Mechanically resistant, biodegradable PVA/CA dressings functionalized with LL-37 peptide reduce microbial burden

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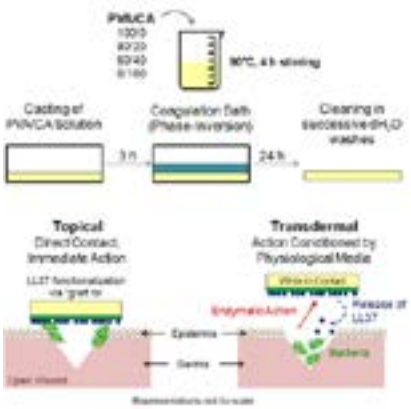
Statement of the Problem: Typically, acute wound healing is a well-organized process that evolves in a predictable amount of time. Chronic wounds (CW) result from gradual tissue degradation, and are characterized by defective cell matrix, high bacteria counts, prolonged inflammation and moisture imbalance. Antimicrobial dressings, that combine dressing and antibiotics, have been suggested as potential strategies to treat CW. However, the rising of antibiotic-resistant pathogens has turned these systems obsolete, revealing antimicrobial-peptides (AMPs), which display a broad spectrum of activity against pathogens and act rapidly at multiple sites within microbial cells, as viable alternatives.

Methodology: In this work, poly (vinyl alcohol) (PVA) and cellulose-acetate (CA) were prepared via casting/phase-inversion method in the form of films. Different PVA/CA ratios were tested. Their mechanical, thermal and biodegradation profiles were followed. The films capacity to absorb exudates was also determined. Films were functionalized with LL-37 peptide. This AMP is endowed with immunoregulatory abilities, with great potential for wound healing, and important antimicrobial features.

Findings: Results revealed the homogeneity of the fashioned dressings, their thermal stability and mechanical resistance above skin, namely tensile strength. As the content of CA increased, the films absorbancy decreased. Dressing's degradation was more important at basic pHs (i.e. simulated body fluid at pH 9). LL-37 was more efficient against Gram positive bacteria (i.e. Staphylococcus epidermidis) than Gram negative. *In vitro*, clotting time was significantly accelerated by this AMP presence in the dressings. Overall, the PVA/CA functionalized films demonstrated their potential for applications in wound healing.



Recent Publications:

1. Querido M M (2018) Cecropin–Melittin functionalized polyurethane surfaces prevent Staphylococcus epidermidis adhesion without inducing platelet adhesion and activation. Advanced Material Interfaces 5(24): 1801390.
2. Felgueiras HP (2017) Functionalization of electrospun polymeric wound dressings with antimicrobial peptides. Colloids and Surfaces B: Biointerfaces 156:133-148.
3. Coelho D (2017) Antibacterial electrospun poly (vinyl alcohol) /enzymatic synthesized poly (catechol) nanofibrous midlayer membrane for ultrafiltration. ACS Applied Materials and Interfaces 9(38): 33107-33118.
4. Felgueiras H P (2017) Octadecyl chains immobilized onto hyaluronic acid coatings by thiol-ene "Click Chemistry" increase the surface antimicrobial properties and prevent platelet adhesion and activation to polyurethane. ACS Applied Materials and Interfaces 9(9):7979-7989.
5. Felgueiras H P (2015) Contributions of adhesive proteins to the cellular and bacterial response to surfaces treated with bioactive polymers: case of poly (sodium styrene sulfonate) grafted titanium surfaces. Journal of Material Sciences: Material in Medicine 26(11):261.

Biography

Helena P Felgueiras has completed her graduation in Biomedical Engineering from University of Minho (Portugal). In 2014, she completed her PhD in Biomedical Engineering with specialization in biomaterials at Université Paris 13, France. Presently, she is working at the Centre for Textile Science and Technology (2C2T) as a Junior Researcher, developing medical textiles.

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