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Controlled release of lysozyme from double-walled poly(Lactide-Co-Glycolide) (PLGA) microspheres (Article)

Ansary, R.H.^{ab} ✉, Rahman, M.M.^{ac} ✉, Mohamad, N.^c ✉, Arrif, T.M.^c ✉, Latif, A.Z.A.^d ✉, Katas, H.^e ✉, Wan Nik, W.S.B.^f ✉, Awang, M.B.^g ✉ 

^aFaculty of Pharmacy, International Islamic University Malaysia, Kuantan, Malaysia

^bDepartment of Chemistry, University of Rajshahi, Rajshahi, Bangladesh

^cInstitute for Community Development and Quality of Life (i-CODE), Universiti Sultan Zainal Abidin, Kuala Nerus, Terengganu, Malaysia

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Abstract

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Double-walled microspheres based on poly(lactide-co-glycolide) (PLGA) are potential delivery systems for reducing a very high initial burst release of encapsulated protein and peptide drugs. In this study, double-walled microspheres made of glucose core, hydroxyl-terminated poly(lactide-co-glycolide) (Glu-PLGA), and carboxyl-terminated PLGA were fabricated using a modified water-in-oil-in-oil-in-water (w1/o/o/w2) emulsion solvent evaporation technique for the controlled release of a model protein, lysozyme. Microspheres size, morphology, encapsulation efficiency, lysozyme in vitro release profiles, bioactivity, and structural integrity, were evaluated. Scanning electron microscopy (SEM) images revealed that double-walled microspheres comprising of Glu-PLGA and PLGA with a mass ratio of 1:1 have a spherical shape and smooth surfaces. A statistically significant increase in the encapsulation efficiency ($82.52\% \pm 3.28\%$) was achieved when 1% (w/v) polyvinyl alcohol (PVA) and 2.5% (w/v) trehalose were incorporated in the internal and external aqueous phase, respectively, during emulsification. Double-walled microspheres prepared together with excipients (PVA and trehalose) showed a better control release of lysozyme. The released lysozyme was fully bioactive, and its structural integrity was slightly affected during microspheres fabrication and in vitro release studies. Therefore, double-walled microspheres made of Glu-PLGA and PLGA together with excipients (PVA and trehalose) provide a controlled and sustained release for lysozyme. © 2017 by the authors. Licensee MDPI, Basel, Switzerland.

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Controlled release Double-walled microspheres Drug delivery Poly(lactide-coglycolide) Therapeutic proteins

Indexed keywords

Engineering controlled terms:

Controlled drug delivery Drug delivery Drug products Efficiency Emulsification Encapsulation Enzymes Proteins Scanning electron microscopy Structural integrity

Compendex keywords

Controlled release Double-walled microspheres Emulsion solvent evaporation Lactides Poly (vinyl alcohol) (PVA) Poly-lactide-co-glycolide Scanning electron microscopy image Therapeutic protein

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🔍 Rahman, M.M.; Faculty of Pharmacy, International Islamic University Malaysia, Kuantan, Malaysia;
email:mokrahman@unisza.edu.my

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