Synthesizing drug-carrying nanocomposite sphere for targeted drug delivery

Janani Sri Gopu*, Bailey Cooper, and Ramazan Asmatulu
Department of Mechanical Engineering, Wichita State University

Magnetic targeting is a promising method of drug localization. Controlled delivery occurs when a drug is associated with a biodegradable polymer and magnetic nanoparticles so the drug molecules are continuously released from the composite structure to the area of interest In this study, drug-carrying magnetic nanocomposite spheres were synthesized using magnetite nanoparticles and poly (D,L-lactide-co-glycolide) (PLGA) for the purpose of magnetic targeted drug delivery. Magnetic nanoparticles (~13 nm on average) of magnetite were prepared by a chemical co-precipitation of ferric and ferrous chloride salts in the presence of a strong basic solution (ammonium hydroxide). An oil-in-oil emulsion/solvent evaporation technique was conducted at 7000 rpm and 1.5-2 hrs agitation for the synthesis of nanocomposite spheres. Specifically, PLGA and drug were first dissolved in acetonitrile (oily phase I) and combined with magnetic nanoparticles, then added drop-wise into viscous paraffin oil combined with Span 80 (oily phase II). Nanocomposite spheres with different contents of magnetite (0%, 10%, 20%, and 25%) were evaluated in terms of particle size, morphology and magnetic properties by using dynamic laser light scattering (DLLS), scanning electron microscopy (SEM), transmission electron microscopy (TEM) and a superconducting quantum interference device (SQUID). The results indicate that nanocomposite spheres (200 nm to 1.1 mmin diameter) are superparamagnetic above the blocking temperature near 40 K and their magnetization saturates above 5,000 degree C at room temperature.