IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 5, November 2024

Alginate Microbeads Technology for Pharmaceutical Applications

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Abstract: *Nowadays, microbeads are inevitable in pharmaceutical formulations with remarkable drug delivery and therapeutic outcome benefits. Usually made from biocompatible polymers, these tiny spherical particles allow for controlled and targeted delivery of APIs within the human body. Other benefits associated with microbeads include their ability to control drug release kinetics in terms of sustained or pulsatile release profiles in order to facilitate patient compliance and minimize adverse effects. This also has a minimal size and allows for adaptation for precise dosing and targeting the right sites, which augments therapeutic efficacy while cutting down systemic exposure.*

The need for safe and effective drug delivery systems has been a crucial aspect in the advancement of new pharmaceutical formulations. Researchers continue to seek new ways in prolonging drug release, minimizing drug wastage, and reducing the side effects of drugs. However, synthetic polymers are costly, non-biocompatible, and potentially toxic. On the other hand, sodium alginate, a natural polymer, is generally used as a matrix material because of biodegradability, low price, simplicity, and excellent biocompatibility. Sodium alginate is nontoxic when delivered orally and gives protection on the mucous membrane of the upper gastrointestinal tract.

Sodium alginate is an anionic polysaccharide of natural origin wherein gelation can be obtained with the use of calcium ions to form stable microbeads. There are multiple techniques used to prepare alginate microbeads, that is, ionotropic gelation, cross-linking, emulsion gelation, spray drying, and both simple and complex coacervation phase separation methods. This review shall highlight the preparation and characterization of alginate microbeads, their therapeutic applications, and their position in the realm of controlled and novel drug delivery systems.

Keywords: Biocompatible polymers, Biodegradable, Emulsion gelation method, Ionotropic gelation method, Site-specific targeting

DOI: 10.48175/IJARSCT-22475