Tales of Harnessing Poly-Extremozymes

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ABSTRACT

Extremophiles, known for thriving in the harshest ecosystems, hold transformative potential for biotechnology and planetary exploration. Our study explores mangrove-dwelling bacteria from Goa, India, as sources of lignocellulases capable of degrading lignocellulosic biomass under poly-extremophilic conditions. These bacteria, from genera such as *Bacillus*, *Vibrio*, and *Exiguobacterium*, produce cellulase, laccase, and xylanase, which are highly active in environments with low pH and high temperatures. This discovery has profound implications for advancing biofuel production, as these enzymes efficiently convert lignocellulose—a renewable but recalcitrant biomass—into fermentable sugars. Beyond Earth, these extremozymes offer exciting prospects for planetary terraforming. By deploying lignocelluloses in regolith enriched with remaining plant biomass, these enzymes could facilitate soil conditioning and nutrient cycling, laying the groundwork for sustainable agriculture in extraterrestrial habitats. The study underscores mangrove microbial communities' ecological and functional diversity, highlighting their role in producing biomolecules capable of thriving in extreme environments. Mangrove conservation thus becomes essential for terrestrial sustainability and expanding biotechnological frontiers for space exploration. This research aligns with the broader vision of extremophiles as models for adaptation to extreme conditions. By mimicking their biochemical strategies, we can pioneer solutions for climate resilience on Earth and extraterrestrial colonization. These findings exemplify how biodiversity in extreme ecosystems can address global challenges, from sustainable biofuel production to terraforming distant planets.

Keywords: Extremophiles, Lignocellulosic biomass,Climate resilience, Extraterrestrial colonization

How to Cite

Rishi R. Gandhi, Rakhee D. S. Khandeparker, “Tales of Harnessing Poly-Extremozymes”, *AIJR Abstracts*, p. 19, Mar. 2025.

DOI: 10.21467/abstracts.177 ISBN: 978-81-984081-3-6 (eBook), 978-81-984081-9-8 (Paperback)