

CHITOSAN-SILVER WOUND DRESSINGS

J. DÍAZ-VISURRAGA¹, J.P. GONZÁLEZ¹, A. GARCÍA² and G. CÁRDENAS¹

¹ CIPA-Chile, Advanced Materials Laboratory, Department of Polymers, Faculty of Chemistry, University of Concepción, Chile. e-mail: galocardenas@udec.cl.

² Department of Microbiology, Faculty of Biology, University of Concepcion, Chile.

The presence of bacteria in chronic wounds exaggerates the tissue-damaging processes. Since ancient times, elemental silver and its salts have been known to possess extraordinary bactericidal properties, and hence they have been widely used in several formulations and dressings in wound care management [1]. Usually, conventional methods have been adapted for including silver on to biomaterials to reduce the bacterial adherence. However, conventional methods generally suffer from many disadvantages, including requirement of special processing methods [2]. This study presents *in vitro* and *in vivo* approaches to enable the assessment of chitosan-silver wound dressings to support optimal conditions for wound healing. Two wound dressings: HMW CS-Ag (I) and MMW CS-Ag (I) [3] were tested for physicochemical properties (Fig. 1 and 2) and antimicrobial activity. Also, a clinical trial was performed in order to evaluate the treatment therapy (Fig. 3). Chitosan-silver wound dressings have been prepared using chitosan-silver complexes of medium and high molecular weight (125 000 g/mol and 400 000 g/mol) and desacetylation degree of 95%.

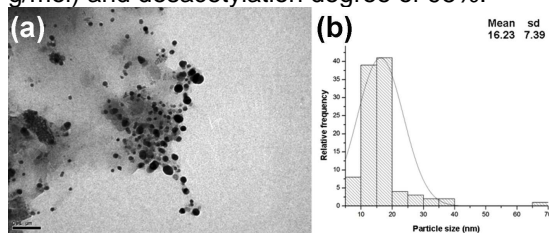


Fig. 1. (a) TEM micrograph, bar 0.1μm and (b) particle size distribution of HMW CS-Ag (I)

The antibacterial activities were performed against *Escherichia coli* ATCC 25922, *Staphylococcus aureus* ATCC 25923 and 6538P and *Pseudomonas aeruginosa* ATCC 27853. Results suggest that chitosan-Ag (I) wound dressings have bactericidal potential at 3 h of incubation against all wound skin pathogens studied.

The clinical trial was performed on an 53-year-old chilean woman which referred with a 5-year history of a nonhealing exudative ulcer (18 cm²) on the right lower leg. The ulcer had not responded to consistent conservative treatment. Her medical history was remarkable for systemic lupus erythematosus, deep vein thrombosis and postthrombotic syndrome of the right lower leg.

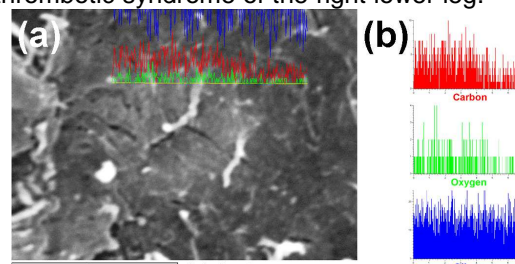


Fig. 2. (a) Scanning electron micrograph of HMW CS-Ag (I) wound dressing, (b) X-ray line scan of HMW CS-Ag (I) wound dressing

The affected area was covered periodically (5 days) with a chitosan-silver wound dressing with complete healing occurring within 10 weeks.



Fig. 3. Treatment therapy

ACKNOWLEDGEMENTS

The research was funded by Project Innova Bío-Bío 8PC-S1-260. The authors acknowledge the Microscopy Laboratory at the University of Concepcion for assistance in imaging specimens for this study. The work described is the subject of an international patent application in preparation.

REFERENCES

1. Wright, J. B., Lam, K., Olson, M. E., Burrell, R. E. (2003) Wounds 15, 133-142.
2. Dowling, D. P., Donnelly, K., McConnell, M. L., Eloy, R., Arnaud, M. N. (2001) Thin Solid Films 398, 602-606.
3. Díaz-Visurraga, J., García, A., Cárdenas, G. (2009) Lethal effect of chitosan-Ag (I) films on *S. aureus* as evaluated by electron microscopy. *J Appl Microbiol* doi:10.1111/j.1365-2672.2009.04447.x