Essential aspects in the generation of biogas from anaerobic digestion to single-cell protein and bio-methanol.

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Abstract

Salt-tolerant enzymes generated by halophilic and halotolerant microorganisms have been suggested for use in a variety of high-saline applications. The current study aimed to evaluate the extracellular proteolytic, esterolytic, cellulolytic, and xylanolytic activities of some halotolerant strains, as well as characterise their functional parameters, in light of their biotechnological significance and the current need for more efficient producers of such catalysts. Quantitative methods were used to test 21 bacterial and fungal strains from the genera Bacillus, Virgibacillus, Salinivibrio, Salinicoccus, Psychrobacter, Nocardiopsis, Penicillium, Aspergillus, and Emericellopsis. Members of the Bacillus genus had the highest catalytic activity among them. Because of these characteristics, these hydrolases could be utilised in a novel application, namely cleaning old consolidants and organic deposits that have accumulated over time.

Keywords: Halotolerant, Halophilic, Bacteria, Enzymes, Salt-tolerant bacteria.

Introduction

Enzymes are ubiquitous components of living organisms that catalyse metabolic reactions at fast enough rates to keep life going. Enzymes have a variety of commercial applications, including industrial catalysts (e.g., starch to glucose conversion in the food industry), therapeutic agents (e.g., removal of fibrin clots from the bloodstream), analytic reagents (e.g., glucose detection in blood), and manipulative tools (e.g., restriction enzymes used to cut DNA). Hydrolases, particularly proteases, amylases, lipases, and cellulases, dominate the global market for enzymes in industrial applications, which is expected to reach USD 6.4 billion in 2021. Due to the economic, technological, and ethical benefits of microorganisms over biocatalysts obtained from animals and plants, microorganisms are the most common source of enzymes. Microorganisms that persist in harsh environmental circumstances have attracted increasing interest in the scientific community over the last decades among the numerous microbial sources of hydrolytic enzymes. Their enzymes, known as extremozymes, perform the same catalytic tasks as their mesophilic counterparts, but they also work under harsh physicochemical conditions that inactivate non-extremophile enzymes. Extremozymes have been found to be effective in a variety of industrial and environmental applications requiring extreme circumstances, such as high/low temperatures, acidic/alkaline pH, or high salinity. Halophiles are a group of extremeophilic microorganisms that manufacture biotechnologically important hydrolases. They are adapted to thrive in highly saline conditions and are classified as extreme halophiles, moderate halophiles, or halotolerant microorganisms based on their salt requirement/tolerance. Extracellular enzymes produced by halophilic and halotolerant bacteria have evolved to maintain structural stability and catalytic activity across a wide range of salinities. When compared to their mesophilic counterparts, these salt-adapted macromolecules have an overabundance of acidic amino acids on the protein surface and an overall decrease in hydrophobic amino acid frequency. Biofuel production, food processing, and bioremediation of polluted hypersaline environments are among the principal applications for such extremozymes that have been proposed [1, 2].

Halophilic microorganisms and their salt-tolerant enzymes have found potential utility in the field of conservation and restoration of cultural heritage. System based on microorganisms or biocatalysts could represent the optimal solution to remove unwanted inorganic (e.g., nitrates, sulfates) or organic compounds. Salt-tolerant hydrolases entrapped in a gel matrix could be used to remove organic residues from wall paintings. These compounds may serve as nutrients for heterotrophic microorganisms, and their removal is crucial to avoid a future microbial colonization of cultural artifacts [3].

Halophilic microorganisms have as yet found relatively few biotechnological applications. Halophiles are involved in centuries-old processes such as the manufacturing of solar salt from seawater. The potential use of bacteriorhodopsin, the retinal protein proton pump of Halobacterium is being explored. Halophiles are a group of extremeophilic microorganisms that manufacture biotechnologically important hydrolases. They are adapted to thrive in highly saline conditions and

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