Sodium Alginate Microspheres for Controlled Drug Delivery

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Abstract: Alginate is used in many foods and biomedical applications. Alginate microspheres are effective carriers for controlled drug delivery. The comparative evaluation of different medications encapsulated in alginate microspheres is crucial for understanding the relationship between variables. This study presents a comparative assessment of alginate microspheres encapsulating two antimicrobial drugs, rifampicin and curcumin, focusing on their drug release, morphological characteristics, drug-polymer interactions, and antimicrobial activity. The surface of the microspheres examined using SEM reveals that they are proficient carriers for controlled drug delivery due to their rough surface texture and microscopic cracks. The FTIR spectral analysis indicates the absence of interaction between rifampicin and the alginate matrix, as observed by the retention of rifampicin's characteristic peaks in the rifampicin-loaded microspheres. Conversely, curcumin-loaded microspheres exhibit slight deviations from curcumin's characteristic peaks, suggesting an interaction between curcumin and the alginate matrix. In in-vitro release studies, rifampicin-loaded microspheres demonstrate superior performance by achieving controlled drug release within four to five hours at pH 6.8 and 7.4. In contrast, curcumin-loaded microspheres require twenty hours to achieve a similar level of drug release. Furthermore, rifampicin-loaded microspheres exhibit enhanced antimicrobial activity against E. coli and S. aureus compared to curcumin-loaded counterparts, highlighting their superior efficacy. The findings of this work contribute to the essential knowledge for designing more efficient drug delivery systems utilizing alginate microspheres.