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Novel magnetic delivery systems for platinum anticancer drugs

Lamis Refaat and Tamer Shoeib

The American University in Cairo, Egypt

Carboplatin's success in the treatment of major types of cancer has been attributed to its ease of administration and its high therapeutic index. However, despite its superior toxicity profile, myelosuppression remains to be its dose-limiting side effect. Liposomes have been researched extensively as carrier systems for therapeutic agents; their high biocompatibility, their ability to escape the immune system and most importantly their ability to incorporate both hydrophobic and hydrophilic drugs led to numerous liposomal formulations being designed for cancer therapy. Magnetic nanoparticles have been gaining attention as their properties enable them to be used in various therapeutic and diagnostic applications, in addition to gene and drug delivery. We report the successful preparation of magnetic liposomal formulation with particle size less than 200 nm, coated with Polyethylene Glycol, encapsulating superparamagnetic magnetite nanoparticles and carboplatin in its aqueous lumen. Two types of liposomes were prepared through thin film hydration technique; magnetite liposome and carboplatin-magnetite liposome with mean particle sizes of 183.3 ± 2.651 nm and 192.5 ± 3.427 nm respectively. Both formulations showed uniform particle size distribution and sterical stability as evident from their polydispersity index and Zeta-potential values. Encapsulation efficiency of magnetite in magnetite liposomal formulation was 61.37%, this value decreased significantly upon incorporation of carboplatin with magnetite in the second formulation. Carboplatin's EE% was found to be 13.87%, its release profile from the liposome showed a controlled release over the course of 72 hours. The prepared formulations have been successfully magnetically controlled and currently the magnetic gradient and input current strength are being manipulated in order to determine the optimum velocity of particles in the desired media. Additionally, *in vitro* tests performed on melanoma and mammary cell lines showed significant superior cytotoxicity profile of carboplatin-magnetite liposome over free carboplatin solution.