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Temperature and pH Profiling of Extracellular Amylase from Antarctic and Arctic Soil Microfungi

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Abstract: While diversity studies and screening for enzyme activities are important elements of understanding fungal roles in the soil ecosystem, extracting and purifying the target enzyme from the fungal cellular system is also required to characterize the enzyme. This is, in particular, necessary before developing the enzyme for industrial-scale production. In the present study, partially purified α-amylase was obtained from strains of *Pseudogymnoascus* sp. obtained from Antarctic and Arctic locations. Partially purified α-amylases from these polar fungi exhibited very similar characteristics, including being active at 15 °C, although having a small difference in optimum pH. Both fungal taxa are good candidates for the potential application of cold-active enzymes in biotechnological industries, and further purification and characterization steps are now required. The α-amylases from polar fungi are attractive in terms of industrial development because they are active at lower temperatures and acidic pH, thus potentially creating energy and cost savings. Furthermore, they prevent the production of maltulose, which is an undesirable by-product often formed under alkaline conditions. Psychrophilic amylases from the polar *Pseudogymnoascus* sp. investigated in the present study could provide a valuable future contribution to biotechnological applications.

Keywords: α-amylase; enzyme; Antarctic; Arctic; temperature; pH

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1. Introduction

Antarctica is the least disturbed continent in the world owing to its harsh climate and geographical isolation. It is a fertile ground for scientific exploration to identify untapped resources from its extremophilic biota. Microbes in Antarctica are exposed to very low temperatures, wide temperature fluctuations, desiccation, and strong winds, which require them to produce unique enzymes and secondary metabolites as an adaptation strategy to survive [1,2]. Likewise, much of the Arctic experiences comparable climatic and environmental stresses, providing a foundation for studies of polar microbial diversity and biochemical adaptations [3,4]. These regions may serve as reservoirs of unexplored secondary metabolites and novel enzymes [5,6].

Microfungi in the polar regions play a dominant role in decomposition processes [7–9] by secreting extracellular enzymes and other secondary metabolites [10,11]. However, understanding of the roles of soil microfungi and their extracellular products in the general soil ecosystem remains poor [10,12]. Even small changes in the decomposition achieved by soil microfungi can affect the availability of carbon for heterotrophs, with these effects then cascading through the entire trophic web. Understanding the ecophysiological responses of