J Nanomedine Biotherapeutic Discov, Volume: 08
DOI: 10.4172/2155-983X-C1-003

Controlled and targeted drug delivery systems using nano-magnetic base polyurethane polymers

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Polyurethanes have great variety of physical and chemical properties due to their different building blocks in their structure which make them possible for different biomedical and pharmaceutical applications. The most important application of these polymers is as a biocompatible, smart and controllable drug carrier which directs the anticancer drugs sufficiently to the cancerous cells for solving the problem of inadequate drug cargo with fewer side effects to the cancerous tissue cells. In this article, a kind of new drug delivery system is introduced which is smart controllable (pH-sensitive) multifunctional magnetic polyurethane (SCMMP) nanocomposite composed of isocyanate as a main chain and cyclodextrin as a chain extender with the magnetic nano particles in their structure. Then consequently, the bulk structure, size and morphology and magnetic characteristic of the synthetic nanocomposite was characterized through different accepted analytical techniques such as FT-IR, TGA, XRD, TEM, SEM, DLS and VSM respectively. The SCMMP was used for loading two effectives currently used pharmaceutical cancer agents of methotrexate and doxorubicin with high loading efficiency of 87% and 89% respectively. Dual drug loaded nanocomposite release behavior was investigated in three different pH values of 4.5, 5.4 and 7.4. According to the concentration profile, low release percentage in the pH of 7.4 for long term circulation and good stability in blood stream and high release in pH of 4.5 and 5.4 for improving vast variety of cancerous cells in physiological media were observed. Thereupon, new drug carrier system has great efficacy for cancer therapy. The MTT calorimetric method was used to track the presented nanocomposite eligibility as a polymer based drug delivery system. Different cellular tests of MTT assay, DAPI staining, cellular uptake and cell cycle was done on Nanocomposite/DOX/MX combination versus free DOX/MX to validate it as a nanocarrier. Biocompatibility of the nanocarrier was done using hemolysis assay through checking on human red blood cells (HRBCs) with very fine results. According to the results, introduced system is very effectible one for delivering synchronous therapeutic agents of DOX and MX to the cancerous cells and on other hand for *in vivo* usage in the future.

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