CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Concrete is the most widely used of construction substantial all over the world. In normal weight concrete, it is made up from cement, coarse aggregates, fine aggregates, water and admixtures. Recent years, oil palm shell (OPS) and steel fibre have taken place as the replaced aggregate and reinforcement inside the concrete. The properties of steel fibre reinforced concrete improved the tensile and bending strength, greater ductility, and greater resistance to cracking and hence improved impact strength and toughness.

In ground-supported slabs, there are two main reasons why steel fibres are used. One of it is to control the development and formation of cracks that is caused by the early age plastic shrinkage and restrained long-term drying shrinkage. Another reason is to provide a degree of post-cracking load-carrying capacity such as the ability of the slab itself to carry load after the first crack has formed during the slab flexure.

Nowadays, lightweight concrete (LWC) has become one of the concrete used in construction. LWCs have many advantages. These advantages include saving on reinforcement, foundation cost, saving on formwork, better fire resistance, durability, heat isolation and frost resistance (Neville, 2008). However, the disadvantages of this concrete included lower mechanical properties and more cement is required compared to the normal concrete, greater shrinkage and higher material cost. Thus, such disadvantages justify the effort to resolve the problems with the existing LWC.
1.2 PROBLEM STATEMENT

Using lightweight aggregate (LWA) in the production of lightweight concrete (LWC) is the most popular method. Common natural LWAs include diatomite, pumice, scoria, volcanic cinders and tuff (Neville, 2008). Other type of LWA that popular in an agriculture field is oil palm shell (OPS). In Malaysia, it has a lot of the residue because Malaysia is one of the world leaders in the production and export of OPS. Generally, the mechanical properties of lightweight aggregate concrete (LWAC) are lower than ordinary concrete (Polat, 2010). One way to enhance the mechanical properties of the LWAC is through the using of steel fibre.

Steel fibre is the most commonly used of all fibre in most structural and non-structural purposes (Mehta and Monteiro, 2006). The addition of steel fibre in LWAC improved the mechanical properties of the concrete especially the tensile strength, impact strength and toughness (Ramados and Namagani, 2008). Steel fibre concretes have much higher fracture energy compared to the plain concrete (Peng et al., 2008).

The approach of using fibre reinforced concrete is expected to be the one of the method that can improve strength of lightweight aggregate concrete. Most research on oil palm shell (OPS) focuses on improving the mechanical properties. Furthermore, only several studies have been conducted or reported on the properties of OPS concrete containing steel fibre. Therefore, this study is conducted to investigate the volume content of steel fibre on the compressive strength and the optimum volume of OPS to be replaced with the coarse aggregate.
1.3 RESEARCH OBJECTIVES

The research objectives are:

i. To study the structural behaviour of oil palm shell concrete (OPSC) slab reinforced with steel fibre.
ii. To determine the effect of fibre hybridization to the behaviour of oil palm shell concrete slab.

1.4 SCOPE OF STUDY

The scopes of this study are:

i. The specimens tested are cubes and slabs; 9 cubes and 3 slabs for each batches with sizes (100 mm × 100 mm × 100 mm) and (350 mm × 500 mm × 100 mm) respectively.
ii. The cement grade used is 20 MPa.
iii. The type of fibre used in this research is steel fibre with L/D ratio is 80, length is 60 mm and the diameter is 0.75 mm with hooked-ends (SF60) and steel fibre with a length of 35 mm, aspect ratio of 65 and the diameter is 0.55 mm with hooked-ends (SF35).
iv. The type of lightweight aggregate used in this research is oil palm shell.
v. Volume fraction of steel fibre used in this research is 1.00%.
vi. The tests that have carried out are:
   i. Cube compressive strength test
   ii. Combined bending and shear test