

Varavut Tanamool. 2012. **Bioconversion of Sweet Sorghum Juice for Production of Polyhydroxyalkanoate**. Doctor of Philosophy Thesis in Biotechnology, Graduate School, Khon Kaen University.

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ABSTRACT

This research aims to study the production of a biopolymer of polyhydroxyalkanoates (PHAs) using sweet sorghum juice (SSJ) via batch and fed-batch fermentations by microorganisms isolated from sugar cane plantation soil comparing with 3 capable PHAs producing strains of *Alcaligenes latus* TISTR 1403, *Alcaligenes eutrophus* TISTR 1095 and *Hydrogenophaga* sp, respectively. The SSJ was characterised and contained of total sugar concentration at 207.43 g/L and composed of three main sugars as glucose (12.32 g/L), fructose (5.75 g/L) and sucrose (175.97 g/L), respectively. The three isolated strains coded as S4, S6 and S11 were selected for cultivation in the SSJ medium containing 20 g/L initial total sugar of SSJ in shaking flask. The results showed that the strain S4 which was identified by 16S rDNA sequencing as *Bacillus aryabhatai* (99.7 %), could grow better than other strains. This strain was selected for further fermentation in fermenter scale. The optimal condition for growth under variation of pH (5-9) was found at 6.5 to obtain the maximum PHAs production. Comparing among nitrogen sources studied, viz. urea, peptone, yeast extract, ammonium chloride (NH₄Cl) and ammonium sulphate ((NH₄)₂SO₄) for PHAs production, it evidenced that urea was the most suitable for the growth of *B. aryabhatai*. Then, Design Expert program (trial version) was used to optimize growth condition and the production of PHAs by response surface methodology (RSM). The optimal medium compositions were obtained as follows; 70.57 g/L of total sugar, 9.37 g/L urea, 4 g/L Na₂HPO₄, 1 g/L KH₂PO₄, 0.1 g/L MgSO₄ 7H₂O and 1 mL/L trace element. The maximum dry cell weight (DCW) and PHAs concentration were 6.22 g/L and 2.43 g/L. When the production was extended to 3 L bioreactor, a maximum DCW and PHAs concentration raised to 10.38 g/L and 4.36 g/L. Furthermore, fed-batch fermentation could improve DCW and PHAs

concentration approximately 3 folds (28.65 g/L and 15.57 g/L). The recovered PHAs exhibited the structure and thermal properties highly similar to the standard biopolymer of polyhydroxybutyrate (PHB).