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Au-$MnFe_2O_4$ nano-flotillas as a cargo for cancer cells drug delivery

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Medical scientists are exploring novel materials for efficient designing of drug delivery vehicles. Iron oxide Nanoparticles (IoNP) were undoubtedly considered as an efficient flotilla for endocytosis and targeted delivery of drugs inside larynx carcinoma cells. The engineering of such a biomedical (IoNP) platform comprised of an inorganic nanoparticle core and a biocompatible surface coating that provides stabilization under physiological conditions. This modular design enables IoNPs to perform multiple functions simultaneously, such as in multimodal imaging, drug delivery and real-time monitoring, as well as combined therapeutic approaches. The ability of IoNPs to enhance proton relaxation of specific tissues and serve as MR imaging contrast agents is one of the most promising applications of nanomedicine. In the present work, Au-$MnFe_2O_4$ nanoparticles are used as able paraphernalia for the docking of anti-cancer drug such as Doxorubicin (DOX) using folic acid (FA) as a linker for the attachment. The attachment could be monitored using UV-visible spectroscopy. HAADF-STEM and line mapping confirms the formation of core-shell structure. SQUID confirms the core-shell nanostructure is highly superparamagnetic. The stability of Au-$MnFe_2O_4$ nanoparticles was scrutinized by measuring the zeta potential measurements, which was found to be in the range of -5 to -40 at 3 different pH. The amalgamation of the drug along with activated folic acid as a navigational molecule is the critical phase for targeted drug delivery. Attachments were verified using FTIR which confirmed the formation of non-covalent interactions. The drug loading capacity of the Au-$MnFe_2O_4$ was found to be more than 90%. Drug-release was carried out at 3 different pH like 5.4, 6.8 & 7.4 and found that at pH 5.4 & 6.8 the release is maximum which is favourable for cancer cell treatment. Au-$MnFe_2O_4$-FA-DOX complex was found to be non-toxic for normal cells and considerably toxic for Hep2 cells detected by confocal microscopy and MTT assay.

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