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PHOTOAUTOTROPHIC PRODUCTION OF POLY-B-HYDROXYBUTYRATE (PHB) FROM CYANOBACTERIA: NITRATE EFFECTS AND SCREENING OF STRAINS

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Abstract

The polyhydroxybutyrate (PHB) production by photoautotrophic cultures is a potential eco-sustainable process to produce bioplastics. The biosynthesis of PHB by cyanobacteria meets a twofold target: the use of CO_2 as feedstock alternative to the fossil resource used in the conventional processes; the contribution to the reduction of the CO_2 concentration in the atmosphere. This contribution reports results of a study regarding the optimal growth conditions for cyanobacteria to produce PHB under photoautotrophic conditions using 16h/8h light/dark irradiation strategy.
Synechocystis PCC6803 was selected as the model organism for optimization of the medium composition with respect to PHB production. Four culture media, characterized by different nitrate concentrations, were investigated: BG_{11} (optimal nitrate concentration), $BG_{1/2}$ (half of optimal nitrate concentration), $BG_{1/4}$ (one fourth of the optimal nitrate concentration) and BG_0 (nitrogen-starved conditions). $BG_{1/2}$ proofed to be the best medium to optimize the PHB production in terms of PHB fraction of cell (8% $_{DCW}$) and PHB productivity (7g/Ld).
Five strains of cyanobacteria were then compared to select the best strain to produce PHB. *Synechocystis* PCC6803 and *Synechocystis aquatilis* were the best strains for PHB production. A PHB fraction and productivity of about 8% $_{DCW}$ and 7g/Ld were obtained for both strains. The production performance was promising when considering the free substrate (CO_2) used.

Key words: cyanobacteria, nitrogen-starvation, photobioreactor, polyhydroxybutyrate (PHB), screening, strain

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