



Contents lists available at ScienceDirect

Bioresource Technology

journal homepage: www.elsevier.com/locate/biortech

Biowaste-to-bioplastic (polyhydroxyalkanoates): Conversion technologies, strategies, challenges, and perspective

Shashi Kant Bhatia^{a,b}, Sachin V. Otari^c, Jong-Min Jeon^d, Ranjit Gurav^a, Yong-Keun Choi^a, Ravi Kant Bhatia^e, Arivalagan Pugazhendhi^f, Vinod Kumar^g, J. Rajesh Banu^h, Jeong-Jun Yoon^d, Kwon-Young Choiⁱ, Yung-Hun Yang^{a,b,*}

^a Department of Biological Engineering, College of Engineering, Konkuk University, Seoul 05029, Republic of Korea

^b Institute for Ubiquitous Information Technology and Application, Konkuk University, Seoul 05029, Republic of Korea

^c Department of Biotechnology, Shivaji University, Vidyanagar Kolhapur 416004, Maharashtra, India

^d Green & Sustainable Materials R&D Department, Research Institute of Clean Manufacturing System, Korea Institute of Industrial Technology (KITECH), Chungnam 331-825, Republic of Korea

^e Department of Biotechnology, Himachal Pradesh University, Shimla 171005, India

^f Innovative Green Product Synthesis and Renewable Environment Development Research Group, Faculty of Environment and Labour Safety, Ton Duc Thang University, Ho Chi Minh City, Viet Nam

^g Centre for Climate and Environmental Protection, School of Water, Energy and Environment, Cranfield University, Cranfield MK43 0AL, UK

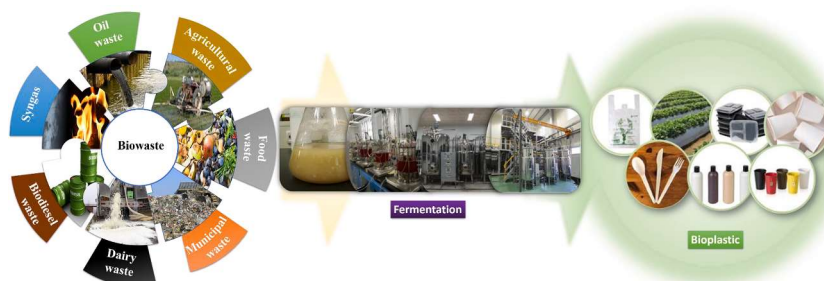
^h Department of Life Sciences, Central University of Tamil Nadu, Neelakudi, Thiruvavur, Tamil Nadu, India

ⁱ Department of Environmental and Safety Engineering, College of Engineering, Ajou University, Suwon, Gyeonggi-do, Republic of Korea

HIGHLIGHTS

- PHA production from biowaste is an economic and ecofriendly approach.
- Microbes are able to recover resource from waste and produce PHA.
- C, N, P and dissolved oxygen are the main factors that affect PHA production.
- The downstream process has a big impact on whole cost of PHA production.
- Functionalization of PHA has potential to improve their applications.

GRAPHICAL ABSTRACT



ARTICLE INFO

Keywords:

Biowaste
Biodiesel waste
Bioplastic
Lignocellulosic biomass
Municipal waste
Polyhydroxyalkanoates

ABSTRACT

Biowaste management is a challenging job as it is high in nutrient content and its disposal in open may cause a serious environmental and health risk. Traditional technologies such as landfill, bio-composting, and incineration are used for biowaste management. To gain revenue from biowaste researchers around the world focusing on the integration of biowaste management with other commercial products such as volatile fatty acids (VFA), bio-hydrogen, and bioplastic (polyhydroxyalkanoates (PHA)), etc. PHA production from various biowastes such as lignocellulosic biomass, municipal waste, waste cooking oils, biodiesel industry waste, and syngas has been reported successfully. Various nutrient factors i.e., carbon and nitrogen source concentration and availability of dissolved oxygen are crucial factors for PHA production. This review is an attempt to summarize the recent

* Corresponding author at: Department of Biological Engineering, College of Engineering, Konkuk University, Seoul 05029, Republic of Korea.
E-mail address: seokor@konkuk.ac.kr (Y.-H. Yang).

<https://doi.org/10.1016/j.biortech.2021.124733>

Received 27 November 2020; Received in revised form 11 January 2021; Accepted 13 January 2021

Available online 19 January 2021

0960-8524/© 2021 Elsevier Ltd. All rights reserved.