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Functionalized Magnetic Iron Oxide Nanoparticles for Extraction of Protein and Metal Nanoparticles from Complex Fluids

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Abstract : Magnetic nanoparticles have received incredible importance in view of their diverse applications, which arise primarily due to their response to the external magnetic field. The magnetic behaviour of magnetic nanoparticles (NPs) helps them in numerous different ways. The most important amongst them is the ease with which they can be purified and also can be separated from the media in which they are present merely by applying an external magnetic field. This exceptional ease of separation of the magnetic NPs from an aqueous media enables them to use for extracting/removing metal pollutants from complex aqueous medium. Functionalized magnetic NPs can be subjected for the metallic impurities extraction if are favourably adsorbed on the NPs surfaces. We have successfully used the magnetic NPs as vehicles for gold and silver NPs removal from the complex fluids. The NPs loaded with gold and silver NPs pollutant fractions has been easily removed from the aqueous media by using external magnetic field. Similarly, we have used the magnetic NPs for extraction of protein from complex media and then constantly washed with pure water to eliminate the unwanted surface adsorbed components for quantitative estimation. The purified and protein loaded magnetic NPs are best analyzed with SDS Page to not only for characterization but also for separating the protein fractions. A collective review of the results indicates that we have synthesized surfactant coated iron oxide NPs and then functionalized these with selected materials. These surface active magnetic NPs work very well for the extraction of metallic NPs from the aqueous bulk and make the whole process environmentally sustainable. Also, magnetic NPs-Au/Ag/Pd hybrids have excellent protein extracting properties. They are much easier to use in order to extract the magnetic impurities as well as protein fractions under the effect of external magnetic field without any complex conventional purification methods.

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