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## 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 different building blocks in their structure which makes it possible to be used 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 new drug delivery system is introduced which is a smart, controllable (pH-sensitive), multifunctional, magnetic polyurethane (SCMMP) nano composite composed of isocyanate as a main chain and cyclodextrin as a chain extender with magnetic nano particles in their structure. Then consequently, the bulk structure, size and morphology and magnetic characteristic of the synthetic nano-composite 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 effects, currently used pharmaceutical cancer agents of metatroxate and doxorubicin with high loading efficiency of 87% and 89%, respectively. Dual drug loaded nano composite release behaviour was investigated in three different pHs 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 systems have great efficacy for cancer therapy. The MTT calorimetric method was used to track the presented nano composite eligibility as a polymer based drug delivery system. Different cellular tests of MTT assay, DAPI staining, cellular uptake and cell cycle was done on Nano composite/DOX/MX combination vs. free DOX/MX to validate it as a nano carrier. Biocompatibility of the nano carrier was done using hemolysis assay through checking on human red blood cells (HRBCs) with very fine results. According to the results, the introduced system is very effective in delivering synchronous therapeutic agents of DOX and MX to the cancerous cells and on other hand for *in vivo* usage in the future.

### Recent Publications

1. Cherg J Y, et al. (2013) Polyurethane-based drug delivery systems. International Journal of Pharmaceutics 450(1):145–162.
2. Wang A, et al. (2013) Temperature-and pH-responsive nanoparticles of biocompatible polyurethanes for doxorubicin delivery. International Journal of Pharmaceutics 441(1–2):30–39.
3. Zhou L, et al. (2011) Synthesis and characterization of pH-sensitive biodegradable polyurethane for potential drug delivery applications. Macromolecules 44(4):857–864.
4. Mitsumata T and S Ohori (2011) Magnetic polyurethane elastomers with wide range modulation of elasticity. Polymer Chemistry 2(5):1063–1067.
5. Zhou J and H Ritter (2010) Cyclodextrin functionalized polymers as drug delivery systems. Polymer Chemistry 1(10):1552–1559.

### Biography

Jafari S received her Master's Degree in Analytical Chemistry from the University of Tabriz and is currently pursuing her Doctorate of Chemistry in the Analytical Area at Imam Khomeini International University. In addition to her Master's Degree, she has well travelled during her schooling and as such has acquired a wide range of different chemistry techniques. With this experience, she gleaned and culminated a wide scope of techniques to develop a novel method for targeting various cancers efficiently with relatively low costs as compared to customized patient medicines. With a generic customized cancer drug delivery system as described in her work, a new field of focus is presented that can make large strides in the fight against breast cancer.

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