PREPARATION OF MAGNETIC Fe3O4 NANO PARTICLES MESOPOROUS SILICA SPHERES AND THE APPLICATION IN DRUG TARGETING

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Abstract: Magnetic nanoparticles with uniform size distribution were used in both in-vivo and in-vitro biomedicines, which should be biocompatible and nontoxic, and also should provide a large amount of surface functional groups suitable for biomolecule coupling. Therefore, Magnetic nanoparticles have been the focus of many researchers because of their possible applications in biomedicine. The latter includes aspects such as magnetic bioseparations, hyperthermia of tumors, retinal detachment therapy, enhancement of contrast agents for magnetic resonance imaging, and drug carriers design. Magnetic nanoparticles as drug delivery vectors provide the ability to selectively target the desired organs or tissues inside the body, as well as accumulate a certain concentration of nanoparticles along the therapy path by means of the application of an external magnetic field. CPT is a potent antitumor alkaloid extracted from the Chinese tree Camptotheca acuminata. The antitumor mechanism of the compound is based on the irreversible inhibition of deoxyribonucleic acid (DNA) topoisomerase I (TOPO I). However, clinical use of CPT was discontinued due to its high toxicity, and water-soluble 10-Hydroxycamptothecin was developed. HCPT can exist in two forms (Fig. 1): carboxylate and lactone. At pH less than 4, HCPT structure predominates. At more alkaline pH, lactone form can transfer to carboxylate form by the reversible hydrolysis. Recently, clinical research has shown that lactone form of the HCPT has stronger bioactivity than the carboxylate form of HCPT. In report, we succeed in preparing the mixture of magnetic Fe3O4 nanoparticles and 10-HCPT which was encapsuled into SiO2 (Fig.2), which displayed greater efficacy compared to free HCPT. The form of the HCPTs exhibit enhanced intracellular drug accumulation, improved drug solubility and reduced unwanted side-effects.

Figure 1: The conversion of the lactone form to the carboxylate form of HCPT occurs under different pH values.

Figure 2: The prepared illustration of magnetic SiO2 with 10-HCPT

Keyword: magnetic Fe3O4, 10-hydroxylactone; SiO2 nanoparticles; lactone form of HCPT; the carboxylate of HCPT

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