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Bacterial proteases and its biotechnological prospects

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ABSTRACT

Bacterial proteases, a diverse group of enzymes produced by various bacterial species, hold significant potential in biotechnology due to their unique properties and wide range of applications. These enzymes catalyze the hydrolysis of proteins, and their functionality under various conditions makes them highly valuable in industrial processes. The biotechnological prospects of bacterial proteases encompass several industries, including pharmaceuticals, food, leather, and detergents. In the pharmaceutical industry, bacterial proteases are instrumental in the synthesis of peptide-based drugs and the development of novel therapeutic agents. Their specific action on proteins is utilized in drug formulation and delivery systems. In the food industry, these enzymes play a crucial role in processing proteins, modifying food texture, and enhancing flavor profiles. They are also used in the production of protein-rich dietary supplements. The leather industry benefits from bacterial proteases in the eco-friendly processing of hides, offering a sustainable alternative to chemical-based methods. In detergent formulations, these enzymes contribute to effective stain removal at various temperature and pH ranges, enhancing cleaning efficiency. Recent advancements in biotechnology, including recombinant DNA technology and protein engineering, have further expanded the scope of bacterial protease applications. These technologies enable the enhancement of enzyme properties, such as stability, specificity, and activity under extreme conditions, making them more suitable for industrial applications.

Keywords: *Bacteria, proteases, DNA, food, Biotechnology and enzymes.*

INTRODUCTION

Bacterial proteases, a class of enzymes produced by various bacterial species, play a pivotal role in the biotechnology sector due to their unique characteristics and wide-ranging applications. These enzymes are specialized in protein hydrolysis, breaking down protein molecules into smaller peptides and amino acids [1]. This capability, combined with their adaptability to diverse environmental conditions, makes bacterial proteases highly sought after in numerous industrial processes.

Bacterial Proteases and Biotechnological Prospects

Microbial proteases are becoming more and more popular since plant and animal proteases cannot keep up with global demand. Microorganisms are a great source of enzymes because of their wide range of biochemical functions and genetic modification sensitivity. Since they possess nearly all the qualities needed for their biotechnological applications, proteases derived from microbial sources are chosen over enzymes derived from plant and animal sources [2].

The one class of enzymes that has a significant role in both physiological and industrial domains of application is proteases. Enzymes known as proteolytic facilitate the breaking of peptide links in other proteins. According to [3], the current global sales estimate for industrial enzymes is $1 billion. About 60% of all industrial enzyme sales globally are made up of proteases, one of the three major categories of enzymes.

Proteases have long been used in the detergent and food industries. Their comparatively recent application in the leather industry for dehairing and bating skins to replace harmful chemicals now used has increased their biotechnological significance. Proteases have been extensively studied in biochemical and biotechnological contexts due to their significance as both metabolic and commercial enzymes [4-7]. Numerous recent review papers [8-10] attest to the fact that most commercial proteases, mostly neutral and alkaline ones, are generated by organisms belonging to the genus [11-12] have shown that the features of protein activity at high pH may be applied in a variety of ways.

Low-temperature growing microorganisms play a vital role in the ecosphere's metabolism and produce valuable enzymes that may find use in industry [13-14]. Proteases have received a lot of attention due to their commercial importance. They may be helpful in the same industrial applications for food processing and chemical biotransformation due to their comparatively low optimum temperatures.

Many types of psychrophilic or psychrotrophic organisms have been shown to include extracellular proteases [15]. According to [16] psychrophilic and psychrotrophic organisms are important for the biodegradation of organic materials in the microbial ecosystems of Antarctica. Then, organisms are effective not just in regions that are always cold but also in environments that see seasonal temperature fluctuations in the late fall and early spring. Studying the makeup of extracellular enzymes like proteases that are released by cold-adapted microbes would thus be interesting.

It is known that cold-adapted microorganisms, such as psychrophiles and psychrotrophs, create high-activity enzymes at low temperatures; these enzymes are referred to as cold-active enzymes [17]. The enzymes of thermophiles have received far more attention than those of psychrophilic bacteria, which are suited to consistently low temperatures. However,

cold-adapted enzymes made by psychrophiles may be helpful for researching the structure-stability connection in proteins as well as for a variety of commercial applications [18-19]. Waste products from marine crustaceans are highly chitinated. According to [20] the yearly recovery of chitin from the processing of trash marine crustaceans is predicted to be 37300 metric tons globally. Apart from chitinase/lysozyme, Pseudomonas aeroginosa K-187 generated a protease that was beneficial in deproteinizing the leftovers of shrimp and crab shells. [21-25] looked into and discussed the best culture conditions for P. aeroginosa K-187 to get the greatest level of protease activity. Proteolytic bacteria have been shown to be effective in treating protein-rich wastes in Antarctica by [26-28].

CONCLUSION

In conclusion, bacterial proteases represent a critical and dynamic component in the realm of biotechnology, offering a broad spectrum of applications across various industries. Their unique ability to efficiently break down proteins, coupled with their adaptability to diverse environmental conditions, has made them invaluable in sectors ranging from pharmaceuticals and food processing to leather manufacturing and detergent formulation. Their diverse applications not only demonstrate the versatility of these enzymes but also underscore the importance of continued research and development in this field. The future of bacterial proteases in biotechnology looks promising, offering prospects for novel applications and more environmentally friendly industrial processes.

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