Magnetite Synthesis for Drug Delivery Purposes

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Ferrofluids mainly consist of stable colloidal suspensions of nanoscale magnetite (Fe_3O_4) particles. (Magnetite particles can be manipulated through magnets in order to change the solution's location.) They have been suggested to be an effective method for the transport of drug compounds to target organs to treat the central nervous system diseases, prostate, breast and thyroid cancers [4]. To make this possible, it is important to control the size of magnetite nanoparticles according to the pore sizes of target organ membranes, which is critical for permeability of the nanoparticles to target organs. In this context, this research project synthesized ferrofluid samples under different conditions to obtain different magnetite particles sizes, which affect the magnetic response of the liquid as well as permeability of particles to desired membrane pores. Based on a specific synthesis method, Magnetite was synthesized in solution and precipitated as nanoparticles. The preparation of the ferrofluid involves the usage of a surface-active dispersing agent to stabilize and prevent clusters of particles. To control the synthesis conditions, drop rate and stirring speeds of NH_3 solution addition to Fe^{2+}/Fe^{3+} solution were varied to determine their effects on the size of the Magnetite particles. The size of the particles obtained from each synthesis was determined using X-Ray diffraction analysis. The results of the X-Ray diffraction analysis on the synthesized ferrofluids samples representing each condition concluded that drop rates and stirring speeds had a relative impact on the size of the Magnetite particles, which were determined to be, on average, about 4.8 nanometers in diameter.

Awards Won:

University of the Sciences in Philadelphia: Tuition Scholarship of $9,250. per year for four years.