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Application of Enzymes: As an Emerging Pharmaceutical Research

Sharma M*

Department of Bioengineering and Biosciences, Lovely Professional University, Punjab, India

***Corresponding author:** Sharma M, Department of Bioengineering and Biosciences, Lovely Professional University, Punjab, India, E-mail: monika28sharma29@gmail.com

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Introduction

Enzymes are most prominent catalysts, which offer a competitive process for the chemical catalysts [1]. Though enzymes have a great potential, its industrial applications have been hampered in terms of catalytic efficiency, specificity and stability. A variety of approaches are considered to overcome this situation including enzyme screening form natural resources, immobilization and random mutations [2]. Industrial enzymes demand is continuously rising in terms of sustainable solutions. More than 600 industrial products are produced by using enzyme [3].

Activase, the first recombinant enzyme was approved by Food and Drug administration (FDA) in 1987. This enzyme is used specifically for treating heart attacks (caused by coronary artery blockage) and known as "clot-buster". After insulin, it was the second recombinant drug to be marketed. Since then many enzymes as coagulant and anticoagulant agents have been approved by FDA [4].

Trends in Engineering of Enzymes for Pharmaceutical Application

For the need to expand the industrial application of enzymes, substrate specificity and catalytic efficiency should be satisfied [5]. Thermo stability is in the current trend in engineering to produce enzymes. Thermo-stability combines computational methods (with directed evolution) with the structure based rational design [6]. For instance, DNA shuffling was performed *via* SCHEMA which generated cellobiohydrolases (CBH II), a thermo stable fungal. SCHEMA being a computational method helps in the estimation of enzyme structural disruption (after recombination of DNA) [7,8]. A useful source for enzymes is extremophiles because of the high stability in terms of pH, salts and heat [9].

In the same scenario, non-natural reactions are also performed to produce enzymes with latest catalytic functions (depends upon catalytic function) and computational methods (in addition with directed evolution) [10,11]. Molecular dynamics, calculating hydrogen bond energy and simulation of substrate docking are also employed in the design of rational approaches [12,13].

Enzyme Therapy

Adagen, a pegadamase bovine is used to treat SCID. This represents the first enzyme therapy application to treat an inherited disease [14]. ADA enzyme cleaves the extra amount of adenosine present in the circulatory system and gets reduced to being toxic to the patient's immune system where adenosine level is high. As soon as ADA gets modified to PEG, success rate of enzyme is enhanced because PEG helps to enhance the half-life of an enzyme. Ceredase, is used in the replacement therapy for Gaucher's disease. It is a lysosomal storage disease (LSD). During therapy, missing glucocerebrosidase is utilized by placental glucocerebrosidase (modified form) [15].

Marine Enzymes

Enzymes obtained from chemical catalysis require high pressure and temperature with sophisticated and analytical techniques. This finally affects both environment and health. This marked the era of marine biotechnology where marine enzymes were begin to be produced due to its application and characteristics [16]. This meant the utilization of fungi, algae, bacteria and sponges from marine source to produce commercial products. Xylanase (a hydrolytic enzyme) used in brew industry and Laccase used in pulp and textile industry are obtained from marine origin [17]. Enzyme fucoidanase is obtained from *Sphingomonas paucimobilis* (a marine bacterium), thermotolerant chitinase from *Pseudoalteromonas sp.* (present in Caspian sea), Ectoine synthase from *Vibrio campbellii,* ectoine synthase from *Sphngopyxis alaskensis, endoglucanase* from *Paenibacillus sp.* etc. are all marine source enzyme [18,19].

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