




Design and evaluation of composite films for in situ synthesis and antibacterial activity of allicin vapour

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ABSTRACT

Although allicin has potent antibiotic properties, its low stability, which is responsible for its persistent biological activity, has posed a significant challenge to its practical application in modern medicine. To harness the healing benefits of this phytochemical, known by humans for thousands of years, we propose a controlled in situ synthesis of allicin vapour near the site of infection. Considering the critical need for novel approaches to prevent pandemic scenarios caused by MDR bacteria, we suggest encapsulating and physically separating allicin precursors (substrate alliin and enzyme alliinase) in alginate-based films and spray-dried chitosan microparticles. The mechanical properties of the hydrogel films of various compositions were evaluated, as well as their ability to protect the encapsulated alliinase against thermal stress and control the overall rate of allicin release upon hydration. Furthermore, the non-contact antibacterial efficacy of free alliin/alliinase reaction mixture (aqueous solution) and three compartmentalised configurations, i.e. film-solution, film-particles, and double-film, were tested against selected bacterial strains, i.e. *E. coli*, *S. epidermidis*, and *S. aureus*. The results indicate that the formation of allicin vapour using the proposed compartmentalised systems addresses allicin's stability issues and provides better control over the rate of allicin production. The observed antibacterial effect was comparable with directly formed allicin using higher initial amounts of both substances, which is given by diffusion limitations associated with encapsulation. These findings illustrate the potential of compartmentalised systems in developing nature-based wound dressings for infection prevention and promoting healing.

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