CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF RESEARCH

Malaysia is among the top most crucial palm oil producers in the world. Oil palm tree is a tropical palm plant which is originates from Africa. The development of oil palm trees has advanced from being a generally little scale crop in Africa to one of the world's most gainful farming wares in under 100 years. In Malaysia climate, oil palm trees can grow well. The historical backdrop of oil palm development in Malaysia was begun when oil palm trees were planted as decorative plant before deliberately being utilized as national crop. Besides, the oil palm tree is a multipurpose crop that benefits the socio-cultural activities of the inhabitants of the area in which it grows. The main problem in the oil palm tree cultivation and its related industries is its substantial amount of biomass wastes. The wastes such as empty fruit bunches (EFB), palm oil mill effluent (POME), mesocarp fiber (MF), palm kernel shell (PKS), oil palm trunks (OPT), oil palm fronds (OPF) and oil palm leaves (OPL) are generated after the oil palm fruits harvesting, palm oil processing or during oil palm trees replantation. Except POME, the rest wastes are higher in fiber content (Mushtaq et al., 2015).

Characteristic strands have pulled in light of a legitimate concern for industry individuals including material scientist and researchers in the previous couple of decades. This is because of their particular points of interest when contrasted with synthetic or conventional fibers. In polymer science field, there are a lot of applications and products produced from polymer composite materials of natural fiber-reinforced. Comparable to composite materials of conventional synthetic fiber, the production of

composite materials that comes from oil palm fibers and other renewable fibers did offered some specific properties. Abundant supply of palm press fibres and oil palm empty fruit bunch (OPEFB) being produced in Malaysia. They are considered as wastes and have not been well-utilized. The fresh oil palm fruit bunch contains about 6-7 % shell, 21 % palm oil, 14-15 % fibre, 6-7 % palm kernel, and 23 % empty fruit bunch (Umikalsom et al., 1997). Generally, large amount of biomass wastes that has been yields from a palm oil plantation in the form of EFB. One of the lignocellulosic wastes from palm oil mills is OPEFB fibre (Rahman et al., 2006).

It is exceptionally basic to do a far reaching study on the chemical compositions significant natural parts in biomass. This will lead towards the improvement of innovation and procedures required for creating bio-based items. Biomass wastes contain a high measure of natural parts, for example, lignin, cellulose, hemicelluloses and extractives otherwise called significant components in biomass (Blasi et al., 1999). Carbon dioxide and daylight are changed over into chemical energy leading to cellulosic biomass during photosynthesis (Akhtar and Amin 2011). The chemical compositions of oil palm biomass are similar to other biomass, which consists of holocellulose (cellulose and hemicellulose), lignin, extractives and ash (Kelly-Yong, 2007). Generally, the OPEFB fiber contains cellulose (40–50 %), lignin (20–30 %), and hemicellulose (20–30 %) with moisture content (10–15 %). There are a few products which have been produced from OPEFB. Among them are the productions of bio-oil and also up to 24 wt.% of lignin which shows the potential of EFB to be used as feedstock of a phenolic compound replace for phenolic resin production (Sidik et al., 2013).

Oil bath heating is one of the methods of conventional heating before microwave irradiation being introduced in field of organic chemistry. This oil bath heating was utilized for heating the reactor. The temperature of the oil bath was controlled by a customizable thermometer. However, some sources said that this oil bath heating method is a conductive warming technique which utilizing an outer warmth source (Xiong et al, 2016).

In this research, oil bath heating liquefaction will be applied in EFB liquefaction using phenol in the presence of sulphuric scid, H_2SO_4 and ratio of sulphuric

acid/phosphoric acid, H_2SO_4/H_3PO_4 as catalysts. The products obtained from the liquefaction process were then reacted with furfural to produce liquefied-EFB-furfural resin. The liquefied EFB and the liquefied-EFB-furfural resin will be characterized using Fourier Transform Spectroscopy (FTIR), Thermogavimetric Analysis (TGA) and Differential Scanning Calorimetry (DSC).

1.2 PROBLEM STATEMENT

Oil palm is the most important commodity from Malaysia with significant contribution to its gross domestic product (GDP). Lignocelluosic biomass which is produced from the oil palm industries include parts such as OPT, OPF, EFB and POME. Nevertheless, it has created a major disposal problem due to thr presence of these oil palm wastes (Abdullah and Sulaiman, 2013). Due to its ready-availability as daily biomass-waste, EFB which are the main oil palm biomass waste could be used as a raw material to produce bio-chemical and reduced the dependency of using petroleum-based chemical in the production of phenolic resins. In order to overcome these problems, a green technology investigation and research for environmental friendly is essential.

Phenol-formaldehyde (PF) is a synthetic polymer acquired from the reaction of phenol or substituted phenol with formaldehyde. PF resin was the first commercialized synthetic resin with huge applications in engineering materials, coatings, casting, household products and adhesives. Besides, PF also still stand at an indispensable position among composite binders, matrixes, fire retarding materials and adhesives although they have a long history since they were first invented in 1907 (Gardziella et al., 2000 and Pilato, 2010). In the present study, there are several reasons to substitute PF with furfural. Based on the World Health Organization's International Agency, formaldehyde is classified to be a carcinogen with genotoxity (Hahnenstein et al., 1994). Furthermore, PF and its vapors are also dangerous to human skin, respiratory tract and eyes as well as the heart and central nervous system (Warner and Harper, 1985; O'Neil and Budavari, 2001). In recent years, even though the price of crude oil is decreasing, the price of chemical such as PF still high due to the high demand from developed and developing country.