CHAPTER 1

INTRODUCTION

1.1 Introduction

At present, concrete is one of the most widely used building materials in bridges, buildings, roads and other infrastructures. Currently, approximately 1 ton of concrete is produced each year for every human being in the world (Van den Heede P, 2012). Natural sand is prime material used for the preparation of concrete. With the growth in urbanization and industrialization, the demand for sand supply is increased day by-days. Continuous sand mining from the natural environment will cause the depletion of this material in the future generation. The reduction in the sources of natural sand and the requirement for lowering the cost of concrete production tend to find new alternative material to replace natural sand in concrete. In order to resolve these problems, one of the available materials which can be widely found in Malaysia is palm oil fuel ash (POFA). It is seen that integrating palm oil fuel ash (POFA) would be one of the steps to reduce the use of natural sand in concrete production.

Palm oil fuel ash (POFA) is an agro-waste ash from which palm oil residue, such as palm fiber and shells, are burnt at temperatures of about 800°C -1000°C to produce steam for electricity generation in biomass thermal power plants. Malaysia produced about 3 million tons of POFA in 2007 (Malaysian Palm Oil Board , 2009) and 100,000 tons of POFA is produced annually in Thailand, and this production rate is likely to increase due to the increased plantation of palm oil trees (Chindaprasirt *et al*., 2007). In addition, the partial replacement of sand with POFA can lower the production costs, as well as improve the engineering properties and durability of concrete. Furthermore, the utilization of POFA in particular in high volume can increase the eco-friendliness and greenness of concrete, contributing to a healthier and more sustainable environment.

1.2 Problem Statement

Generally, palm oil fuel ash (POFA) is one of the common wastes from palm oil mill generated from the combustion of palm oil residue which are used to power oil mill plants for electricity generation (Hussin *et al*., 2010). Annually, it was estimated that the total production of POFA was 2.6 million in Malaysia (Hassan et al., 2014). These waste are disposed off as landfill material without any economic return or recycling (Borhan et. al., 2010). Utilization of POFA is minimal and unmanageable, while its quantity increases annually thus creating large environmental problems in future. The palm oil mill has been facing difficulties in disposing this abundantly generated waste. In future, more dumping site needs to be allocated for this waste disposal and large sum of money is to be spent for managing this waste.

1.3 Objectives

The objectives of this research are:

i. To investigate the workability of concrete containing ground palm oil fuel ash (POFA) as partial sand replacement.
ii. To investigate the effect of ground palm oil fuel ash (POFA) content as partial sand replacement towards compressive strength of concrete.
iii. To determine the effect of ground palm oil fuel ash (POFA) content as partial sand replacement towards flexural strength of concrete.

1.4 Scope of Studies

This study concentrated on investigation of workability, compressive strength and flexural strength of concrete made by integrating palm oil ash fuel (POFA) as a partial sand replacement. In this study, each sample of concrete being designed with grade 30MPa. Two type of mixes were used in this experiment work namely plain concrete which act as a control specimen and concrete containing of palm oil fuel ash as partial sand replacement. Control specimen were mixed with 0% of POFA. The content of POFA has been produced in the ranging from 10%, 20%, 30%, and 40% respectively by weight of the sand.

The concrete were casted in form of cubes and poured into the mold until it was harden. The process of taken out the concrete from the mold can be done after 24 hours to harden the concrete. Then, the harden concrete was cured in water curing and was tested at 7, 14, 28 days for all mixes. After the specimens matured due to curing period, the compressive and flexural strength test will be conducted at 7, 14 and 28 days. Application of water curing is the most suitable method to be applied to achieve better strength in the concrete containing POFA as partial sand replacement. Continuous presence of moisture promotes better hydration and pozzolanic reaction contribute to formation of extra Calcium Silicate Hydrate (C-S-H) gels and that subsequently make the concrete become denser and more compacted with higher strength.

1.5 Significance of Studies

There are several significance in this research project. Firstly is the effective POFA in concrete is would able to decrease the cost of concrete production. Then, it also one of the main goals of sustainable waste management where would maximize recycling include reducing environmental pollution, solve the landfill problem for the disposal of these wastes and preserving the naturals resources. These is to ensure that the replacement of this material in sand production give a good impact in the environment. Not only that, the modified concrete also can give a more quality construction material in the future.

1.6 Layout of Thesis

This report consist of five chapters. Chapter 1 describes about the introduction of this research. The background of the present research has been stated to identify the problem. Then, objectives, significance and scope of the research also has been discussed in this part.

Chapter two discussed about the origin, production, negative impact and physical characteristics incorporating with POFA. The type of fine aggregate in concrete and its characteristics has been stated in this research. Besides, the properties of concrete and the factor influencing it also has been included in this chapter.