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Enhanced Stability and Topical Promise of Chloramphenicol in a Dry Dressing Format

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Extended Abstract

The global rise in chronic wound cases, exacerbated by an aging population, presents a significant healthcare challenge, particularly due to persistent infections that necessitate antibiotic intervention [1]. Topical antibiotic administration offers a targeted approach to combat infections while minimizing systemic side effects. This study explores the use of chloramphenicol, a broad-spectrum antibiotic with known systemic side effects, in a novel drug delivery system administered as a dry format wound dressing, aiming to leverage its antimicrobial efficacy in the context of antibiotic resistance.

We propose an advanced delivery strategy utilizing liposomes, which are lipid-based nanocarriers renowned for drug protection, controlled release, and skin hydration properties [2]. Being a liquid system, liposomes need a secondary vehicle for topical administration. Chloramphenicol-liposomes for topical application have been reported before, but then with a hydrogel as a secondary vehicle. In the aqueous environment of the hydrogel, chloramphenicol was shown to hydrolyse easily, leading to a limed shelf-life [3].

To overcome the limitations of aqueous liposomal formulations, we investigated the incorporation of chloramphenicol-loaded liposomes into nanofibers as a secondary vehicle for topical application. Nanofibers are dry fibrous mats, produced via electrospinning from polymer solutions. With their extracellular matrix-mimicking structure and versatility in polymer choice, they emerged as an ideal secondary vehicle that also allows for a long-term storage due to its dry state. However, most polymer systems used for electrospinning require toxic organic solvents, solvents that are both harmful to the environment and can damage liposomes. To avoid this, we selected a water-soluble pectin-polyethylene oxide blend for electrospinning and liposome incorporation.

Successful, defect-free nanofiber formation was confirmed with SEM-images. Confocal imaging of rhodamine-labelled liposomes within the nanofibers demonstrated successful liposome incorporation. Antimicrobial efficacy was well retained after several weeks of storage, as evidenced by testing against *E.coli* and *S.aureus*. Remarkably, the nanofibers exhibited a high swelling index, absorbing up to 1700% of their weight, and showed a transition to a hydrogel-like state upon contact with wound exudate, while offering the benefits of dry storage and ease of handling.

In conclusion, our study introduces a promising chloramphenicol delivery system that addresses the limitations of hydrogel vehicles and enhances the practicality and stability of liposomal formulations for chronic wound management.

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