A Novel Zwitterionic Superparamagnetic Iron Oxide Nanoparticle Synthesis

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This project investigates a novel synthesis of superparamagnetic iron oxide nanoparticles (SPIONs) and effective applications thereof. SPIONs are a type of nanoparticle, typically ranging from 20-30 nanometers, which are biologically compatible for a primary application of in vivo cancer targeting. Through the newly proposed and highly effective self assembling zwitterionic micelle synthesis to form a poly(carboxybetaine) capping agent for these nanoparticles, various methods of conjugation involving proteins and ligands were possible. SPION synthesis and conjugation with proteins and ligands is significant as it allows the nanoparticles to target specific cancer cells with excessive membrane proteins. Both the stability and effectiveness of the SPION shell directly affect how well these nanoparticles are able to target tumor cells since degradation and breakdown of the nanoparticles prohibits targeting and attachment to cellular membranes. After release into cell cultures, SPIONs attach to tumor cells and cell membranes take in the SPIONs through endocytosis for discharge into the cell cytoplasm. Using magnetic resonance imaging technology, magnetic waves can be manipulated to initiate magneto spin vibrations that induce heat in carcinogenic tumor cells containing the SPIONs, which will effectively and safely destroy tumor cell regions. The project itself forms a new one pot injection synthesis and specialized purification methods that have been mathematically modeled to find a direct relation between the ratio of shell to core compound of the SPIONs and the radius of the produced SPIONs, proving optimum synthesis results.

Awards Won:
Third Award of $1,000