A Novel and Efficient Method for the Synthesis of Fe-TiO2 Nanoparticles for Enrichment of Phosphorylated Proteins

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Objective: There are currently not many efficient methods for enrichment of phosphorylated proteins in complex biological samples. However, phosphoproteins play a significant role in several cellular processes such as signal transduction. The objective of this experiment is to fabricate superparamagnetic titania nanoparticles in a water based solution which are efficient and selective in phosphoprotein enrichment. Methods/Materials: Titania nanoparticles in a water based solution were fabricated in a modified sol gel process. The titania was made superparamagnetic by cation exchange with iron. These titania nanoparticles were then loaded into a solution of phosphoproteins and nonphosphorylated proteins. The proteins adsorbed by the nanoparticles were separated from the supernatant using an external magnetic field, and they were then eluted from the titania using ammonium hydroxide. Both the adsorbed proteins and the proteins in the supernatant were put in a matrix of sinapinic acid and were analyzed using MALDI-TOF. Results: The titania nanoparticles were shown to be selective in enrichment. The mass spectra of the adsorbed proteins had a peak for beta-casein, which was the phosphoprotein in the protein sample. The mass spectra of the proteins in the supernatant had peaks for beta-lactoglobulin and horseradish peroxidase, which are nonphosphorylated proteins. Conclusions: The ability to synthesize superparamagnetic titania nanoparticles in a water based solution which are selective in phosphoprotein enrichment allows phosphorylated proteins to easily be characterized, which can reveal more information about many cellular processes, including the regulation of enzyme activity. Phosphoproteins may also have applications in cancer diagnosis and in dentistry.

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