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Hollow porous nanocapsules: Sustained delivery of immunomodulatory drugs and adjuvant properties for the effective management of various infectious or tumor diseases

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Significant efforts have been made over recent years to design suitable delivery materials for efficient loading as well as the controlled/sustained release of drugs. Out of various materials which have been exported, polymeric colloidal particles/nanocapsul es are of particular interest in which drug can be encapsulated through absorption/conjugation onto the surfaces or in the void space of the same. Their biocompatibility and degradability, nontoxic and the ability to facilitate sustained release of drugs, have attracted significant rese arch interest as potential drug carriers over metal or inorganic, non-biodegradable nanoparticles as drug delivery systems. Different types of polymers; both synthetic and natural have been utilized in the preparation of nanocapsules Polymeric hollow nanocapsules have attracted significant research interest as novel drug carriers and their preparation is of particular concern for their feasibility to encapsulate a broad range of drug molecules. This work presents for the first time the synthesis and development of a novel poly-N-acryloyl L-phenylalanine methylester hollow core nanocapsules (NAPA-HPN's) of Avg. size ca. 100-150 nm prepared by mini-emulsion technique. NAPA-HPN's are biocompatible and capable of encapsulating sodium nitro prusside (SNP) at a rate of ~1.3 µM per mg of capsules. These NAPA-HPN's + SNP nano-formulations while maintaining homeostasis of macrophages which carries and facilitate the action of various drug molecules used against the various diseases. These NAPA-HPN's also facilitated the prolonged release of the low level of Nitric oxide(NO) and enhanced metabolic activities of pro-inflammatory macrophages which are important for the action of various drugs in body fluids. NAPA-HPN's mediated skewing of native macrophages toward M1 phenotype potentially demonstrated its adjuvant action on the innate immune system. These results potentially suggested that NAPA-HPN'scan serve both as a carrier of the drugs as well as an adjuvant for the immune system. Thus, these nanocapsules could be used for the effective management of various infectious or tumor diseases where immune-stimulation is paramount for treatment.

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