Immobilization of His-tagged dual ring-fission oxygenases on nickel (Ⅱ) ion functionalized silica-magnetic nanoparticles for complete degradation of phenol

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In some bacteria, biodegradation of phenol occurs with ring fission processes by mono- and di-oxygenases. This study shows an indirect method of protein immobilization by using Ni(Ⅱ) ion for specific interaction of metal-protein to conduct stable and renewable biocatalysts for complete phenol degradation. For this, silica-coated Fe_3O_4 magnetic nanoparticles(Si-MNPs) were functionalized with Ni(Ⅱ) ion (Ni/Si-MNPs) to immobilize histidine-tagged dual ring-fission oxygenases which are phenol-monooxygenase(PMO)and catechol 1,2-dioxygenase (CatA) originated from *Corynebacterium glutamicum*. After immobilization on the Ni/Si-MNPs, the apparent K_m for the PMO and CatA were increased than free enzymes. The recyclability of immobilized enzymes was ~70% after recycling it up to six times. This approach also enabled us to develop the sequential removal process of phenol via catechol degradation indicating the applications in aquatic environments.