Preparation and in-vitro evaluation of Polylactic glycolic acid/Polylactic glycolic acid- Polyethylene glycol magnetic nanoparticles containing Methotrexate

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Abstract:
Magnetic nanoparticles are used in medicine as drug delivery, imaging and therapeautic systems. Poly(lactic glycolic acid) (PLGA) is a biodegradable polymer that can be conjugated with poly(ethylene glycol (PEG) to prolong the circulation time. In this study, magnetic nanoparticles and the antineoplastic drug, Methotrexate, encapsulated into PLGA/PLGA-PEG nanoparticles and their effects evaluated on MCF-7 breast cancer cell line.

PLGA-PEG copolymer synthesized via chemical conjugation. Methotrexate loaded magnetic PLGA/PLGA-PEG nanoparticles prepared by simple nanoprecipitation method. Properties of nanoparticles characterized using 1HNMR, FTIR, DSC and VSM. Then, In-vitro release (at pH 5.4 and 7.4) and toxicity effect of nanoparticles evaluated by MTT test using MCF-7 cell line.

PLGA and PLGA-PEG magnetic nanoparticles can load about 70 and 80% of Methotrexate, respectively. The amount of Methotrexate released from PLGA-PEG was higher than PLGA after 72 hours (90% compared to 50%) at pH 5.4 and 7.4. In pH 5.4, both PLGA and PLGA-PEG nanoparticles showed higher release (7 folds) in comparison with pH 7.4. Nanoparticles remain their magnetic properties after encapsulation in copolymeric particles. MTT in-vitro cytotoxicity study assay showed that non-drug nanoparticles had no cytotoxicity and were biocompatible, but Methotrexate loaded nanoparticles had dose and time-dependent cytotoxicity against MCF-7 cells.

Present work shows that PLGA/PLGA-PEG magnetic nanoparticles can be used as potential delivery system for biomedical applications. However, PLGA-PEG nanoparticles have better in-vitro properties than PLGA nanoparticles. Further in-vivo studies are required to investigate further aspect of these particles.

Keyword: Methotrexate, PLGA/PLGA-PEG Magnetic nanoparticle, MCF-7 cell line.