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Nanoparticles Made of Amino Acid Derived Biodegradable Polymers as Promising Drug Delivery Containers

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Abstract : Polymeric disperse systems such as nanoparticles (NPs) are of high interest for numerous applications in contemporary medicine and nanobiotechnology to a considerable potential for treatment of many human diseases. The important technological advantages of NPs usage as drug carriers (nanocontainers) are their high stability, high carrier capacity, feasibility of encapsulation of both hydrophilic or hydrophobic substances, as well as a high variety of possible administration routes, including oral application and inhalation. NPs can also be designed to allow controlled (sustained) drug release from the matrix. These properties of NPs enable improvement of drug bioavailability and might allow drug dosage decrease. The targeted and controlled administration of drugs using NPs might also help to overcome drug resistance, which is one of the major obstacles in the control of epidemics. Various degradable and non-degradable polymers of both natural and synthetic origin have been used for NPs construction. One of the most promising for the design of NPs are amino acid-based biodegradable polymers (AABBPs) which can clear from the body after the fulfillment of their function. The AABBPs are composed of naturally occurring and non-toxic building blocks such as α-amino acids, fatty diols and dicarboxylic acids. The particles designed from these polymers are expected to have an improved bioavailability along with a high biocompatibility. The present work deals with a systematic study of the preparation of NPs by cost-effective polymer deposition/solvent displacement method using AABBPs. The influence of the nature and concentration of surfactants, concentration of organic phase (polymer solution), and the ratio organic phase/inorganic(water) phase, as well as of some other factors on the size of the fabricated NPs have been studied. It was established that depending on the used conditions the NPs size could be tuned within 40-330 nm. At the next step of this research was carried out an evaluation of biocompability and bioavailability of the synthesized NPs using a stable human cell culture line – A549. It was established that the obtained NPs are not only biocompatible but they stimulate the cell growth.

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