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Cellulase Enzyme Immobilization on Magnetic Nanoparticles for Clean Sugar Production from Cellulose

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Extended Abstract

The main objective of the present work is to develop stable enzyme-magnetic nanoparticle immobilization for potential application in clear sugar production. The pure cellulase was immobilized on Fe3O4 magnetic nanoparticles by covalent binding using gluteraldehyde. The cellulase enzyme showed 85% of binding efficiency with functionalized nanoparticles. Free and immobilized enzyme was characterized by NTA, Zeta potential, FTIR and TEM techniques. In enzymatic hydrolysis of cellulose, immobilized enzyme showed superior catalytic activity compared to free enzyme. In first cycle, immobilized enzyme hydrolyzed more than 50% of cellulose in 12 hours and after 48 hours it reached up to 98%. On the contrary, free enzyme hydrolyzed only 33% and 69% of cellulose in 12 and 48 hours respectively. In second cycle (reuse) of immobilized enzymes, 31% of cellulose was hydrolyzed in 48 hours. Again immobilized enzyme separated from hydrolysate and reuse for third cycle of hydrolysis process in which immobilized enzyme hydrolyzed about 15% of cellulose in 48 hours of process. The results confirmed that immobilized enzyme maintained its stability with more than 28 and 15% of activity respectively even in second and third cycle. This research will be very useful for biofuel production because of high binding efficiency and admirable reusability of immobilized enzyme, which leads to the cost- effective production of sugar from sugarcane bagasse.

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