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Electro-hydrodynamic assisted synthesis of lecithin-stabilized peppermint oil-loaded alginate microbeads for intestinal drug delivery

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Abstract

Peppermint oil (PO) is the most prominent oil using in pharmaceutical formulations with its significant therapeutic value. In this sense, this oil is attracting considerable attention from the scientific community due to its traditional therapeutic claim, biological and pharmacological potential in recent research. An organic solvent-free and environment-friendly electrohydrodynamic assisted (EHDA) technique was employed to prepared PO-loaded alginate microbeads. The current study deals with the development, optimization, in vitro characterization, in vivo gastrointestinal tract drug distribution and ex-vivo mucoadhesive properties, antioxidant, and anti-inflammatory effects of PO-loaded alginate microbeads. The optimization results indicated the voltage and flow rate have a significant influence on microbeads size and sphericity factor and encapsulation efficiency. All these optimized microbeads showed a better drug release profile in simulated intestinal fluid (pH 6.8) at 2 h. However, a minor release was found in acidic media (pH 1.2) at 2 h. The optimized formulation showed excellent mucoadhesive properties in ex-vivo and good swelling characterization in intestine media. The microbeads were found to be well distributed in various parts of the intestine in in vivo study. PO-loaded alginate microbeads similarly showed potential antioxidant effects with drug release. The formulation exhibited possible improvement of irritable bowel syndrome (IBS) in MO-induced rats. It significantly suppressed proinflammatory cytokines, i.e., interleukin- IL-1β, and upregulated anti-inflammatory cytokine expression, i.e., IL-10. It would be a promising approach for targeted drug release after oral administration and could be considered an anti-inflammatory therapeutic strategy for treating IBS. © 2021 Elsevier B.V.

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Electrohydrodynamic; Emulsion; GIT distribution; Microencapsulation; Peppermint oil

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