

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

As the increasing of product manufacturing and expansion of industrial area, the environmental impact assessment is more widely concerned in terms of how to raise the economic performance together with decreasing environmental degradation. Life Cycle Assessment software is playing important role in processes and/or products design, so demand of using LCA software has been increased significantly. Several LCA software have been developed to fulfill that requirement. However, the simple LCA software that can be integrated with other process design tools is still needed. Therefore, LCSOft has been developed to be the software that has ability to be integrated with other process design tools. This version of LCSOft has been added 4 new features including LCI calculation function, extended database, new impact categories, and new contribution analysis function. The accurate and reliable results of development were presented together with case study of acetic acid (98 %) production and bioethanol production using cassava rhizome as a feed stock. LCSOft allows a fast, reliable, and systematic calculation of inventories and emissions, and the integration with other important tools for economic and sustainability analysis allows a robust, flexible, and systematic calculation in order to perform multi-criteria evaluation.

5.2 Recommendations

Although the development of LCSOft could be successfully, several recommendations could be offered as follows:

5.2.1 LCI Calculation Function

LCI calculation function developed in this version of LCSOft can give accurate results compared to commercial LCA software, SimaPro7.1. In order to increase the completeness of the LCI calculation, this function need to be further

developed for advance calculation such as multifunctionality and product allocation, cut-off, closed- loop recycling for instance. The completeness of LCI calculation affect directly to quality of LCA results

5.2.2 LCI Database

LCI database is very important part in LCA. Several data are published but the quality and completeness of data are needed to be concerned. LCI in LCSoft should keep extending with good quality data to increase the application range ,completeness of dataset, and quality of assessment results.

5.2.3 Uncertainty Analysis

In order to understand LCA clearly, uncertainty factor is one of important factor that need to be concerned. Analyzing LCA results without uncertainty information cannot fully accepted due to the uncertainty in results, so the uncertainty analysis are strongly recommended to be developed as a very useful function for LCA in order to quantify and estimate the influence of uncertainty in LCI database or in impact category model to the assessment results.

Finally, future work is focused on extension of LCI database in LCSoft. Other impact categories for supporting on LCIA calculation are concerned. Uncertainty analysis needs to be developed.