Lignocellulose plant biomass being the most copious renewable energy reservoir on earth has shown the potential to be utilized for production of various high value commodities. For the proper utilization of this biomass, enzyme saccharification is one of the most significant and highly accepted procedure. However, its use is limited due to the resistance of plant cell wall towards conversion into simple sugars, high production costs of enzymes employed for hydrolysis and inability of the enzymes to survive in the harsh industrial conditions present in a reaction chambers needed for commercial application of this process. A number of studies have been focused on the immobilization of biomass degrading enzymes onto carries for the purpose of enhancing their stability and providing reusability. In this study we obtained a thermotolerant β-xylosidase enzyme originally obtained from a thermophile *Thermoanaerobacterium thermosaccharolyticum*, and immobilised it on to the surface of Iron oxide magnetic nanoparticles synthesized via co-precipitation method with subsequent modification by silica coating. The effect of immobilisation on the thermostability and pH stability was observed along with its reusability potential against p-nitrophenol-β-D-xylopyranoside substrate. The saccharification potential of the free and bound enzyme was also observed by its reaction sugarcane bagasse samples previously undergone physical and chemical treatments. Magnetic IONPs were

synthesized of an average size around 200 nm and immobilized with the enzyme displaying an immobilization yield of 68.46% . The resultant activity of the bound enzyme along with its stability against different temperatures and pH values concluded an overall enhancement in the activity and operational stability of the enzyme after immobilisation as compared to the free enzyme. The reusability of the enzyme showed an almost unaltered activity up to three cycles with a 50% decrease in the following cycles. When employed for the degradation of pre-treated bagasse samples an almost four folds increase in the sugar release was observed with bound enzyme as compared to free enzyme. The comparative bagasse-degrading abilities of free and immobilized enzymes were further analyzed by FTIR of the bagasse fibres displaying a more efficient degradative capacity of NP-bound enzyme. Hence, it was concluded that immobilization of enzyme onto a carrier makes it highly suitable for saccharification of sugarcane bagasse on industrial scale applications.