CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Oil palm tree or logically called (Elaeis guineensis) is a tropical palm which is started from Africa. The development of oil palm trees began as a moderately little scale plantation. However in less than 100 years, it became one of the most profitable agricultural commodities in the world. Malaysia’s climate is suitable for the development of oil palm tree. The cultivation in Malaysia has started almost a century ago. Malaysia was acquainted by the British in mid-1870 as decoration plant. In early 1960s, the cultivation of oil palm expanded at a quick pace. It was under the administration farming broadening project to minimize the country economic reliance on rubber and tin. Up to this point, Malaysia still on the top in the world as one of the biggest exporter of palm oil (Awalludin et al. 2015). The main product from oil palm is crude palm oil which is largely used in many industries.

Despite the benefits obtain from the cultivation of oil palm tree, there is also problem arises that need to be solved by the country. The main issue in the cultivation of oil palm is the substantial amount of biomass wastes. Some examples of wastes generated after harvesting or processing are empty fruit bunches (EFB), oil palm trunks (OPT), mesocarp fiber (MF), palm oil mill effluent (POME), oil palm fronds (OPF), oil palm leaves (OPM) and palm kernel shell (Awalludin et al. 2015) (PKS). These wastes are left behind and smoldered in incinerators by palm oil mills that created pollution to the environment and offers limited value to the industry (Rahman et al. 2006).
Empty fruit bunch (EFB) fibres is the waste product commonly from oil palm industry. The chemical composition of oil palm EFB biomass contains holocellulose (cellulose and hemicellulose), lignin, extractives and ash (Rahman et al. 2006). Holocellulose are naturally from the removal of the extractives and the lignin in lignocellulosic materials. It is known to be soluble in dilute alkali. Other chemical composition of oil palm EFB is lignin which acts as a binder in supporting all cells and microfibrils in the lignocellulosis structure but it is different in chemical structures relying on the types of plant it presents (Rahman et al. 2006). Extractive and ash in oil palm EFB comes in small proportion which is less than 10% each. EFB can be converted into useful biomass such as bio-oil that can be used to produce biophenolic resin which gives economic advantages to the country.

Numerous research have been made on oil palm EFB to find alternative ways to beneficially utilize EFB (Yusoff 2006). Generally, EFB biomass can be converted into value-added products through several processes for example, mechanical processes, direct combustion, gasification, pyrolysis and liquefaction. This research will be focused on liquefaction technique via oil bath heating to produce biophenolic resin.

Liquefaction is a process by where the biomass went to complicated thermochemical reaction in a solvent medium to produce liquid product. Oil bath heating is used to assist the liquefaction process in this study instead of using microwave heating. This is because it is suitable for heating reaction mixtures and has been widely used by researchers unlike microwave assisted which is still in study as it is a new technique. The contact is intimate as the hot oil used will completely surrounds the sides and bottom of the neck flask which will results in effective heat control. In addition, oil bath is inexpensive and safer to handle without being assisted.

In this study, liquefied EFB are produced from the reaction of EBF with phenol in the presence of acidic catalyst. The effect of phenol to EFB ratio will be investigated to obtain optimum ratio that will give highest yield of liquefied EFB. The liquefied EFB is then reacts with Glyoxal. Glyoxal is a dialdehyde that is used to
replaced formaldehyde in the synthesis of phenolic resins (Ramires et al. 2010). Formaldehyde, which is one of economical important chemical has been recently classified by The International Agency for Research on Cancer (IARC) as human carcinogen which can cause leukemia with its exposure (Zhang et al. 2009). This become main reason of replacing Glyoxal to natural sources that is non-toxic and environmental friendly. The bio-phenolic glyoxal resin that is produce from this study can be beneficial used in various application such as adhesives, composites and coating materials.

1.2 STATEMENT OF PROBLEM

Over the last few decades’ Malaysian palm oil industry has become one of important agriculture-based industry (Awalludin et al. 2015). The demand for palm oil from the global is high as Malaysia is one of the leading countries in producing and exporting the palm oil. With the increase of need for the palm oil, indirectly, it increase the oil palm waste from the harvesting process such as empty fruit bunches (EFB). The abundance of the EFB has caused environmental issues such as air pollution, fouling and attraction of pests.

In order to overcome the problem, a study is conducted to produce bio-phenolic resin from EFB via microwave-assisted liquefaction which can be used in industry. This bio-phenolic resin produced can be applied into various industry as it is environmental friendly and reusable. Utilization of EFB waste will reduce the wastes and it effects to environment. It also can reduce the dependency on petroleum chemical to produce PF resin.

Oil bath heating is used to assist the liquefaction process in this study. This is because the use of oil bath instead of microwave heating will help in reducing the cost and it is suitable for heating reaction mixtures. For resinification process, Glyoxal was used as the dialdehyde replacing the formaldehyde. This is because formaldehyde contains toxic which can effect in developing of cancer and other diseases. Research that were conducted by Michael Krzyzanowski et al. shows that exposed of formaldehyde causes upper respiratory tract irritation (Michael K. et al.