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PILOT-SCALE MIXED-CULTURE PRODUCTION OF POLYHYDROXYALKANOATE USING UNFERMENTED INDUSTRIAL FOOD PROCESSING WASTEWATER

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Abstract

In this study, pilot-scale polyhydroxyalkanoate (PHA) production in the food processing industry was investigated as a two-step process including enrichment of PHA-storing microorganisms and PHA production. In addition, the effects of seasonally varying wastewater composition produced from the food-processing factory and different content of inoculum on PHA production were evaluated. In the enrichment step, two sequencing batch reactors (SBRs), which were inoculated with activated sludge obtained from the municipal wastewater treatment plant (SBR_1) and industrial wastewater treatment plant (SBR_2), were fed with unfermented orange processing wastewater and operated in aerobic dynamic feeding (ADF) conditions. SBR_1 (41% gPHA/gVSS) showed higher performance in accumulating PHA compared to the SBR_2 (23% gPHA/gVSS). In the production step, SBRs were fed with different wastewater types (apple, strawberry, apricot and, orange processing) without fermentation at different periods for 130 days. It was determined that enriched biomass in SBR_2 did not adapt to varying wastewater types and lost PHA-accumulation ability in the production step. However, enriched biomass in SBR_1 adapted to different types of wastewaters at different periods and presented a higher PHA content (42.23%; gPHA/gVSS). Results of ^{1}H-NMR and DSC analysis revealed that produced PHA in SBR_1 was poly (3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV).

Key words: biopolymer, food processing industry, pilot-scale production, polyhydroxyalkanoate, wastewater

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