New Results

The phototrophic bacteria Rhodomicrobium spp. are novel chassis for bioplastic production

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Abstract

Polyhydroxybutyrate (PHB) is a bio-based, biodegradable alternative to petroleum-based plastics. PHB production at industrial scales remains infeasible, in part due to insufficient yields and high costs. Addressing these challenges requires identifying novel biological chassis for PHB production and modifying known biological chassis to enhance production using sustainable, renewable inputs. Here, we take the former approach and present the first description of PHB production by two prosthecate photosynthetic purple non-sulfur bacteria (PNSB), Rhodomicrobium vannielii and Rhodomicrobium udaipurense. We show that both species produce PHB across photoheterotrophic, photoautotrophic, photoferrotrophic, and photoelectrotrophic growth conditions. Both species show the greatest PHB titers during photoheterotrophic growth on butyrate with dinitrogen gas as a nitrogen source (up to 44.08 mg/L), while photoelectrotrophic growth demonstrated the lowest titers (up to 0.13 mg/L). These titers are both greater (photoheterotrophy) and less (photoelectrotrophy) than those observed previously in a related PNSB, Rhodopseudomonas palustris TIE-1. On the other hand, we observe the highest electron yields during photoautotrophic growth with hydrogen gas or ferrous iron electron donors, and these electron yields were generally greater than those observed previously in TIE-1. These data suggest that non model organisms like

Rhodomicrobium should be explored for sustainable PHB production and highlights utility in exploring novel biological chassis.

Competing Interest Statement

The authors have declared no competing interest.

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