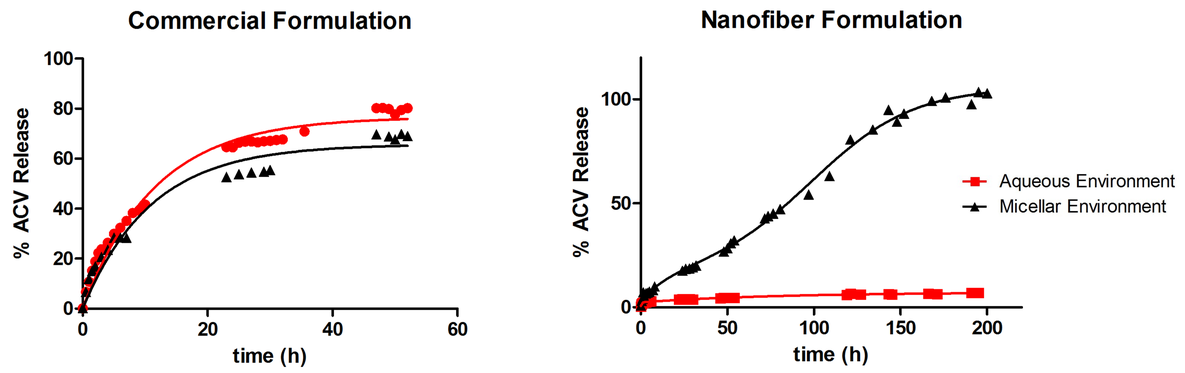
CELL VIABILITY



Viability of epidermal keratinocytes - HaCaT (left) and human foreskin fibroblasts HFF-1 (right) assessed by the MTT assay after 24 h incubation with extracts of PCL fibers and hydrophilic gauze. Columns represent mean values and error bars the standard deviation (n=3).

The nanofibers presented acceptable cell viability up to a concentration of 25 mg/mL.

CONTROL RELEASE ASSAYS



Drug Loading = 3.45%

Drug Loading = 10.90%

Release profile of ACV: Commercial cream formulation (left) and nanofiber formulation (right) in aqueous environment and micellar environment.

The ACV release profile of the nanofibers in micellar environment is more sustained and more pronounced (when compared to the aqueous environment and the commercial formulation).

CONCLUSION:

The electrospinning technique was efficient in producing ACV-loaded nanofibers, being a promising approach to reach a more sustained drug release profile. Moreover, the biological interface (micellar environment) showed to be an important parameter in allowing the assessment of ACV controlled release.

References:
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