BIOPLASTIC PRODUCTION BY HARNESSING CYANOBACTERIA-RICH MICROBIOMES FOR LONG-TERM SYNTHESIS

Key message

For the first time, this study demonstrates that it is possible to produce PHB using a photosynthetic microbial community over the long term in a non-sterile environment. This breakthrough brings us closer to developing more sustainable methods for producing biodegradable plastics, while also providing new insights into the biological processes involved in PHB production.

Objective

This research explores a new method of producing PHB by shifting away from traditional approaches that rely on sterile and heterotrophic cultures. Instead, it studied the potential of using photosynthetic microorganisms dominated by cyanobacteria *Synechocystis* sp. and *Synechococcus* sp., cultivated in a 3 L photobioreactor. These microorganisms use CO2 and sunlight to grow and could offer a more sustainable way to produce PHB.

Background

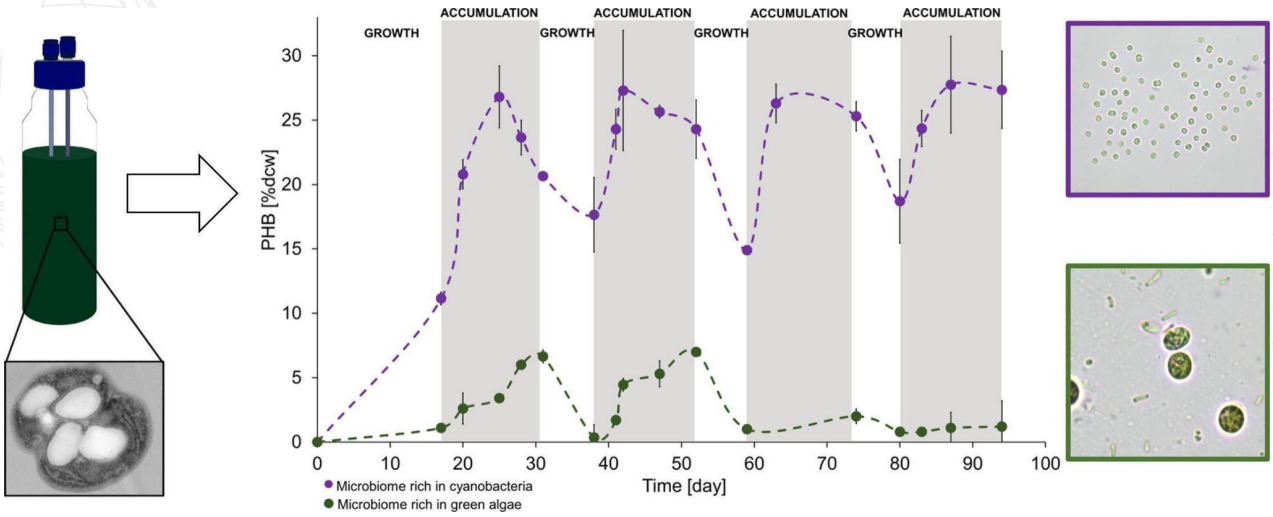
Polyhydroxybutyrate (PHB) is a type of biodegradable plastic that could become an environmentally friendly alternative to conventional plastics. However, there are still significant challenges to producing PHB on a large scale in an efficient and cost-effective way.

Results

- Over a period of 108 days, the microbiome was able to produce PHB, reaching up to 28% of the dry weight of the cells.
- Nile Blue staining and Transmission Electron Microscopy confirmed the presence of PHB granules inside the cyanobacteria.
- The overexpression of the enzyme PHA synthase correlated directly with the increased PHB production.
- It was confirmed that the biopolymer produced was specifically poly-3-hydroxybutyrate.

Source

Altamira-Algarra, B., Lage, A., Meléndez, A. L., Arnau, M., Gonzalez-Flo, E., & García, J. (2024). Bioplastic production by harnessing cyanobacteria-rich microbiomes for long-term synthesis. *Science of The Total Environment*, 954, 176136. https://doi.org/10.1016/j.scitotenv.2024.176136



This project receives funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000733. Views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the EU nor REA can be held responsible for them.