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Polymer-lipid hybrid nanoparticles as enhanced indomethacin delivery systems

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Abstract

Non-steroidal anti-inflammatory drugs (NSAIDs), i.e. indomethacin used for rheumatoid arthritis and non-rheumatoid inflammatory diseases, are known for their injurious actions on the gastrointestinal (GI) tract. Mucosal damage can be avoided by using nanoscale systems composed by a combination of liposomes and biodegradable natural polymer, i.e. chitosan, for enhancing drug activity.

Aim of this study was to prepare chitosan-lipid hybrid delivery systems for indomethacin dosage through a novel continuous method based on microfluidic principles. The drop-wise conventional method was also applied in order to investigate the effect of the two polymeric coverage processes on the nanostructures features and their interactions with indomethacin. Thermal-physical properties, mucoadhesiveness, drug entrapment efficiency, in vitro release behavior in simulated GI fluids and stability in stocking conditions were assayed and compared, respectively, for the uncoated and chitosan-coated nanoliposomes prepared by the two introduced methods.

The prepared chitosan-lipid hybrid structures, with nanometric size, have shown high indomethacin loading (about 10 %) and drug encapsulation efficiency up to 99 %. TEM investigation has highlighted that the developed novel simil-microfluidic method is able to put a polymeric layer, surrounding indomethacin loaded nanoliposomes, thicker and smoother than that achievable by the drop-wise method, improving their storage stability. Finally, double pH tests have confirmed that the chitosan-lipid hybrid nanostructures