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A NEW GENERATION OF BIOACTIVE DRESSINGS FOR WOUND-HEALING MANAGEMENT

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ABSTRACT

The present work evaluated the surface, thermal, friction, drape and moisture properties of surgical cotton weaved and knitted fabric gauzes coated with chitosan nanocapsules containing essential oil of *Copaifera multijuga* Hayne. The result indicates that the biofunctionalized medical textiles induce low capillarity, allowing a good degree of moisture and absorption capacity of wound exudates. The gauzes coated with chitosan (CH) at the optimized mass fractions of 0.125 wt% demonstrate good thermal, friction and draping properties, thus promoting the best conditions for maintenance of the wound healing microenvironment. The knitted fabric shows the best thermal, friction and capillarity proprieties compared to weaved gauze. This gauze allows the development of a knitted biofunctionalized medical device especially designed for burn wounds treatment.

INTRODUCTION

Dressings available in the market can be as simple as a strip of plain textile, or as complex as an engineered composite that contains layers of different geometries and reactive materials, including drugs. The type of dressing used by clinicians depends on wound type and condition (Gupta and Edwards, 2009). The incorporation of natural-based compounds such as antimicrobial peptides or healing-promoting agents like essential oils, on the surface of a common bandage have been used as a strategy to increase the healing efficiency. For example, copaiba oil has been used as a healing, anti-inflammatory and antibiotic agent for a long time being swallowed or applied directly on the skin surface (Santos et al., 2008). A recent work have studied the use of copaiba oleoresin applied in electrospun mats for wound care applications (Millas et al., 2014). Nevertheless, these type of oils has never been encapsulated and further applied in textile bandages. Herein, we developed oil-containing chitosan nanocapsules and further applied them onto surgical cotton gauze and cotton knitting as a novel strategy for obtaining a textile dressing for wound healing applications.

RESULTS AND CONCLUSIONS

Chitosan-coated textiles properties are shown in Table 1. Both samples provided higher thermal performances, friction, water uptake values and drape coefficient compared to control samples. The oil-containing CH nanocapsules were synthesized with the ionic gelation technique and showed an average diameter of 97 nm (Figure 1-A). Among different chitosan tested concentrations the gauze coated with 0.125 wt% of CH displays the best water uptake values suggesting good water retention capability. Surface analysis shows an even nanocapsule distribution onto the fibres (Figure 1-B). This CH concentration does not significantly reduce flexibility capacity of gauze and knitted cotton (16,2% and 6%, respectively). Water transport capability of weaved gauze increased 19.5% and 17.7 % in warp and weft directions, respectively. Knitted cotton also shows good water transport capability, with an increase of 15.6% and 20.2 % in warp and weft directions, respectively. Moreover, the knitted gauze provide the best drapability and flexibility as well as the best thermal comfort properties. It is expected that knitted cotton could maintain an optimum temperature and moisture content with reduced abrasion on the wound surface improving wound healing properties.

Table 1 Thermal, surface, moisture management and water uptake properties

Samples	Friction Properties - µ kinetic	Drape Coefficient F	Water vapor transmission (%)	Mas of absorbed water warp (g)	Mas of absorbed water weft (g)	Thermal Conductivity (W/mK)	Thermal Resistance (m^2 K/ W])
Weaved Control	0.2792±0.021	0.41±0.08	105.95±2.7	0.083±0.007	0.158±0.017	32.8±0.5	16.2±0.1
Weaved CH0,125	0.2299±0.012	0.77±0.03	104.2±2.1	0.086±0.004	0.174±0.006	31.8±0.4	16.8±0.0
Knitted Control	0.6853±0.030	0.31±0.04	94,45±2,9	0.651±0.09	0.193±0.04	50.4±1.3	22.9±0,6
Knitted CH0,125	0.5852±0.037	0.43±0.03	90.85 ±1,1	0.772±0.084	0.242±0.041	48.1±1.7	29,84±0,4

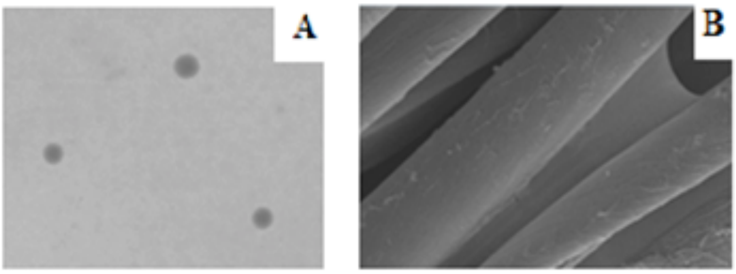

Fig.1 **A –** oil-containing chitosan nanocapsules CH, **B** – Chitosan coated knitted gauze

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REFERENCES

Gupta, B. S., & Edwards, J. V. Textile materials and structures for wound care products. *Advanced textiles for wound care. Cambridge, England: Woodhead Publishing Limited*, 2009, p. 48-92.

Morelli, C. L., Mahrous, M., Belgacem, M. N., Branciforti, M. C., Bretas, R. E. S., & Bras, J. Natural copaiba oil as antibacterial agent for bio-based active packaging. *Industrial Crops and Products*, 2015, *70*, p. 134-141.

Millas, A. L. G., McKean, R., Stevens, R., Yusuf, M., Silveira, J. V., Puzzi, M. B., & Bittencourt, E. Fabrication of Electrospun Scaffolds Incorporating an Amazonian Therapeutic Oil from the Copaifera Species for Wound Care Applications. *Journal of Biomaterials and Tissue Engineering*, 2014, *4*(3), p. 217-220.