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Inulinase Immobilization on Functionalized Magnetic Nanoparticles Prepared with Soy Protein Isolate Conjugated Bovine Serum Albumin for High Fructose Syrup Production

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Abstract : Inulinase from Aspergillus niger was covalently immobilized on magnetic nanoparticles (MNPs/Fe₃O₄) covered with soy protein isolate (SPI/Fe₃O₄) functionalized by bovine serum albumin (BSA) nanoparticles. MNPs are promising enzyme carriers because they separate easily under external magnetic fields and have enhanced immobilized enzyme reusability. As MNPs aggregate simply, surface coating strategy was employed. SPI functionalized by BSA was a suitable candidate for nanomagnetite coating due to its superior biocompatibility and hydrophilicity. Fe₃O₄@SPI-BSA nanoparticles were synthesized as a novel carrier with narrow particle size distribution. Step by step fabrication monitoring of Fe₃O₄@SPI-BSA nanoparticles was performed using field emission scanning electron microscopy and dynamic light scattering. The results illustrated that nanomagnetite with the spherical morphology was well monodispersed with the diameter of about 35 nm. The average size of the SPI-BSA nanoparticles was 80 to 90 nm, and their zeta potential was around −34 mV. Finally, the mean diameter of fabricated Fe₃O₄@SPI-BSA NPs was less than 120 nm. Inulinase enzyme from Aspergillus niger was covalently immobilized through gluteraldehyde on Fe₃O₄@SPI-BSA nanoparticles successfully. Fourier transform infrared spectra and field emission scanning electron microscopy images provided sufficient proof for the enzyme immobilization on the nanoparticles with 80% enzyme loading.

Keywords : high fructose syrup, inulinase immobilization, functionalized magnetic nanoparticles, soy protein isolate
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