# CHAPTER 1

# INTRODUCTION

## 1.1 Background of the Study

The utilization of lignin for production of molecular aromatic chemicals has become an effective alternative way instead of using petroleum. Lignin is considered as a potential renewable resource of chemicals and fuels due to the high energy content and its structure especially in the condition of escalating petroleum price and renewable energy demand (Wang et al., 2013). Lignin is capable in producing valuable products such as carbon fibre, phenols, and adhesives (Zhang et al., 2010; Uraki et al., 1997; Pan et al., 2000).

Besides that, rather than using chemical treatment, the biochemical depolymerization of lignin also will be apply to increase the yield of molecular aromatic chemicals. An effective method for analytical determination of lignin and its degradation products is very valuable in various industries as well as for decreasing the percentage of environmental pollution (Shleev et al., 2006).

## 1.2 Motivation

The production of chemicals and fuels by utilizing of lignocellulosic biomass has attracted growing attention as it does not compete with food production (Huang, et al., 2014). Furthermore, the high worldwide demand for energy, the reduction of fossil fuel reserves, as well as the concern over global climate change had cause the resurrection in renewable carbohydrates as energy sources (Lynd et al., 2005; Zhang et al., 2007; Zhang et al., 2010). Due to this scenario, lignocellulosic biomass, especially

that are arising from agriculture residues such as forestry wastes, waste paper and energy crops, is increasingly being viewed as a potential renewable energy source. Moreover, lignocellulosic materials such as agriculture wastes, grasses, and woody materials also have a great potential in the bio-fuel production. Lignocellulosic biomass comprise of three dominant components which are cellulose, hemicelluloses and lignin.

One of the components is lignin, which are the most recalcitrant components in lignocellulosic biomass. Lignin has been treated as a by-product in the pulp and paper industry (Rahimi et al., 2014). Regarding the former group, increasing the production cost, stiff competition from new pulp and paper producers in Asia and Latin America, and also complying with stringent environmental legislation are the main challenges facing by the pulp and paper industry in Europe and North America (Viikari et al,2010; Ragaukas, 2003). Thus, instead of being treated as a waste product, lignin actually is one of the most abundant natural sources of aromatic chemicals.

Lignin is known as renewable source for aromatic chemicals, thus depolymerization of lignin is the important starting point for many valorization strategies. It could generate many valuable aromatic chemicals and also provide a source of low-molecular-mass feedstock which is suitable for downstream processing (Rahimi, et al., 2014). Besides that, depolymerization of lignin also apply biological reaction under mild condition instead of chemical reaction only that will consume more energy which can contribute to high cost of manufacturing.

On the other hand, biological reaction will decrease the percentage of environmental pollution since it offer a green process reaction. Therefore, lignin is not function as a waste product that supply energy but a deeper research regarding lignin could bring a victory to the economic viability of integrated biorefineries. In the future, lignin is expected to have an important role as a raw material for the production of biofuels and valuable aromatic chemicals.

## 1.3 Problem Statement

Typically, aromatic chemicals had been produced from petroleum. But, in order to decrease the uses of petroleum in production of aromatic chemical, an effective alternative had been introduced which is by using lignin as it is known as an abundant source of aromatic chemicals. In addition, to improve the yield of these products, instead of using lignin, formic acid also has been used in the experiment as it can pretreat the lignin**.**

## 1.4 Objectives

The following are the objectives of this research:

1) To study the effect of formic acid on the pretreatment of lignin from palm oil empty fruit bunch (POEFB) by varies the reaction time through the depolymerization by laccase from *Trametes versicolor.*

2) To explore the depolymerization of lignin by laccase from *Trametes versicolor* in production of aromatic compounds.

## 1.5 Scopes of Study

The following are the scopes of this research:

1) To study the effect of 100 ml of 86.24% of formic acid and 0.2 M sulphuric acid as a catalyst in the isolation of lignin from palm oil empty fruit bunch (POEFB) by varies the reaction time (2,4 and 6 hours) through the depolymerization by laccase from *Trametes versicolor.*

2) To produce the value added product which is vanillin through depolymerization of lignin by laccase from *Trametes versicolor.*