World Academy of Science, Engineering and Technology
International Journal of Biotechnology and Bioengineering
Vol:12, No:12, 2018

Magnetic Cellulase/Halloysite Nanotubes as Biocatalytic System for Converting Agro-Waste into Value-Added Product

Authors : Devendra Sillu, Shekhar Agnihotri

Abstract : The 'nano-biocatalyst' utilizes an ordered assembling of enzyme on to nanomaterial carriers to catalyze desirable biochemical kinetics and substrate selectivity. The current study describes an inter-disciplinary approach for converting agriculture waste, sugarcane bagasse into D-glucose exploiting halloysite nanotubes (HNTs) decorated cellulase enzyme as nano-biocatalytic system. Cellulase was successfully immobilized on HNTs employing polydopamine as an eco-friendly crosslinker while iron oxide nanoparticles were attached to facilitate magnetic recovery of material. The characterization studies (UV-Vis, TEM, SEM, and XRD) displayed the characteristic features of both cellulase and magnetic HNTs in the resulting nanocomposite. Various factors (i.e., working pH, temp., crosslinker conc., enzyme conc.) which may influence the activity of biocatalytic system were investigated. The experimental design was performed using Response Surface Methodology (RSM) for process optimization. Analyses data demonstrated that the nanobiocatalysts retained 80.30% activity even at elevated temperature (55°C) and excellent storage stabilities after 10 days. The repeated usage of system revealed a remarkable consistent relative activity over several cycles. The immobilized cellulase was employed to decompose agro-waste and the maximum decomposition rate of 67.2 % was achieved. Conclusively, magnetic HNTs can serve as a potential support for enzyme immobilization with long term usage, good efficacy, reusability and easy recovery from solution.

Keywords : halloysite nanotubes, enzyme immobilization, cellulase, response surface methodology, magnetic recovery
Conference Title : ICBB 2018 : International Conference on Biotechnology and Bioengineering
Conference Location : Bangkok, Thailand
Conference Dates : December 13-14, 2018