METAL OXIDE NANOPARTICLES FOR DELAYED DRUG RELEASE IN WOUND DRESSING MATERIALS

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Wound management is critically important in order to prevent wound infection and to facilitate the healing process. Traditional passive wound dressing material acts as a physical barrier to cover the wound, thereby lowering the chance of an infection. These wound dressing materials lack inherent antibacterial properties and/or wound healing properties. With the emergence of nanotechnology, methods have been explored in order to develop "active" wound dressing materials which stimulate tissue regrowth or provide an antibacterial effect. Nanocellulose has been of interest as a potential wound dressing material due to its beneficial properties (e.g. gas permeability, exudate removal), however it lacks antibacterial properties. Efforts have been made to include antibiotics into nanocellulose materials, however these typically show low retention and rapid release of antibiotics. To facilitate the incorporation antibiotics and to control the release thereof, efforts were made to incorporate metal oxide nanoparticles to produce cellulose-based hybrid materials for controlled drug delivery, materials which are generally considered to be bio-compatible. In this manner iron oxide-based hybrid materials were produced, permitting the controlled release of Tetracycline by daylight.[1] Incorporation of titania within a nanocellulose matrix revealed slow release of tetracycline from wound dressing materials. Finally, Cerium(IV) oxide was incorporated as an alternative to nano-sized titania for the controlled release of ampicillin.[2] Introducing metal oxide nanoparticles offered an approach to functional, biocompatible, hybrid patches for delayed drug release, which may be used as active wound dressing materials.

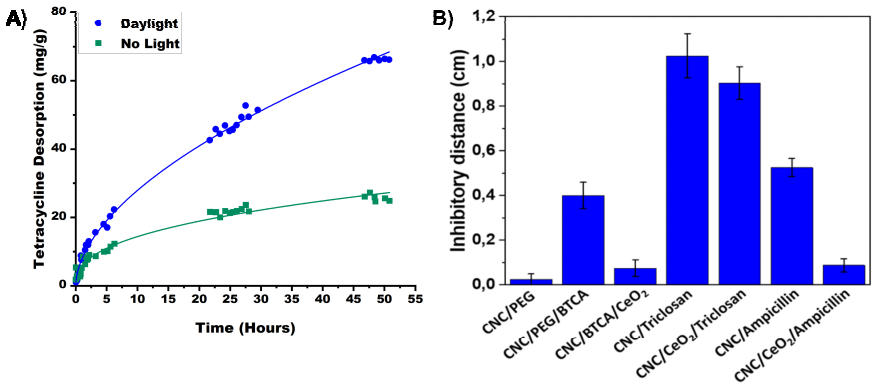

Figure 1. A) Release of the broad spectrum antibiotic Tetracycline from a nano-cellulose iron oxide composite.[1] B). Average inhibitory effect of cellulose materials in gel diffusion tests, with and without cerium(IV) oxide.[2]

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[1] Breijaert, T. C.; Daniel, G.; Hedlund, D.; Svedlindh, P.; Kessler, V. G.; Granberg, H.; Håkansson, K.; Seisenbaeva, G. A. Self-Assembly of Ferria – Nanocellulose Composite Fibres. *Carbohydrate Polymers* **2022**, *291*, 119560. https://doi.org/10.1016/j.carbpol.2022.119560.

[2] Gaio, S.; Svensson, F. G.; Breijaert, T. C.; Seisenbaeva, G. A.; Kessler, V. G. Nanoceria–Nanocellulose Hybrid Materials for Delayed Release of Antibiotic and Anti-Inflammatory Medicines. *Mater. Adv.* **2022**, *3* (19), 7228–7234. https://doi.org/10.1039/D2MA00471B.