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Abstract

Simultaneous biohydrogen (H2) and bioplastic (poly-b-hydroxybutyrate-PHB) productions

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Abstract:
Hydrogen is the highest energy density among the fuel types and energy sources. In essence, PHB is one of the known poly-hydroxy alkanoates (PHAs). PHB is an alternative to synthetic plastics as its physical properties are equivalent to those of polypropylene and also readily biodegradable (Arun et al., 2006). PHB from a single-cultured commercial-grade substrate is often more expensive due to its production cost and substrate. In contrast, PHB is easily synthesized from VFAs without requiring the β-oxidation, glycolysis pathways, with the support of fewer enzymes and metabolic reactions. The use of acid-rich wastewater as the substrate for PHB production can simultaneously reduce the production cost and the treatment of wastewater (Venkata Mohan et al., 2010). Agricultural wastes (i.e., rice husk (RH) and rice straw (RS)) are abundant renewable sources around the world and especially in Asia. Approximately 87% of the total global rice production is from Asian regions (Saini et al., 2015). Rice straw and husk are the by-products of rice cultivation for more than 50% of the total weight of the rice crop. They are usually disposed of traditionally in open fields in Asia (Sen et al., 2016).

We evaluated the biohydrogen (H2), bioplastic (PHB) production utilizing various wastes under Dark Fermentative (DF), Photo Fermentative (PF) and subsequent DF-PF. Potential bio H2 and PHB producing microbes were enriched and isolated. The higher bio H2 and PHB producing substrate (RH and RS) under DF were used for subsequent DF-PF studies. The effects of substrate concentration (10-100%), pH (5.5-8.0) were examined in batch mode under DF and PF conditions. The maximum bio H2, PHB production, was found at 100% RS hydrolysate (H) (1.53±0.04 mol H2/mol glucose and 9.8±0.14 g/L PHB). In subsequent DF-PF, the highest amount of bio H2, PHB, was recorded at 100% RSH (1.82±0.01 mol H2/mol of glucose and 19.15±0.25 g/L PHB) at pH 7 by Bacillus cereus (KR809374) and Rhodopseudomonas rutila. Subsequent DF-PF biological H2, PHB production from renewable biomass such as RHH and RSH has considerable potential with respect to the sustainable management of global energy and environmental issues.

Biography:

Dr. A. Arun (Ph.D.), Associate Professor and Head (i/c) at the Department of Microbiology, Alagappa University, Karaikudi, Tamil Nadu, India. He holds a Ph.D. in Microbiology from Madurai Kamaraj University, Madurai, India and a Master degree in Microbiology from Madurai Kamaraj University, Madurai, India. He has a total of 20 years of research experience in the field of Bioenergy, Microbial fuel cell, Bioremediation, Biomass and Bioplastic and Bioactive compounds. Based on his research output, his Cumulative Impact Factor is 85.718, h-index is 12, i10 index is 17. He received awards like a young scientist award from DST-SERB, India and Dr. APJ Abdul Kalam Award for scientific excellence -2018 by Marina Labs, Chennai, Tamilnadu, India. He also received many travel grants to visit the US, Singapore, Hungary and China. He received research projects for a value of INR 408.13 lakhs.

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