CHAPTER I

INTRODUCTION

1.1 GENERAL INTRODUCTION

At present, it is widely known that environmental problems are the great problems in the world. Providing our society with goods and services contributes to a wide range of environmental impacts. Waste generation, emissions and the consumption of resources occur at many stages in a product's life cycle—from raw material extraction, energy acquisition, production and manufacturing, use, reuse, recycling, through ultimate disposal. All of these contribute environmental impacts are climate change, stratospheric ozone depletion, photo-oxidant formation (smog), eutrophication, acidification, toxicological stress on human health and ecosystems, the depletion of resources and etc. Since environmental problems, which widely spreads in the world are due to the growth of industry and population, become a very important problem. So the organizations dealing with environmental problems have issued regulations and guidelines, such as ISO 14000, for industries to operate with the least environmental effect. Because many products and processes contain multiple effects on the environment, hence, addressing each of the environmental effects individually provides very little improvement. A holistic approach that looks at the product or process and all the environmental problems it causes is more effective. There are several available assessment tools; such as an Environmental Impact Assessment (EIA), a Risk Assessment (RA), and a Waste Minimization Strategy etc. However in many cases, the results do not truly reflect the environmental impacts. Since, Life Cycle Assessment (LCA) is one of a powerful tool being capable quantifying environmental burdens associated with a product, process or activity, which encompasses extracting of raw materials, manufacturing, transportation distribution, use, re-use, maintenance, recycling and disposal.

Environmental impacts from emissions into the environment and through the consumption of resources associated with providing products that occur when

extracting resources, producing materials, manufacturing the products, during consumption/use, and at the products' end-of-life. Most people involved in the industrial engineering community (consultants, manufacturers, researchers and institutional actors) assert that Life Cycle Assessment (LCA) is the most successful tool to assess environmental considerations in the product. LCA is a tool being capable quantifying environmental burdens associated with a product, process or activity, which encompasses extracting and raw materials, manufacturing, transportation distribution, use, re-use, maintenance, recycling and disposal. LCA was proposed to solve this problem and establish a link between environmental impacts, operations and economics of a given product or process.

Wood plastic composites (WPCs) are a new material type and a wide range of these materials is being developed. WPCs utilize wood fibers as reinforcing filler in the polymer matrix. The plastics being used include PP, PE, PS and PVC and the fillers used include sawdust, wood flour, flax, rice hull and jute. This range of raw materials gives a wide range of properties and the high wood content of some products (up to 70%). It has advantageous over the neat polymers in terms of the materials cost and some mechanical properties such as stiffness and strength. WPCs have a wide range of application. They can attractively replace wood and plastic products in many applications such as wood-replacement application like decking. Therefore, WPCs are expected to constitute the most prominent segment of the artificial wood industry within the next decade. From the great demand and use of WPCs, the environmental assessment should be considered in the production of WPCs. Hence, it is crucial for the development of green products in the future. Since, LCA is a method aimed at identifying the environmental effects connected with a given product, process or activity along its life cycle then LCA is applied to evaluate the environmental impacts of WPCs and show the important burdens in various aspects and categories throughout the WPCs life cycle.

This research focused on identifying, quantifying and comparison of environmental impacts of production of WPC based on PP and PVC. Since LCA is the most appropriate tool to achieve this purpose, allowing a global overview of this activity. So, we perform a LCA as a tool for analyzing our problems. For LCA data

and compilation and analysis, SimaPro® 6.0 software was used to assess the environmental impacts of various categories.

1.2 OBJECTIVES OF THE RESEARCH

The objectives of research are to study the life cycle of wood-plastic composites prepared from poly(vinyl chloride) and polypropylene resins blend with sawdust, agriculture waste, to analyze and compare environmental impacts and economic performance between each steps through its life cycle for determine the process which has the highest performance for production of WPC. The results lead to the production of WPCs appropriately.

1.3 SCOPE OF THE RESEARCH

This research investigates life cycles of wood-plastic composites prepared from poly(vinyl chloride) and polypropylene resins blend with sawdust associate with material acquisition, production, product disposal and transportation. Since the data acquirement is not derived from any processes in any companies, therefore all of data in life cycle of WPC are derived from literature review such as thesis, paper from journals and database from SimaPro®6.0 software. The estimation of environmental impact and economic performance are quantified and compared two different WPCs. SimaPro® 6.0 software was used as software tool to assess the environmental impacts of various categories by Eco-Indicator 99 and Eco-Indicator 95 method.

1.4 CONTRIBUTIONS OF THE RESEARCH

This work provides criteria for an appropriate selection of plant location and two different WPCs; between WPC prepared from PP/sawdust and PVC/sawdust by comparison of environmental impacts which occur through its life cycle (material extraction, transportation, production and production disposal), economic performance and its properties. Moreover, this thesis presents principle of Life Cycle Assessment (LCA) method for comparison and estimation of environmental impacts of any products using SimaPro®6.0 software.

1.5 THESIS ORGANIZATION

This thesis is organized into 6 chapters. Relevant results and detailed analysis are documented in the appendixes.

Chapter 1 introduces this research with the general background, the problem statement, research objectives and the scope of study. Chapter 2 combines primary theories relative to the field of Life Cycle Assessment (LCA) and Wood Plastic Composites (WPC). This chapter prepares requisite knowledge in order to construct the research plan and implementation. Chapter 3 provides a summary of literature relevant to the present study, which is an important background to this field. Chapter 4 represent materials equipments and research methodology for evaluate environmental and economic effects. Chapter 5 illustrates experimental results and discusses the environmental impacts and economic performance of wood plastic composites. Chapter 6 finalizes the research with conclusion of validated results. In addition, recommendations for further study are proposed.