

PHOTOTROPHIC PHB PRODUCTION WITH CYANOBACTERIA BY USING LOW SOLIDS DIGESTATE

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With rising environmental pollution caused by persistent and petroleum-based plastics, the interest in biodegradable materials like poly-β-hydroxybutyrate (PHB) increases. Currently, PHB production is based on heterotrophic bacteria, using organic carbon sources from crops. To avoid the competition to food and feed production cyanobacteria, metabolizing CO₂ e.g. from exhaust gas, can be used. For cultivating cyanobacteria at larger scales high amounts of mineral nutrients are needed. Due to this reason alternative nutrient sources, such as digestate, are required. In this study photoautotrophic PHB production with cyanobacteria was investigated, with emphasis on increasing the ecological and economic efficiency of the process by using anaerobic digestate as nutrient source as well by using the residual biomass. The results obtained herein demonstrate that low solids digestate, produced by anaerobic digestion thin stillage, is suitable to produce PHB with *Synechocystis salina*. By using digestate supernatant diluted 1/3, biomass and PHB concentrations of 1.6 g/L and 89 mg/L, respectively, were achieved within 40 days in a tubular photobioreactor system with a working volume of 200L. In mineral medium, optimised with regard to biomass and PHB production in a single cultivation stage, biomass and PHB concentrations of 2.1 g/L and 123 mg/L were obtained. The PHB quality was hardly influenced when digestate was used as nutrient source. Additionally, anaerobic digestion of residual biomass yielded in 348 Nm³ CH₄/t VS, being comparable with maize silage, a frequently used substrate in biogas plants. Other options would be to use the residual biomass as animal feed or fertiliser, since it still contained lipids (14 mg/g TS), proteins (242 mg/g TS) and carbohydrates (6 mg/g TS). Based on these results it can be concluded that photoautotrophic PHB production has a high potential to be connected to already existing processes, at which digestate and CO₂ accrue.

Keywords - Biorefinery, digestate, polyhydroxy butyric acid, *Synechocystis salina*

Recent Publications

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Biography

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