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Lipase -based on starch material as a development matrix with magnetite cross-linked enzyme aggregates and its application

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ABSTRACT

The Fe_3O_4 magnetic nanoparticles were prepared by precipitating ferrous ion (Fe^{2+}) and ferric ion (Fe^{3+})in alkaline solution. The Fe_3O_4 magnetic nanoparticles were modified by tannic acid. After functionalization process, two methods were used to immobilize Lipase on Fe_3O_4 magnetic nanoparticles. In the first method, novel tannic acid magnetic cross-linked enzyme aggregates of lipase (TA-MNPs-CLEAs) were synthesized by cross-linking of lipase aggregates and starch as co-feeder with Fe_3O_4 magnetic nanoparticles improved by tannic acid (TA-MNPs). In the second method, the lipase was successfully immobilized on the surface of TA-MNPs. The properties of Fe_3O_4 and its modified forms were examined by Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), vibrating sample magnetometer (VSM), scanning electron microscopy (SEM) and zeta potential measurements. Novel TA-MNPs-lipase and TA-MNPs-CLEAs-starch-lipase were enhanced and provided an effective method to improve the activity and stability of lipase for biodiesel production. Using 1% TA-MNPs-lipase and TA-MNPs-CLEAs-starch (w/w of oil) conversions around 67.87, and 85.88%, respectively, were obtained at 40˚C after 2 h of reaction. Furthermore, the immobilized enzyme was easily recovered from the reaction mixture and reused. The obtained results suggest that TA-MNPs-lipase and TA-MNPs-CLEAs-starch-lipase can become a powerful biocatalyst for biodiesel production.

Keywords: magnetic cross-linked enzyme aggregates; lipase and enzyme immobilization.

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