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Perspective

Studies on Marine Microbes of Western India: Producing Industrial Enzymes

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DESCRIPTION

Gujarat has a coastline of 1600 km with a rich unexplored microbial diversity. This provides a strong ground for conducting a study for isolating marine microbes producing extra-cellular industrially important enzymes. 'White' biotechnology or industrial and environmental biotechnology is a broad and expanding field that includes making enzymes with a variety of industrial uses that include the manufacture of bioplastics and biofuels using micro-organisms and plants for the treatment of wastes and abatement of pollution, a process known as bioremediation. Microbial enzymes have an edge over the ones from terrestrial origin when it comes to stability of the enzymes. Proteases, amylases, lipases, cellulases, xylanases etc., widely used in several industries are mainly derived from microorganisms. Enzymes, the biological catalysts have been in limelight since early nineteenth century when for the first time Louis Pasteur correlated alcoholic fermentation to the cellular processes and organization of living yeast cells. Industrialization and globalization has lead to the search for enzymes which has taken up a pivotal position in the field of research and development. With more than 75% of globe accounting for marine environment, the seas and oceans still remain unexplored treasures of innumerable biological and chemical entities which require to be discovered and harnessed for prolonged sustainability. The potential of marine organisms for commercial development impinges on virtually every area of biotechnology, like biomedical products, antifreeze proteins, bioadhesives etc. In recent times, marine microorganisms are emerging as a rich source of industrial enzymes. These marine bacterial enzymes have advantage of being stable under wide range of extreme environmental conditions. The marine bacterial enzymes usually have their optimum activity at higher salinities as compared to mesophilic counterparts, giving them dexterity in harsh industrial processes, where the concentrated salt solutions used would inhibit other enzymes. In addition, most marine bacterial enzymes are considerably thermotolerant and remain stable at room temperature over long periods. Majority of currently used industrial enzymes are hydrolytic, being used for the degradation of various natural substances. The industries, dominated by the detergent, starch, textile and fuel alcohol, account for the major consumption of these enzymes. Amongst wide range of commercially used enzymes, xylanases, amylases and lipases can be appropriately called as "industrial enzymes" due to their multifaceted applications in various industries. The review of literature that follows in this thesis has been done taking into account the major discoveries related to these three important enzymes, which has been presented in three sections, each dealing with xylanase, amylase and lipase. Xylanases catalyze the hydrolysis of xylem, the major constituent of hemicelluloses found in plant cell wall. The use of these enzymes could greatly improve the overall economics of processing lignocellulosic materials for the generation of liquid fuels and chemicals.

CONCLUSION

Cellulase-free xylanases have received great attention in the development of environmental friendly technologies in the paper and pulp industry. A variety of microorganisms are reported to produce endoxylanases that can degrade β-1, 4-xylan in a random fashion, yielding a series of linear and branched oligosaccharide fragments. Xylanases are reported to be produced by diverse group of organisms including bacteria, algae, fungi, protozoa, gastropods and arthropods. Recently, there has been great deal of interest in insects as sources of unique microbial endo-β-1, 4 xylanases with possible applications in bio-industrial applications. Similarly, invertebrates like earthworms also contain a wide variety of fibrolytic microbes in the gut hence it is likely that some of these organisms produce novel endoxylanases reported the isolation of *Cellulosimicrobium* sp. HY-13 from the digestive tract of earthworm with xylanolytic properties. One of the most interesting sources of xylanases is rumen where efficient hydrolysis of plant polysaccharides occurs. It is a complex ecosystem where diverse group of microbes including bacteria, fungi, protozoa coexist. Amongst fungal strains, xylanases from *Trichoderma* sp. and *Aspergillus* sp. have been widely studied, characterized thoroughly and are commercially utilized in bakery and food processing industries. The enzymes had relative molecular masses of 43 kDa and 62 kDa and pI of 5.0 and 3.4 respectively. Stimulation of activity by Ca^{2+}, Mn^{2+}, Mg^{2+}, Ba^{2+}, Li^{2+}, NaN_3 and isopropanol was observed.

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