# Potent Biotechnological Applications of Psychrozymes

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Burhan Hamid

**Abstract**

Psychrophilic yeasts possess the ability to live in extreme environmental condition (i.e. low temperature). This property makes them more valuable and more significant as they are adapted to these harsh conditions. It is well-known that major area of the earth is covered with cold environments. Psychrophilic yeasts are molecularly adapted to these cold conditions; due to these reasons researchers are getting attracted towards exploring adaptability of psychrophilic yeasts. Psychrophilic yeasts are capable of producing extremozymes having utmost stability and activity at low temperatures. Psychrozymes produced by psychrophilic yeasts show maximal activity at lower temperatures, they are having potential application in different fields. Psychrophilic enzymes produced by yeasts have proven to be economically feasible at industrial level and also keep process contamination free. These enzymes possess utility in different industries like food, pharmaceutical, detergent, leather, textile, biomedical, brewing for multiple low temperature process. The few potential enzymes secreted by psychrophilic yeasts are amylases, proteases, pectinases, lipases, lactases, etc., they are known as a valuable tool for various biotechnological processes. Climate change has directly or indirectly influenced the diversity of psychrophilic microorganisms including yeasts. Global warming leads to the negative impact on the habitats of cold-loving microorganisms and that is a matter of concern for researchers. In this chapter, industrial and biotechnological aspect of psychrophilic yeasts and their cold-active enzymes are reviewed and discussed. The focus has been given to their application in different sectors like food, pharmaceutical, detergent, leather, textile, biomedical, molecular, brewing, waste management.

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CHAPTER 14

# Nanoremediation: A Sustainable Reclamation Method for Future Deployment

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## ABSTRACT

Nanotechnology has fascinated scientists and researchers for exploitation of unparalleled biological, physical, and chemical characteristics of nanoparticles. Nano-formed compounds are developed for utilization in a diverse number of fields from medicine to the space exploration. Because of high surface area to volume ratio, size-dependent attributes and high reactivity,

Nano-Bioremediation for Water and Soil Treatment: An Eco-Friendly Approach.
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Environmental Science/Climate Change & Mitigation

# Advances in Natural Dyes for Environmental Protection

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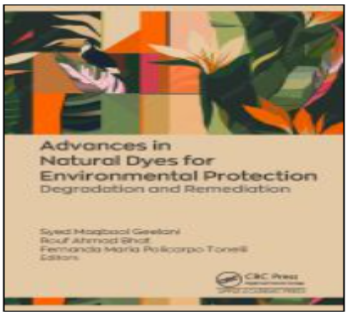


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REVIEWS

*"The most important aspects regarding textile pollution caused by dyes, its remediation, natural dyes as sustainable alternative to synthetic ones, challenges, and the market for the field are covered. . . . Comprehensive and up to date. The editors deserve to be complimented for their sincere*



ABOUT THE AUTHORS / EDITORS:

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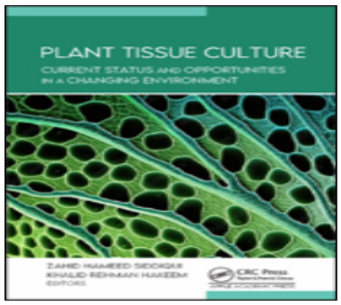


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Plants are sessile and constantly exposed to changing environmental conditions. Seasonal cues govern plant growth, development, and reproduction. In this era of climate change, the environment is unstable and takes a toll on the productivity of plants. This new book, **Plant Tissue Culture: Current Status and Opportunities in a Changing Environment**, explores this unique area of

This book will prove beneficial for plant biotechnologists, environmentalists, ecologists, and scientists in enhancing their understanding of the complexities of climate change under in vitro conditions.

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# Cold-Active Enzymes in Food Processing

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Burhan Hamid and Fayaz A. Mohiddin

**Abstract**

Microorganisms living in extreme environmental conditions (extremophiles) are potential source of extremozymes; they possess utmost stability under extreme environmental conditions. Cold-active enzymes are extremozymes produced by the psychrophiles (extremophiles) and have attracted much attention as biocatalysts due to their capacity to resist unfavourable reaction conditions in the industrial process. Cold-active enzymes possess wide applications in the food industry; these enzymes are not only secreted by bacteria but also from yeasts and moulds. Although enzymes are derived from plant and animal sources, cold-active microbial enzymes have taken advantage, due to their productivity and thermostability. Psychrophilic microorganisms produce a wide range of cold-active enzymes with immune application in food processing. The use of ß-galactosidase for the removal of lactose from refrigerated milk, application of pectinase for the reduction of viscosity and turbidity in chilled juice and use of amylase for hydrolysis of polysaccharides in starch processing industries and processing of meat with the help of cold-active proteases are the representative examples of application of cold-active enzymes. Cold-active enzymes possess exceptional molecular flexibility that has opened up newer areas of applications. In food processing industries, cold-active pectinases have been used for the removal of pectin which is important in fruit juice and wine processing, coffee and tea processing and macerating of plants and vegetable tissue, for degumming of plant fibres, for extracting vegetable oils and for adding poultry feed and in the alcoholic beverages. To fulfil the demand of industries, enzyme technology needs extension of biotechnological approach in terms of both quality and quantity. The potential of cold-active enzymes provides numerous opportunities for industrial

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# 8 Harnessing Soil Rhizobacteria for Improving Drought Resilience in Legumes

Parvaze A. Sofi, Zahoor A. Baba, Burhan Hamid, and Ram Swaroop Meena

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