

CHAPTER 5

CONCLUSIONS AND FUTURE WORKS

5.1 Conclusion

The optimal digestion procedure was the simultaneous addition of all three enzymes. The highest specific sugar production level ($p \leq 0.05$) was obtained when 100 kNU, 25 FBG and 500 FXU, respectively either with or without pressurized steamer was employed (10.72 ± 0.10 and 10.70 ± 0.04 g sugar/g enzyme/l, respectively). The implementation of all three enzymes at the same time without application of the pressurized steamer was the most economical statistically ($p \leq 0.05$) ($1,097 \pm 10$ $\mu\text{g/baht/l}$) which was higher than the situation where the pressurized steamer was employed by 3.3 folds.

The digestion condition with the dried longan flesh powder to acetic acid solution/sodium hydroxide solution ratio at 2:10 using of 2%(w/v) acetic acid solution and 0.1%(w/v) sodium hydroxide solution at 1:1 ratio resulted in the maximum increase of specific sugar production level ($p \leq 0.05$) of 11.33 ± 0.01 g/g/l and the most commercially viable ($p \leq 0.05$) ($1,159 \pm 47$ $\mu\text{g/baht/l}$) in comparison with the other conditions.

S. cerevisiae TISTR 5606 could produce the highest level of dried biomass concentration (7.04 ± 0.07 g/l), consume the highest amount of sugars (82.9 ± 2.0 , 33.0 ± 0.8 and 38.0 ± 0.7 g/l for sucrose, glucose and fructose, respectively), and produce the highest level of ethanol production at 61.9 ± 5.5 g/l with the ethanol yield of 0.40 ± 0.04 g ethanol/ g sugars consumed in batch system. Fed batch system illustrated the toxicity of DDLFH medium in comparison to DLE medium. DDLFH medium feeding had a slower increasing trend of ethanol production than its counterpart.

The whole cells of *S. cerevisiae* TISTR 5606 in the condition of batch cultivation with DLE at 48th h fermentation period could produce the highest overall concentration of PAC in both phases at 15.6 ± 0.5 mM. However, the certain lost/undetected concentration of substrate benzaldehyde was observed. This might be due to the absorption by cells and formation of the benzaldehyde-cells suspension between the interfacial layer of aqueous/organic phase in the system which generated a relatively smaller amount of PAC.

5.2 Future works

- 5.2.1 The decreased xylan and/or cellulose concentrations in enzymatic digestion experiment should be determined to account for the source of additional sugar concentrations.
- 5.2.2 The fed batch cultivation period should be prolonged for the additional period of 24 h with another round of aeration to improve the ethanol production for both *S. cerevisiae* and *C. utilis*.
- 5.2.3 The furan, furfural and HMF should also be determined by HPLC to account for the level of inhibitory substance in the medium.
- 5.2.4 The whole cells of *C. utilis* UNSW 709400 and 709700 should be cultivated in the conditions that induce high level of ethanol production for later examination of PAC production from the harvested whole cells PDC.
- 5.2.5 PAC biotransformation system could be improved by decreasing volume ratio of organic to aqueous phase with increasing temperature to 20 – 21 °C to facilitate the higher level of PAC production with smaller organic phase volume as well as to increase production rate and to curtail the cooling cost.
- 5.2.6 The utilization of MOPS and DPG and further detailed study should be investigated to rectify the benzaldehyde loss problem so that the benzaldehyde balance could be improved.