4311 In Vitro Studies of Ferromagnetic Coils for Implant Assisted Magnetic Drug Targeting

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One of the key problems associated with drug administration is the difficulty to target specific areas or sites in the body, like cancerous tumors or arterial blockage. Typically in these cases, exceedingly large doses of a drug are needed to ensure that some of the drug reaches a specific site, a fact which unavoidably imposes substantial toxic side effects at non-targeted organs. One way to achieve drug targeting in the body is to incorporate magnetic particles into drug carriers and then to retain them at the site using an externally applied magnetic field. This process is referred to as magnetic drug targeting (MDT). However, the main limitation of MDT is that under a given set of conditions an externally applied magnetic field alone may not be able to retain a sufficient number of magnetic drug carrier particles (MDCPs) to justify its use. Such a limitation may not exist if high gradient magnetic implants (HGMIs) are used to assist MDT.

The overall objective of this study was to elucidate whether ferromagnetic stents and high gradient magnetic separation (HGMS) principles can be effective tools in improving the collection MDCPs at a given location of a body; a process that is referred to here as implant assisted MDT. To this end, the magnetic collection of polymeric magnetic particles by a unique ferromagnetic coil under conditions typically found in the human circulatory system was evaluated via in-vitro studies. The coil was located within a 1 mm glass tube and was magnetically energized using an external permanent magnet to achieve magnetic collection of the particles. The velocity (1-100 cm/s) and flow regiment (i.e., steady or pulsatile) of the suspension flow, the external magnetic field strength (0.17-0.65 T), the radius of the coil (50-200 micrometers), and the amount of ferromagnetic material (20-60 wt%) and radius (0.42-1.175 micrometers) of the MDCP surrogates were analyzed, as they are some of the primary variables that affect the collection efficiency of this unique MDT approach. I addition, the implant assisted results were contrasted with those in the absence of either the wire or the external magnet. Overall, the results to be presented will provide considerable insight into the many potential possibilities that such a system brings to targeted drug delivery.