

The Importance of Polyhydroxybutyrate (PHB) to Eukaryote from Prokaryote

Cennet Canan Karaderi^{1*} and Hüseyin Kahraman²

¹Department of Biology, Institute of Science, Inonu University, Turkey

²Department of Biology, Faculty of Art and Science, Inonu University, Turkey

*Corresponding author

Cennet Canan Karaderi, Department of Biology, Institute of Science, Inonu University, Turkey. Tel: 0422 377 37 87; E-mail: ckaraderi@gmail.com

Received: May 18, 2020; **Accepted:** May 22, 2021; **Published:** May 26, 2021

Introduction

The increase of human population has caused to accumulation of enormous amounts of non-degradable waste substance in our world [1]. Increased utilize of plastic substance in the domestic and industrial section exceeds which poses critical worry as they are no biodegradable, as a result important problems such as environmental pollution, toxicity to human health. At last years, plenty of emphasis has been given in the way of the improvement of microbial-derived biodegradable polymers manufacture [2]. Many investigators prefer to utilize and manufacture biodegradable polymers from microorganism, because of controlled fabrication, simple purification, more prospects of genetic modifications with rapid biodegradability without collapsing the environment [3]. Biopolymers are manufactured from natural renewable materials as a result of microorganisms such as, algae, yeast, and bacteria. Those microorganisms are capable of producing many biodegradable polymers in nature such as, polyhydroxyalkanoate (PHA), polyhydroxybutyrate (PHB) accumulate in cells as source of energy and carbon [4]. The synthesis of PHA polymers rises when deficiency in nutrients, carbon and lack of Mg, N, S, P etc. occurs during growth. Polyhydroxybutyrate (PHB) is classified as one of the most fundamental polymers of PHA, as it has mechanical characteristics similar to polypropylene properties. Besides PHB is biodegradable and no toxic; so, it can be produced from cheap carbon sources. PHB is a homogeneous polymer, which has a solid structure that is occurred by its 4-6 carbon atoms. The high crystallization rate is one more characteristic of this polymer, which arrives to 50%. The melting point of PHB depends on its solid structure and crystallization degree, which ranges from 160 - 180 m [5]. PHB-producing microorganisms are *Bacillus cereus*, *Escherichia coli*, *Nostoc muscorum*, *Pseudomonas aeruginosa*, *Penicillium expansum*, *Ralstonia eutropha*, *Saccharomyces cerevisiae*, *Synechocystis* sp., *Rhizobium*, *Azorhizobium*, *Alcaligenes*.

It is considered that PHB synthesis by bacterial way is more expensive than synthetic plastics manufacture, hence it is attempted to transfer it to eukaryotic cells by using yeasts as model microorganisms in PHB production. Yeasts as hosts for synthesis of PHA have advantages over bacteria. For example; yeasts have been researched intensively from physiology, molecular

biology and biotechnology points of view. Besides, yeasts are physiologically flexible and they are enormous than bacteria. So they are preferred by many researchers [6]. *S. cerevisiae* is a biotechnologically significant model organism used in basic researches. Because it is a unicellular fungus, possessing a nuclear genomic DNA of 12068 kilobases organized in 16 chromosomes [7].

Presence of bacterial PHB biosynthesis genes and the improving of procedures for transmission them to eukaryotic organisms, it ought to be possible to equip higher organisms such as plants or yeasts with the ability to produce PHA [8]. Yeasts are thought to be widely used in many other areas.

References

1. Karim F, Mumtaz T, Fakhruddin ANM, Rahman Khan M (2018) Isolation and screening of biopolyester (poly- β -hydroxybutyrate) producing bacteria from compost samples in Bangladesh, *Journal of BioScience and Biotechnology* 7: 23-29.
2. Ganesh Saratale R, Kyung Cho S, Dattatraya Saratale G, Ghodake GS, Naresh Bharagava R, et al. (2021) Efficient bioconversion of sugarcane bagasse into polyhydroxybutyrate (PHB) by *Lysinibacillus* sp. and its characterization, *Bioresource Technology* 324:1-6.
3. Narayanan M, Kandasamy S, Kumarasamy S, Gnanavel K, Ranganathan M, et al. (2020) Screening of polyhydroxybutyrate producing indigenous bacteria from polluted lake soil, *Heliyon* 6: 1-8.
4. De Paula FC, Kakazu S, Chimello de Paula C B, De Almeida A F, Gomez JGC, et al. (2019) *Burkholderia glumae* MA13: A newly isolated bacterial strain suitable for polyhydroxyalkanoate production from crude glycerol, *Biocatalysis and Agricultural Biotechnology* 20: 1-11.
5. Yousif J (2018) Production, Extraction, and Characterization of Green Biodegradable Bioplastics Polyhydroxybutyrates (PHB) for Biomedical Applications, Master of Engineering, Ryerson University.
6. Carpa R (2010) Microbial production of poly- β -hydroxybutyrates -an overview, *Extreme Life, Biospeology & Astrobiology International Journal of the Bioflux Society*

- 2: 64-70.
7. Parapouli M, Vasileiadis A, Afendra AS, Hatziloukas E (2020) *Saccharomyces cerevisiae* and its industrial applications, *AIMS Microbiology* 6: 1-31.
8. Breuer U, Terentiev Y, Kunze G, Babel W (2002) Yeasts as Producers of Polyhydroxyalkanoates: Genetic Engineering of *Saccharomyces cerevisiae*, *Macromolecular Bioscience* 2: 380-386.

Copyright: ©2021 Cennet Canan Karaderi. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.