Preparation of Fe_3O_4@metal-silicate core-shell nanospheres for His-tagged protein separation

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Separation of His-tagged protein taking advantage of immobilized-metal affinity chromatography (IMAC) or using magnetic nanoparticles attracted enormous interests in the exact purification of the recombinant protein, but the selection of optimized metal ion has been reported infrequently. Including histidine, each amino acid exhibits different affinity or specificity with diverse metal ion so that the selection of suitable metal ion can be an important issue. Herein, we successfully synthesized Fe_3O_4@metal-silicate core-shell nanospheres doped with diverse metal ion, Mn^{2+}, Co^{2+}, Ni^{2+} and Cu^{2+}. Sea urchin shaped (spiky) sparse metal-silicate covered super-paramagnetic nanospheres provided effective protein binding sites to which enabled efficient metal affinity attachment of His-tagged protein resulting in rapid separation as well as convenient application of external magnetic field. In addition, detachment of His-tagged protein was available using excess imidazole solution and Fe_3O_4@metal-silicate nanospheres could be reusable. Finally, we reported comparison study of His-tagged protein purification efficacy according to various metal ion types.