

Green anti-oxidant drug delivery system based on bacterial cellulose for wound healing applications

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Introduction Rising consumption of finite resources highlights the need for sustainability, with agro-industrial waste offering promising biomedical alternatives. Bacterial cellulose (BC) is a green substitute for plant-derived cellulose¹, showing potential in wound healing². Zein can be sourced as a corn byproduct and used to develop nanoparticles (ZNPs)³. This study focused on a sustainable wound healing drug delivery system using BC hydrogels loaded with curcumin-loaded ZNPs.

Experimental methods BC pellicles were produced by *Komagataeibacter xylinus* and scale-up production was explored. Curcumin-loaded ZNPs (2.5-10 µg/mL) were prepared through nanoprecipitation and characterized. *In vitro* biocompatibility of ZNPs/curcumin was assessed with HaCaT cells after 24h. Loading of ZNPs/curcumin into BC was optimized. Curcumin content in BC pellicles and its release kinetics were characterized. Antioxidant activity and biocompatibility of ZNPs/curcumin/BC pellicles were investigated with HaCaT cells.

Results and discussion BC pellicles were successfully produced with high yields (1.07 g/L). ZNPs/curcumin exhibited high encapsulation efficiency (80%) and good biocompatibility with HaCaT cells. Loading ZNPs/curcumin into BC pellicles yielded high curcumin content (86%) with a sustained release profile (50% over 1 month). *In vitro* tests showed high compatibility and restored cell viability after H₂O₂ treatment, demonstrating good antioxidant properties.

Conclusion This study optimized BC production and the preparation of ZNPs for curcumin delivery. Future studies will explore the antibacterial effects of ZNPs/curcumin/BC pellicles, aiming to develop innovative drug delivery systems for skin diseases.

References

¹ Gregory et al., 2021, ² Orlando et al., 2020, ³ Tivano and Chiono, 2023

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