A world without petroleum-based plastics

Philipp Doppler and Oliver Spadiut

Institute of Chemical, Environmental and Bioscience Engineering, Research Area Biochemical Engineering, Technische Universität Wien, Gumpendorfer Straße 1a, 1060 Vienna, Austria

The reason bioplastics from cyanobacteria have not found their way into global applications yet, is that scaling-up the processes for production is very cumbersome. Usually externally illuminated glass reactors with small volumes are used. At higher cell concentrations cell shading limits light penetration and thus biomass concentration and volumetric production rates. The light intensity cannot be raised anymore due to photoinhibition of the cells.

Our solution is a novel illumination strategy using LEDs on one side of quartz glass rods, guiding photons to the other side of the rod to lighten the fermentation broth. Utilizing dimmable LEDs in different colors gives us the flexibility to control the growth of the cells always at optimal light intensities. With several of these quartz rods, the process is scaled-up easily. With the available super-producing *Synechocystis* sp. PCC 6714 mutant strain the production of biodegradable poly(3-hydroxybutyrate) (PHB) will get economically feasible [1].

[1] Kamravamanesh, D., Kovacs, T., Pflügl, S., Druzhinina, I., Kroll, P., Lackner, M. and Herwig, C., 2018. Increased poly-β-hydroxybutyrate production from carbon dioxide in randomly muatated cells of cyanobacteria strain Synechocystis sp. PCC 6714: Mutant generation and characterization. Bioresource Technology, 2018. 266, 34-44.