

CHAPTER VI

CONCLUSIONS AND SUGGESTIONS

6.1 Conclusions

The studies of bioconversion of sweet sorghum juice for producing as biopolymer of polyhydroxyalkanoates (PHAs) products lead to make conclusions as follow;

6.1.1 An isolated soil bacteria identified as *Hydrogenophaga* sp. showed successfully for utilising several refined sugars especially sucrose. It has proven in its potential to produce PHAs in a high content (68.15% w/w) when sucrose medium was used as a sole carbon source and giving maximum PHA yield ($Y_{P/S}$) of 0.17 (g/g) and a productivity of 0.057 g/Lh.

6.1.2 Batch fermentation was carried by each 3 isolated strains and was compared to 3 referenced strains of *Alcaligenes eutrophus*, *A. latus* and *Hydrogenophaga* sp. under controlled condition of pH 7, 35°C and 20 g/L of initial total sugar in the SSJ. The results clearly showed that the isolates S4, S6, S11, *A. eutrophus*, *A. latus* and *Hydrogenophaga* sp. produced maximum PHAs at 57.62, 51.56, 21.17, 38.72, 20.33 and 31.53% dry weight and gave maximum productivity at 0.097, 0.082, 0.009, 0.038, 0.003 and 0.005 g/L.h, respectively. Comparing among the strains used, the isolate S4 clearly showed as a good candidate to produce PHAs from the SSJ. This isolate was identified similarly as *Bacillus aryabhatai*.

6.1.3 The optimal culture media composition predicted by statistical media design using Expert design software were as follow; total sugar 70.57 g/L, urea 9.37 g/L, Na_2HPO_4 4 g/L, KH_2PO_4 1 g/L, $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ 0.1 g/L and trace element 1 mL/L, respectively. A maximum biomass and PHA content of 6.22 g/L and 2.43 g/L were obtained from shaking flask culture. Interestingly, when the cultivation was conducted in 3 L bioreactor, the biomass and PHA concentration were significantly increased to 10.38 g/L and 4.36 g/L. Furthermore, PHAs were characterised and showed their structure and thermal properties such as the melting (T_m) and the degradation temperatures similarly to polymer standard of polyhydroxybutyrate (PHB)

6.1.4 The results obtained in batch and fed-batch experiments at various C/N ratio of feed medium were compared. In batch cultivation, the highest cell, PHB concentration and PHB content were 8.83, 1.96 and 22.20% (w/w), respectively. In case of fed-batch cultivation, the highest cell and PHB concentration were 28.65 and 15.60 g/L, obtained from C/N ratios of 10 and 20. The resulting in a highest PHB content of 59.14 % was obtained from C/N ratio 30. The results showed that both DCW and PHB in fed-batch cultivation increased approximately 3.24 and 7.96 folds when compared to those of the batch cultivation. PHB content and PHB productivity were also increased about 2.66 and 2.54 folds which was compares to batch cultivation

6.2 Suggestions

6.2.1 The optimisation of PHAs production in this study should be covered to the other certain factors.

6.2.2 The studies are required to supply pure oxygen and optimum substrate concentration of feeding medium to improve the PHB yield and to reduce the shear force that may damage bacterial cell.

6.2.3 Due to the cell structure of Gram positive cell wall, it was difficult to extract PHB from their cells. Hence, the appropriate extraction method is necessary to obtain the higher extractability for further study.

6.2.4 To improve fermentation process, other kinds of fermentation should be investigated such as continuous fermentation, repeated-batch and repeated-fed batch fermentations.