CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Lignin, a heterogeneous and highly cross-linked macromolecule (El Hage et al., 2010) is the most abundant aromatic biopolymer in nature. This aromatic nature is capable in becoming a potential renewable source of aromatic chemicals and also others production with higher added value (Huijgen et al., 2014). Lignin is the major structural constituent of lignocellulosic biomass. Lignocellulosic biomass consist of lignin, which is the polymer of aromatic compounds and also sugar polymers, where include of cellulose (a linear polymer of glucose) and hemicellulose (a branched copolymer of C5 and C6 sugars). The lignocellulosic biomass current application had forces the growth of pretreatment technologies which are required to separate them. There is been a lot of pretreatment methods have developed but most of the time, the structure of isolated lignin usually rely on the type of method being applied. Hence, the pretreatment methods affects the quality and also purity of lignin structure.

Among the pretreatment methods to isolate lignin from its lignocellulosic biomass, the organosolv method process is the promising pretreatment method for biorefinery approach (Huijgen et al., 2014). Others method such as Kraft lignin, which is acquired by cooking in soda–sodium sulfide liquor has the weakness that it contains large amounts of sulfur compounds including lignosulfates and effect the purity of lignin produce. Eventhough it is the most commonly used method to obtain
chemical pulp, it still resulted with low yield, high uses of bleaching reagents and release of gaseous sulfur compounds during cooking (de la Torre et al., 2013).

Organosolv method has been optimized for delignification for many types of lignocellulosic biomass like hardwood (e.g. poplar), softwood (e.g. pine) and also herbaceous (e.g. miscanthus, wheat straw). Organosolv method could offer cellulose-rich pulps with a better enzymatic digestibility and also yields large amount of high quality and purity lignin where this lignin could be further use in the field of composites or even biodegradable polymers (El Hage et al., 2010). The organosolv process uses an organic solvent as delignifying agent and mostly use ethanol as the solvent. It produces cellulose and possible to recover by-products from the black liquors that contains hemicellulose degradation products and dissolved lignin where both sulfur-free (de la Torre et al., 2013).

Nowadays, renewable lignocellulosic feedstocks like agricultural crop residues offers a right choice as feedstocks for pulp and also cellulose-fiber based products in order to reduce agriculture residues accumulation (Alriols et al., 2009). In South East Asia, oil palm empty fruit bunch (OPEFB) being the main waste from the palm oil industry. This agroindustrial byproduct have been measured as a potential low-cost and plenty cellulosic biomass for use as an alternative and renewable bioresource existing for the biorefinery field (Hong et al., 2013). About 15 million tons per year of OPEFB are produced in Malaysia and being burned thus creating pollution and economical problems. Oil palm empty fruit bunch (OPEFB), a lignocellulosic residue generated during oil extraction process was used as raw material for lignin production in this study. Mostly, the large quantities of these residues are unutilized and offer several studies to support the prospect of this OPEFB as raw materials in variety of applications (Alriols et al., 2009).

In this work, a complete approach for establish a system in separating and isolating high yield of lignin from lignocellulosic residue was developed. This study attempts to develop an organosolv pretreatment process under mild conditions in separating lignocellulosic components from OPEFB and isolating the lignin through precipitation. The aim of this study was to find the best condition to achieve the high
yield of lignin from OPEFB through organosolv method. The organosolv method required a list of parameters that needed to be study to achieve high yield of lignin including the solvent concentration and also the extraction time.

1.2 MOTIVATION

Nowadays, renewable lignocellulosic feedstocks like agricultural crop residues offers a right choice as feedstocks for pulp and also cellulose-fiber based products in order to reduce agriculture residues accumulation (Alriols et al., 2009). In South East Asia, empty fruit bunch (EFB) being the main waste from the palm oil industry. This agroindustrial byproduct have been measured as a potential low-cost and plenty cellulosic biomass for use as an alternative and renewable bioresource existing for the biorefinery field (Hong et al., 2013). About 15 million tons per year of EFB are produced in Malaysia and being burned thus creating pollution and economical problems. Mostly, the large quantities of these residues are unutilized and offer several studies to support the prospect of this OPEFB as raw materials in variety of applications (Alriols et al., 2009). About 25% of OPEFB are produced for every FFB entered to the oil extraction processes. Nowadays, OPEFB solid wastes have become a major issue in biorefineries that using palm oil as their feedstocks. OPEFB use as fuel are limited due to the high content of moisture even though it is use as a fertilizer for oil plantation and a material for growing mushrooms (Narapakdeesakul et al., 2013).

OPEFB is a lignocellulosic residue of palm oil mill that creates environmental problem and has low economic value that become the major waste stream of palm oil production that usually used as fertilizers, disposed in landfills, and also been burned in incinerators (Jeon et al., 2014). This OPEFB fiber that is one of the massively biomass being produced in Malaysia able to maintain the sustainability resource for the production of value-added fiber-based products like pulp, paper, fiber board, panels and now, OPEFB also are capable in converting into cellulosic ethanol. Researches have been made and prove that OPEFB can be converted into glucose and xylose successfully for bioethanol production (Ying et al., 2014) and they support the chance of using OPEFB as raw material in range of applications like