Simulation and Experimental Analysis of Drug Release Rates From Magnetic Nanocomposite Spheres

K. Cluff[1], L. Saeeednia[2], H. Mehraein[1], F. Abedin[2], R. Asmatulu[2]

[1]Department of Bioengineering, Wichita State University, Wichita, KS, USA
[2]Department of Mechanical Engineering, Wichita State University, Wichita, KS, USA

Abstract

Targeted drug delivery systems have been wildly studied in cancer therapy using various chemotherapy drugs. Due to the toxicity of these cancer drugs, it is desired to target them into the tumor site, hence increasing the efficiency and decreasing the overall side effects of the drugs. Nanotechnology has received significant attention in many biomedical applications, such as drug delivery, biosensors, and scaffolding for over 10 years. Nanoparticles can be attached to the small molecules of the drugs and serve as drug carriers to deliver the drug molecules into the area of interest. In this research, polymeric nanocomposite microspheres containing biodegradable poly(D, L-lactide-co-glycolide) (PLGA) were incorporated with magnetic nanoparticles, albumin and therapeutic drugs as a breast cancer treatment system. The drug release behavior of the magnetic microspheres was studied in-vitro. The drug release of the drug loaded microspheres was also simulated in COMSOL Multiphysics® software (Figure 1). PLGA is a biodegradable polymer and its rate of degradation has an important role in the drug release mechanism. The release behavior of the drug from the nanocomposite spheres was simulated in previous studies; however, the effects of degradation were not considered in detail. The results of the simulation showed that the simulation data is in agreement with the experimental data, which may be useful for the future applications of the drug delivery system.

Figures used in the abstract

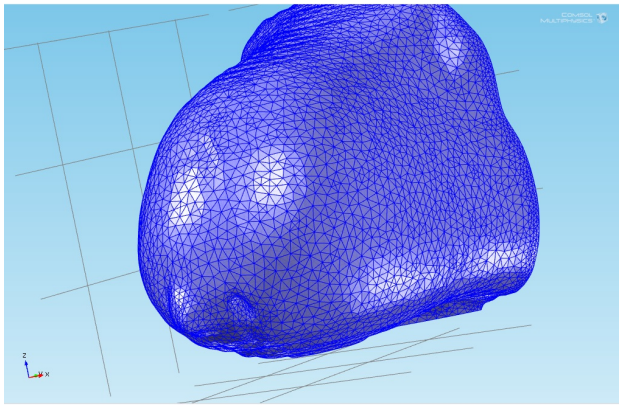

Figure 1: Imported mesh.