CHAPTER III
EXPERIMANTAL

3.1 Materials and Equipment

Equipment:

Desktop, Intel® Core™ 2 Duo CPU E6750 2.66 GHz, 2.95 GB of RAM

Software:

VBA in Microsoft Excel on Window XP

3.2 Methodology

3.2.1 Literature Review

"Chemical process design and integration" was reviewed in order to understand the process design method and to learn how to optimize the designed process in the aspect of economy, sustainability and environmental. The background and procedures of LCA were reviewed as well as necessary equations to be used to develop calculation models for the program. After that, available LCA softwares were reviewed to study relevant features that should be included in the program.

3.2.2 Develop Calculation Model of LCI and LCIA for Program

In this part, all steps of LCA necessary to implement into the program were defined. The program developed in this study is called "LCSoft" which consists of two parts which are inventory analysis (LCI) and impact assessment (LCIA). Make list of equation that require for LCI and LCIA including the following:

- Equation for calculating inventory data for the process, for example, indirect emission, energy and resource consumption
- Equation for carbon footprint estimation
- Equation for impact assessment for eight impact categories like shown in equation (2.1) - (2.8)

All identified equations were verified using existing data and parameters to ensure accuracy and correctness of the models. Finally, calculation models were developed by building-up calculation step as a flowchart which illustrates all calculation steps for both LCI and LCIA step-by-step.

3.2.3 Software Design and Development

Software architecture was created to use as a structure of the software. This architecture must show connection between each feature of the software. The activity diagram was then generated based on calculation models in order to show work flow and data flow of the software as well as all necessary data and parameters needed in each step. After activity diagram has been done, calculation procedure was validated. At this step, hand calculation was performed on a selected case study, step-by-step according to the activity diagram. Acetaldehyde production process created in the process simulation course 2010 at the Petroleum and Petrochemical College was used as a case study. Eventually, the resulting software (LCSoft) was implemented by VBA in Microsoft Excel.

3.2.4 Final Validation

In this step, the developed software "LCSoft" was validated for LCA study using a case study mentioned above (acetaldehyde production process). The results were then compared with the results obtained from hand calculation method.

3.2.5 Write Manual

It is important that a manual was written to describe how to use the software for users.