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Synthesis and functionalization of ferrite magnetic beads for bioseparation and biosensing applications

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The biosensing platforms have potential applications in the diagnosis of disease as sensitive, durable, portable and inexpensive systems. The use of Ferrite Magnetic Beads (FMBs) in biosensors for high-performance clinical diagnosis is gaining popularity due to their low toxicity and ability to be manipulated by an external magnetic field. FMB-based biosensors necessarily involve well-tuned magnetic beads, which consist of a ferrite core, as biolabeling, bioseparation, and biodetection probes in order to generate significant and precise biological signals and also separate analytes for further detection of diseases. In this study, FMBs will be synthesized through chemical routes and functionalized as a bioseparation material. Functionalization of MNPs not only ensures the integrity of FMBs in solution but also prevents interparticle reactions and agglomeration. For producing functionalized MNPs, silica will be used, which allows the binding of biological or other ligands to the surface of NPs. We'll make particles with a variety of sizes, surface charges and coatings, then evaluate their biomolecule binding affinity. The aim of the project is to isolate blood-borne pathogens from human plasma via using aptamer-modified and silica-coated FMBs integrated into a biosensor system that integrates processes such as separating, mixing, detecting biomolecules in a single piece of platform. The proposed project would build on previous studies in this area by evaluating the properties of FMBs that would maximize iron oxide nanoparticle Finally, we also aim to eliminate the stability problems by effectively functionalizing iron oxide nanoparticles and developing effective and orderly magnetic micro/nano-assembly structures.

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