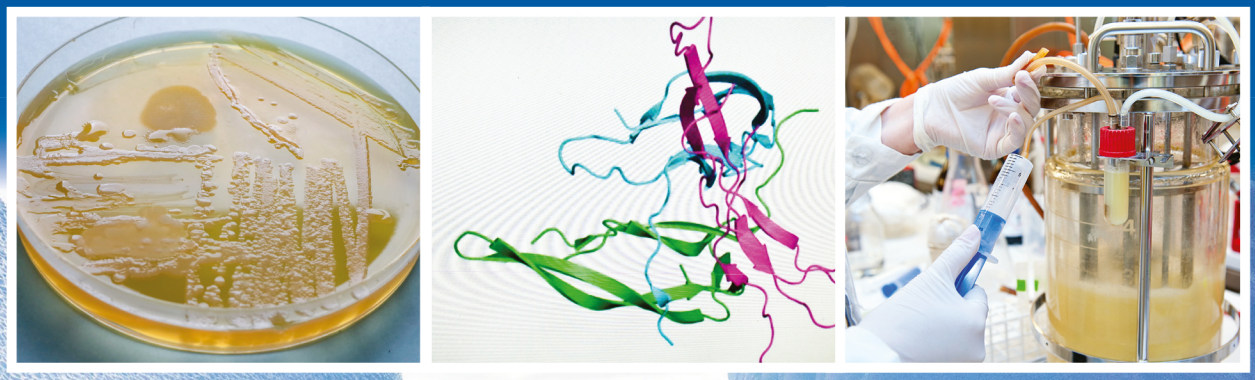
MICROBIAL EXTREMOZYMES

Novel Sources and Industrial Applications



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Chapter 1

Microbial screening for extremozymes

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Introduction

Biotechnology, an omnipresent and infinite potential field of biology, excitingly transforms our lives in many ways and has a great influence on various industries such as biofuel, feed and food production, and high value sustainable production of chemical compounds. Extremophiles are the organisms that can survive in extreme environments, and few extremozymes are initiating their mode into large-scale use in biotechnology. Many of the extremophiles that present in nature are an excellent source of auxiliary enzymes (Coker, 2016). The word extremophiles are derived from the Latin word "extremus" that means "extreme", and the Greek word "philia" means "love," which means an organism with the ability to thrive in extreme environments. The extremophiles are the most secretive group of life on Earth, and due to their unique properties, they can flourish in extreme habitats. Due to the metabolic strategies and inventive adaptations of extremophiles, they are feasible to survive in the extreme conditions (Elleuche et al., 2014).

What are extremozymes?

Extremophiles have made useful adaptations in their genetic and metabolic machinery to thrive in the hostile conditions. Extremozymes are very useful in research applications and for industrial processes due to their potential to persist under the unembellished surroundings, which are naturally employed to them. The new generation stable enzymes are in extensive demand because of their ability of changing or enhancing traditional chemical processes (Elleuche et al., 2014).

Classification of extremophiles

Extremophilic microorganisms are arranged by the conditions in which they develop. They can survive in many severe conditions like extreme hot and cold conditions, extreme salt concentrations and also in acid and alkaline niches and similarly the places where heavy metals, toxic waste, high pressure, organic solvents and other surroundings that are considered as unfriendly for lifecycle. Extremophiles can be categorized into diverse groups after considering the conditions that they inhabit (Dumorné et al., 2017) as shown in Fig. 1.1. The characteristics of different extremophiles based on their habitats and some examples are described in Table 1.1 (Capasso and Barboiu, 2019).

Thermophiles

Thermophiles are the class of extremophiles, and they can grow above 45°C in various regions of the Earth in geothermally high temperature like deep-sea hydrothermal vents, hot springs, decaying living matter, fermenting materials like compost piles and silage, where temperature ranges from 60°C to 65°C. Thermophiles are capable to grow between 41°C and 122°C and secrete various thermophilic enzymes like amylases, cellulases, lipases, mannanase, xylanases, pectinases, chitinases, proteases, esterases and phytases that have been majorly categorized. Thermophilic enzymes have the ability of accepting proteolysis and extreme circumstances, such as occurrence of denaturing agents and organic solvents and high salinity, and also they have the capacity to increase the amount of hydrophobic deposits, forming bisulfide liaison between two opposite ions (Dumorné et al., 2017; Jin et al., 2019).

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