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Physical properties of an antibacterial and antiviral woven cotton functionalized with a multi-nanocomposite

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Introduction

Wound infection is a critical factor that seriously hinders adequate healing preventing epithelialization and angiogenesis. This is particularly grievous and prevalent in burn and chronic wounds. To prevent wound infection, a multi-nanocomponent (M-NCP) textile was developed through the combination of four different elements:
i. antimicrobial agents, ii. carrier, iii. binding matrix (chitosan), iv. textile substrate (cotton, CO). The antimicrobial agents comprised: lysozyme, protease and silver nanoparticles (AgNPs). The carrier was a zeolite containing high surface area and halves that increase the concentration load of the antimicrobial agents.

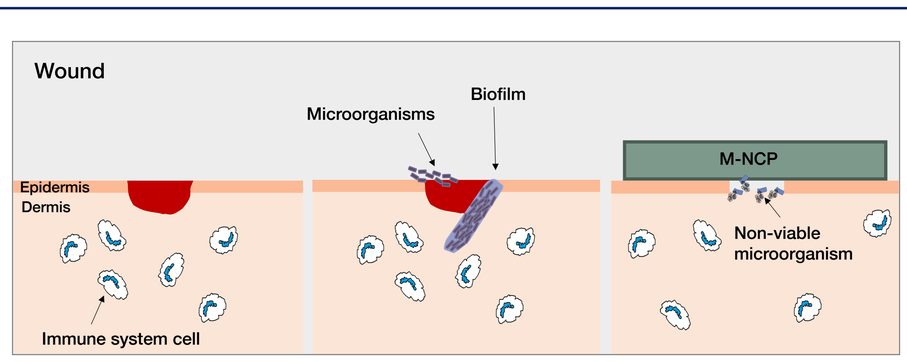

Fig 1. Wound infection and its control by nanocomponent textile.

Methods

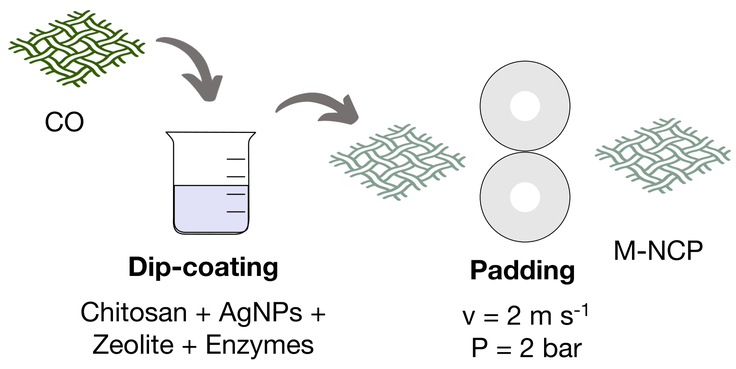

Fig 2. M-NCP production.

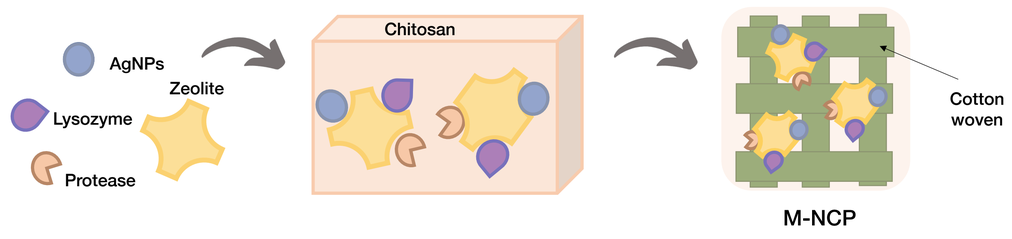

Fig 3. Schematic representation of the M-NCP production.

Results

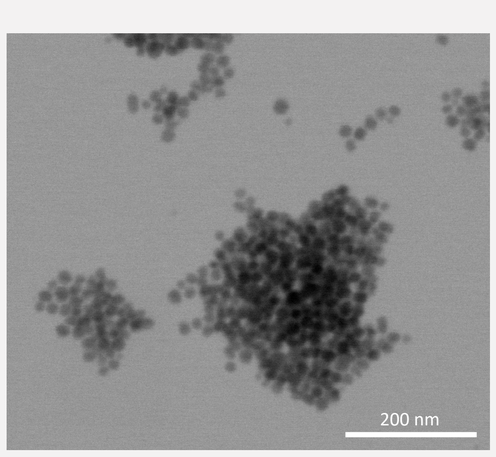

Fig 4. STEM micrograph of AgNPs.

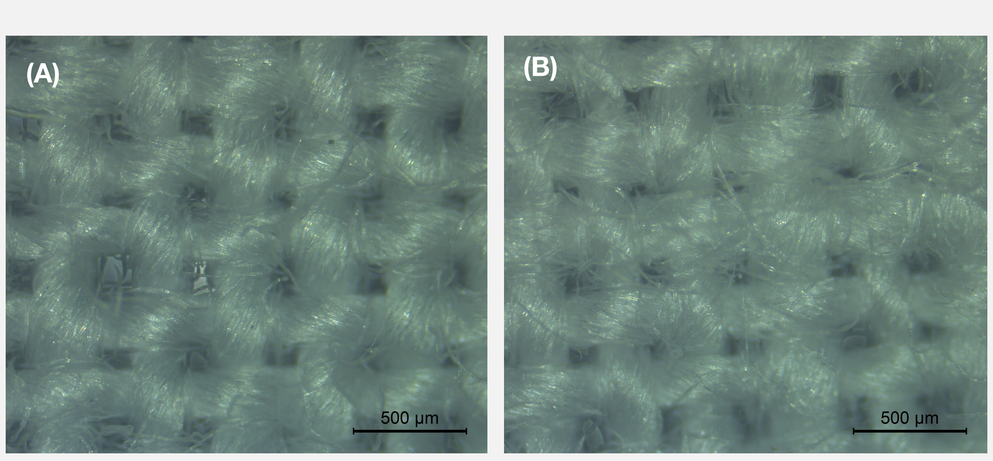

Fig 5. Microscopic images of **(A)** CO and **(B)** M-NCP.

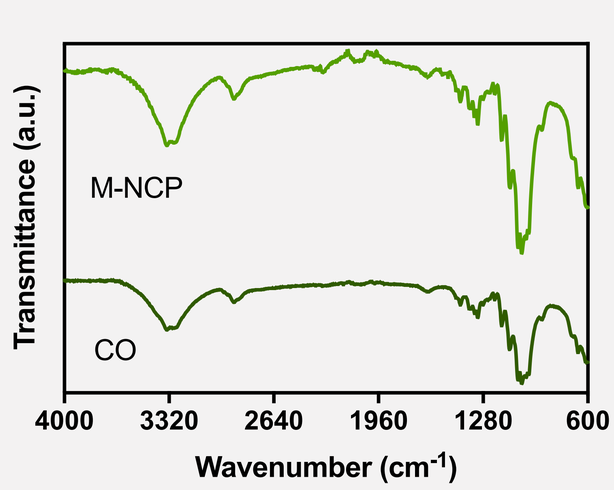

Fig 6. ATR-FTIR spectra of CO and M-NCP.

- Average size of 17.48 ± 3.34 nm.
- Microscopic images show similarity between CO and M-NCP.
- Chemical structural displayed no significant alterations.

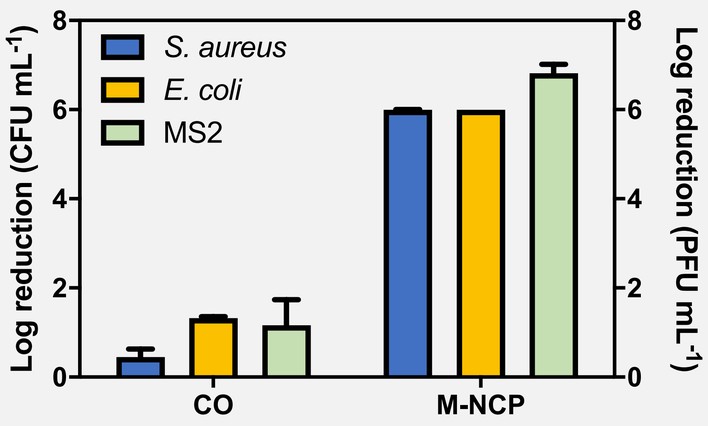

Fig 7. Antimicrobial activity of CO and the M-NCP obtained through ATCC100 TM100 – Contact Killing test.

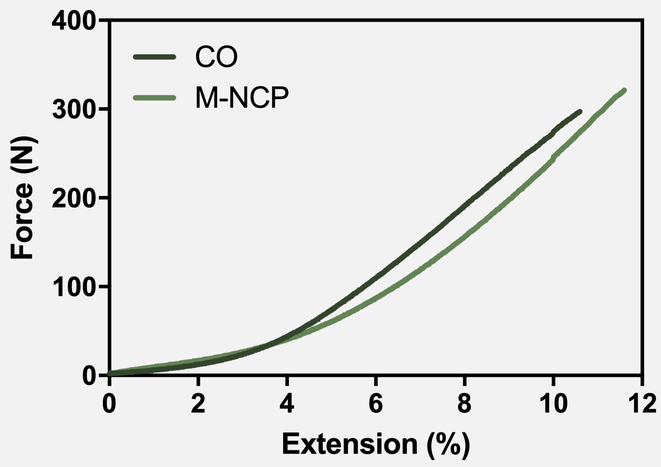

Fig 8. Tensile strength.

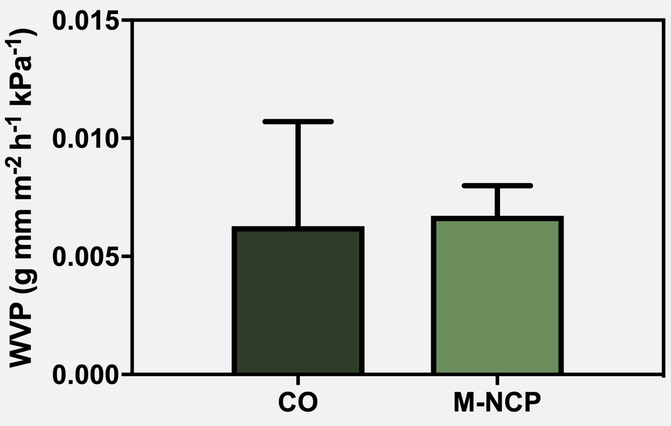

Fig 9. Water vapour permeability.

- M-NCP exhibited outstanding antimicrobial activity higher than 4 log reduction against bacteria *S. aureus* and *E. coli* and encapsulated virus MS2.
- Suitable mechanical properties.
- No clear difference displayed in WVP between M-NCP and pristine CO.

Conclusion

The developed M-NCP for prospective wound dressing exhibited wide antimicrobial spectrum: Gram-positive, Gram-negative and bacteriophage, with no alteration to the original physical properties of the substrate.

Acknowledgements

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