CHAPTER 1

INTRODUCTION

1.1 Introduction

Concrete has been the most widely used construction material that made up of course aggregate, fine aggregate, cement, and water in which its application can be seen mostly as a building elements, such as column, wall, slab, foundation and other building material. The properties for concrete mix will be determined in different proportion in terms of workability and permeability. Aggregate is the major component material in concrete production that makes 70 per cent of its volume. ASTM defines aggregate as granular material such as sand, gravel and crushed stone used with cementing medium to form mortar or concrete (Lamond & Pielert, 2006). Sand usually give the necessary strength to solidification of concrete.

Palm kernel shells are often removed after crushing and transported in separate mills. The by-products from this palm oil plantation are often turned into wastes in the form of empty fruit bunches, fibers and shells, as well as liquid effluent. However, a lot of wastes are generated from the palm oil industry during the process of disposal. Thus an early review in the previous study has investigate through the utilisation of industrial waste substances, such as saw dust and oil palm kernel shell (OPKS) to replace fine aggregate and course aggregate respectively. It can be seen that the production of concrete slabs are often used in IBS (Industrialized Building Systems) onto building with precast concrete.

In this study, crumb rubber (CR) and OPKS are used as coarse aggregate replacement in the production of lightweight concrete slab. Both are utilized to meet the design specification. However, lightweight concrete is different from conventional concrete in which it is lighter in weight and lower in density and thermal conductivity.

The application of rubber particles and OPKS in lightweight concrete provides further opportunity to recycle waste tires and make use of the abundant shells available.

Malaysia as an emerging country has no exception in receiving all the new technology for the construction industry. Hence recycling of these waste substances could somehow solve the disposal problem of waste and safe the nature. Hence it can be a good start to the country in reducing health problem causes from the surrounding economical design inside any building and at the same time meet the design specification.

This study would go further into determine the strength and flexural behaviour of lightweight concrete as a slab. The performance of concrete should be seen when certain percentage of kernel shells and crumb rubber to replace coarse aggregate are added. Throughout this chapter, an overview of the background of study, problem statements, objectives, scope of research and research significant will be further discussed.

1.2 Background Of Study

In today's rising construction costs and the world's concern to reduce the environmental effect to make construction sustainable, has necessitated research into the use of alternative materials. This includes the readily available material and such materials should be cheap which can replace conventional concrete. The use of cheaper building materials without loss of performance is very crucial to the growth of developing countries (Zemke & Woods, 2009).

In the previous research, Olutoge (2010) investigated the suitability of sawdust and palm kernel shells as replacement for fine and coarse aggregate in the production of reinforced concrete slabs. He concluded that 25% sawdust and palm kernel substitution reduced the cost of concrete production by 7.45%. He also indicated the possibility of partially replacing sand and granite with sawdust and palm kernel shell in the production of lightweight concrete slabs.

As in Malaysia, a researcher has make use of the old oil palm kernel shell (OPKS without fibre) collected from a local palm oil mill producer located in Johor, the Southern state of Malaysia. In the study, OPKS were used in order to achieve better

workability in regards to fresh OPKS concrete and a better bond between the OPKS and mortar phase (P. Shafigh et al., 2011). Olanipekun (2006) has compared concrete made with coconut shells and palm kernel shells as replacement for coarse aggregates and concluded that coconut shells performed better than palm kernel shells as replacement for conventional aggregates in the concrete.

There exists the possibility of replacing coarse aggregates with crumb rubber in the production of concrete for experimental study towards the effects of strength, density and workability of concrete. In the study, Yilmaz et al. (2009) and Ganesan et al. (2013) verified that flexural strength of concrete increased with the increase of crumb rubber percentage.

1.3 Problem Statement

In Malaysia, agricultural waste disposal has become a subject matter as the abundant of agro-waste disposed could give negative impact to the nature. All forms of consumed rubber tire become waste because several tons of wastes rubber tire cannot be fully recycled at once. Researchers have found that these abundant of wastes rubber tire can be used to replace different constituents of concrete.

In previous research, Ling et al. (2010) reported that the recycled waste tires could be crushed into particles with different sizes and subsequently using them as cement mortar and concrete. The experiments indicated that the wastes used in concrete were able to save the long-term effects of reducing natural resources and protect the environment from waste deposits simultaneously. Oil Palm kernel shells (OPKS) on the other hand are hard, carbonaceous, organic by-products of the palm oil fruit in its process. Thus the disposal of used palm kernel shells will create waste management problems although the shells have no commercial value.

In this study, OPKS and wastes crumb rubber tire is utilized as replacement to coarse aggregate and being used to develop into lightweight concrete slabs. The study identified possible cost reduction in the replacement as the coarse aggregate was partially replaced (from 10% to 50% by volume) with OPKS and varied percentage from 10 to 50% of rubber particles, thus can occupy large mass in concrete.