CEFOTAXIME-LOADED CHITOSAN NANOPARTICLES TO OVERCOME ANTIBIOTIC-RESISTANCE

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The complex membrane structure of Gram-negative bacteria presents a considerable barrier to the entry and action of anti-infective agents, and is partly responsible for mediating the growing level of Gram negative resistance to antibiotics. Nanotechnology can be considered as an effective solution to enhance anti-infective trafficking across the bacterial cell envelope. Carriers made of chitosan (CHT) have attracted interest due to the biodegradable and biocompatible nature of this material, as well as its intrinsic antimicrobial activity.
The aim of this study was to manufacture blank and loaded chitosan nanoparticles (CHT NPs) containing cefotaxime, a third-generation cephalosporin antibiotic, using the NanoAssemblr™ bench-top instrument. This is an innovative, microfluidics-based platform for the production of particulate delivery systems. To prepare CHT NPs, chitosan and TPP (tripolyphosphate), were dissolved in 1% acetic acid and distilled water respectively at desired concentrations. Taguchi design L18 orthogonal array, constructed through Minitab 16 Statistical Software®, was used to determine the optimum blank formulation in terms of size, PDI (polydispersity index) and charge. Different amounts of cefotaxime were added to the TPP and chitosan solution to manufacture cefotaxime-loaded CHT NPs followed by characterization in terms of size and PDI. Encapsulation efficiency (EE%) of loaded-NPs was measured using HPLC. Results indicated particle sizes of less than 100 nm and a low PDI for the blank formulation, with no significant differences for the cefotaxime-loaded NPs. EE% of cefotaxime within nanoparticles ranged from approximately 5%, when the smallest amount of drug was added to CHT solution, to approximately 15% when the highest amount of drug was added to the TPP solution. The study showed that CHT NPs can be easily manufactured in the nanometer size range using microfluidics technology. Moreover, it is possible to encapsulate cefotaxime within nanocarriers, allowing the manufacture of nanoparticles in a fast and reproducible way.

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