CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Concrete is widely used as a construction material. Therefore, there is no escaping from the influenced of concrete in everyday life. It is estimated that the present consumption of concrete in the world is of the order of ten billion tonnes every year. Concrete is a composite material composed mainly of water, aggregate and cement. Usually there are admixtures and reinforcements included to achieve the desired properties of the finished products. When these compositions are mixed together, they form a fluid mass that is easily molded into shape. Over time, the cement forms a hard matrix which binds the rest of the ingredients together into a durable stone.

Cement is a finely pulverized, dry, material that by itself is not a binder but develops the binding property as a result of hydration. Water is responsible for the hydration reactions with the cement. Aggregate is the granular material, such as sand, gravel, or crushed stone that is used with a cementing medium to produce either concrete or mortar. Meanwhile, admixtures are defined as materials other than aggregates, cement, and water, which are added to the concrete batch immediately before or during mixing. The use of admixtures in concrete is now widespread due to many benefits which are possible by their application.

However, these primary materials can be replaced with others to obtain or to develop a more sustainable concrete. It has been reported that oil palm shell (OPS) can be used as replaced aggregate in concrete. Since OPS is an organic material, its properties differ from that of conventional granite aggregates. OPS is lightweight in
nature and has bulk density of about 590 kg/m$^3$ (Teo et al., 2009). Consequently, the resulting concrete is lightweight. OPS aggregate can be used as an alternative to the conventional granite aggregates for the production of lightweight concrete. The utilization of OPS as aggregate replacement in concrete is a good way of practicing sustainable development (Teo et al., 2009).

Steel fibers (SF) with different yield strengths are available in various shapes and sizes which improves the mechanical properties of the concrete in a wide range. Addition of SF changes the workability of the concrete and also balling of these fibers in concrete may occur depending on the amount and shape of the fiber used (Tadepalli et al., 2009). SF are available in various shapes namely straight, crimped, hooked single, hooked collated and twisted. Among the fibers, hooked fibers performs better than straight and crimped SF in terms of flexural strengths and energy absorption capacities (Bayasi et al., 1992).

1.2 PROBLEM STATEMENT

The environmental impact of oil palm cultivation is a highly controversial topic. OPS are agricultural solid end products of oil palm manufacturing processes. Palm trees grow in regions where the temperature is hot with copious rainfall such as Malaysia, Indonesia, and Nigeria. The utilization of OPS as lightweight aggregate (LWA) in the production of lightweight aggregate concrete (LWAC) has been a topic of research since the early 1984 in Malaysia. OPS are one of the wastes produced during palm oil processing. Figure 1.1 shows the oil palm efficiency compared to the other major oil crops.

Recently, a large amount of OPS waste materials are stockpiled and dumped, which causes storage problems within the vicinity of factories as large quantities of these wastes are produced every day. In Malaysia, it is estimated that over 4.6 million tonnes of OPS is produced annually as waste. A cost analysis in Nigeria revealed that a cost reduction of 42% is possible for concrete made from OPS. Several studies showed that although the engineering properties of oil palm shell concrete (OPSC) are generally satisfactory, there is still reluctance in implementing OPSC compared with other types of LWAC. The reason for this was given by Okafor., 1988 who concluded that OPS are
incapable of producing concrete with a compressive strength above 30 MPa (Ming et al., 2014).

Figure 1.1: Oil palm efficiency compared to the other major oil crops

Due to the higher amount of oil palm shell wastes, we can create something that useful to the public by using this kind of wastes for example the OPSC reinforced with SF. This solution will provide a good strength of reinforced concrete.

1.3 RESEARCH OBJECTIVES

The objectives of this research are:

i. To determine the effect of different mix designs to the behaviour of steel fiber oil palm shell concrete (SF-OPSC).

ii. To study the mechanical properties of SF-OPSC.

1.4 SCOPE OF STUDY

The scopes of this study are:

i. Testing specimen of cube, cylinder and prism specimens

ii. The size of cube is 100 mm x 100 mm x 100 mm, cylinder with 150 mm in diameter and 300 mm in height and prism with the cross-section of 100 mm x 100 mm and 500 mm in length