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Drug release behavior for magnetite nanoparticle loaded with Tamoxifen citrate for drug delivery application

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Abstract. Statistic shows that 23 % of all cancers diagnosed in women are breast cancer. Hence, it is crucial to develop the treatment for breast cancer patient. Since 30 years ago, tamoxifen (TAM) has been used for treating estrogen receptor (ER)-positive breast cancer. Nonetheless TAM if used at high concentration can caused adverse effect such as thromboembolic events and endometrial cancer. So, by reducing the TAM doses its toxicity can be overcome. Therefore, TAM was introduce to targeted drug delivery system to increase tissue selectivity and improve its toxicity profile by using magnetite nanoparticles (MNP) as an anti-cancer drug carrier because of its biocompatibility, ultrafine size, and its superparamagnetic nature. MNP were synthesized via the co-precipitation method. Afterward, it was coated with oleic acid to improve the stability of the MNPs. MNP was conjugated with Poly (D,L lactide-co-glycolide acid) (PLGA) and TAM by applying oil in water emulsion evaporation method and was abbreviated as TAM-PLGA-OAMNP. After conjugation of MNP with TAM and PLGA. It was discovered that the size of the TAM-PLGA-OAMNP is 131±28 nm with a magnetic saturation of 8.3096×10-3 emu/g maintaining its superparamagnetic properties. This project further studies the drug loaded and drug release behaviors of the conjugated nanoparticles. The drug load and entrapment efficiency of TAM was determined via the UV-Vis spectroscopy. From the standard curve, TAM inside TAM-PLGA-OAMNPs is 0.1602 ± 0.0239 mg, so the percentage drug loading and percentage entrapment efficicency is around 6 % and 80 % respectively. After that, drug release was conducted for the next 96 hours releasing about 90 % of the drug. The in vitro drug release was fitted with different kinetic models. It was discovered that, the release pattern was best fitted in pseudo-second order R2=0.989. Several work had reported the pseudo-second order kinetic model that occur to PLGA. Therefore, the drug release was subjected to the autocatalysis of PLGA.

Keywords: Magnetic nanoparticle, Tamoxifen citrate, Poly (d,l lactide-co-glycolide) acid, Drug delivery