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Antimicrobial evaluation of the synergisms of Tiger 17 and pexiganan peptides while loaded onto PVA-based electrospun mats for potential wound care applications

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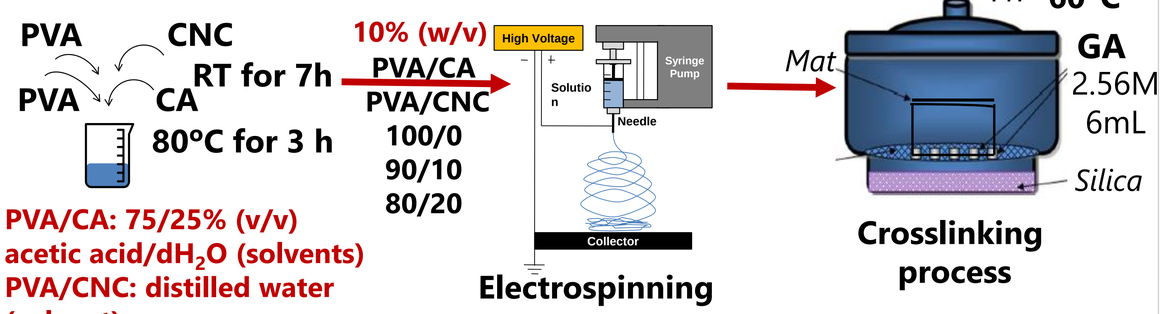
Introduction

The incidence of chronic wounds (CW) is growing at an accelerated rate around the world. To address this problem, new wound dressings functionalized with active biomolecules are being engineered to manage and treat CW [1]. The introduction of peptides, such as pexiganan and tiger 17, has already been established as a viable solution within dressing formulations due to the emergence of bacterial strains with increased resistance to conventional antibiotics [2]. Pexiganan displayed a broad spectrum of activity against pathogens and reducing bacterial resistance, while Tiger 17 is a not so explored peptide with improved regenerative potential is also being investigated to unveil its antimicrobial potential so far unknown. Nowadays, biocompatibility and biodegradability are assumed as essential requirements in biomedical purposes. The eletrospinning technique is an excellent candidate to produce 3D porous mats with high porosity and high surface area from a wide range of polymers with capacity to mimic the structure of the extracellular matrix [3]. The present work reports the antimicrobial effect of pexiganan and tiger 17 when immobilized onto poly(vinyl alcohol)/cellulose acetate (PVA/CA) and poly(vinyl alcohol)/cellulose nanocrystals (PVA/CNC) crosslinked mats. The crosslinked films morphology and antimicrobial efficacy against *Pseudomonas aeruginosa* were evaluated considering the requirements for CW healing.

Electrospun meshes production

PVA (88% hydrolyzed and Mw 78,000) was purchased from Polysciences, Warrington, USA. CA (Mw 30,000) and CNC (diameters of ≈ 75 nm and polydispersity index (PDI) of 0.181) were purchased from Sigma Aldrich, USA and CelluForce, Canada, respectively. The acetic acid (glacial) 100% was purchased from Merck, Darmstadt, Germany. Glutaraldehyde (GA, 25% aqueous solution, Sigma Aldrich).



Characterization

Analyses of the electrospun nanofibers' morphology (e.g. 80/20 PVA/CA and PVA/CNC)

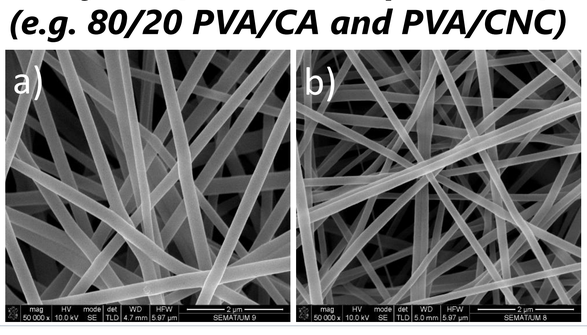
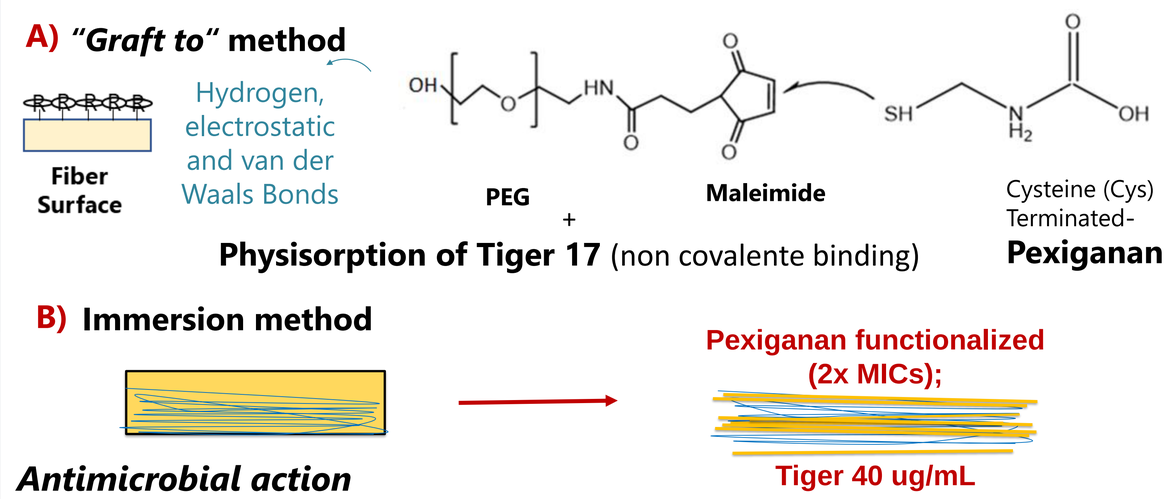


Figure 1: FEG-SEM image of 80/20 GA crosslinked (a) PVA/CA and b) PVA/CNC) (n=100) with respective means (M) of nanofibers diameters (images with 50,000x magnification).

Functionalization of electrospun mats with pexiganan and tiger 17

"Graft to" methodology using Mal-PEG2-OH as binding agent and Physisorption were the strategies used to functionalize the mats with pexiganan at 2xMIC value (2x 62.5ug/mL) and tiger 17 at 40 ug/mL (based on ***Tang et al. 2014*** **[4]**).

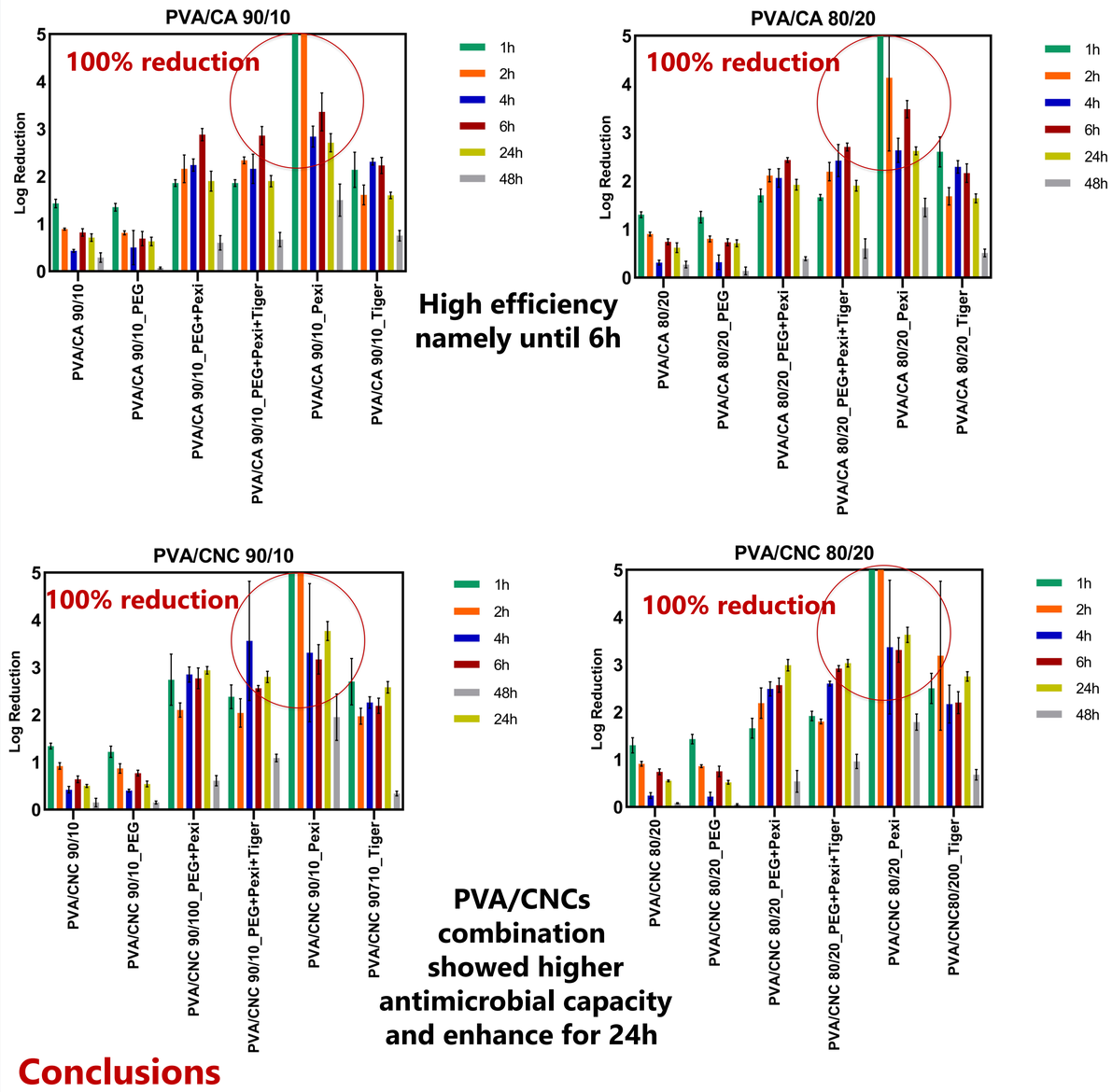


Antimicrobial action

Shake Flask Method (ASTM-E2149-01)

Initial Bacteria Concentration: $1x10^5$ CFUs/mL in Muller

Their antimicrobial action was accessed against *Pseudomonas aeruginosa (PA)*.



Conclusions

These biomolecules showed great potential as substitutes of antibiotics in the fight against *P. aeruginosa* bacteria, namely during 24h.

References: [1] Felgueiras, H. P., et al., Colloids Surf. B. 2017;156:133–148.; [2] Shityakov, S.,et al., Eur. J. Med. Chem. 2019;149-161.; [3] Agarwal, et al., Polymer. 2008, 49,5603-5621; [4] Tang et al. 2014, *PLOS ONE*. 2014, 9.

Acknowledgments

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