CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

There are a lot of developing countries undergo urbanisation process due to the rapid population growth. Therefore, more infrastructures and building are needed to facilitate the population in these countries. The construction industry in the developing country including Malaysia is growing rapidly. Nowadays, concrete is highly contributed in the construction works for its various advantages such as low cost, availability, fire resistance, etc. and it is one of the main elements of the building (M.M. Rahman et al, 2011). Hence, concrete is essential for the construction industry.

Concrete is a mixture of cement, aggregates, sand, water and some chemical admixtures. Traditionally, concrete has a high compressive strength but low tensile strength. Therefore, steel which has a high tensile strength is generally used to reinforce the concrete. However, steel is relatively high cost and use of steel should be limited. In addition, manufacturing process of steel consume a lot of energy. Therefore, it is necessary to reduce the use of steel by using more environmental friendly, low cost and less energy consuming materials to enhance the concrete properties is a major concern nowadays.

Cement has been reinforced with natural fibres for several years, particularly in developing countries that used materials such as bamboo, sisal, jute and coir with some success. These natural materials are cheap and have environmental benefits since they are renewable and non-toxic. However, bamboo still has more and better advantage among these natural fibres although most of these studies give positive results.

Bamboo species can grow at rates up to 20 cm per day and full height of approximately 20 m is reached in half year time. The strength of bamboo increases with
its age and maximum strength is reached after 3 to 4 years. Bamboo has a high tensile strength and able to attain up to 370 MPa (M.M. Rahman et al, 2011). The strength to specific weight ratio of bamboo is six times greater than that of steel. Ability of bamboo in nitrogen and carbon dioxide in the air is very beneficial to the environment.

Many researches have been done on the use of bamboo as reinforcement for composites. The bamboo is in cylindrical shape limits the direct use of it in some engineering systems. Therefore, there is alternative that the bamboo is extracted into fibres from the culm and the bamboo fibres are use as reinforcement of polymeric matrices (E. Trujillo et al, 2014). Bamboo fibre is capable to capture large CO₂ and consume low energy per kg of fibres (E. Trujillo et al, 2014). The mechanical strength of the bamboo is the highest among natural fibre and have the lowest density with is 0.9G/cm³ (Shah Huda et al, 2012). The flexural strength of autoclaved bamboo fibre reinforced cement composites is greater than 18 MPa and about 1.3 g/cm of density when a fibre loading of 14% is used (R.S.P Coutts et al, 1995). Humberto C. Lima Jr. et al (2007) did a research on the durability analysis of bamboo as concrete reinforcement. The durability of bamboo was evaluated by changing the tensile strength and Young’s modulus of bamboo. As a result, the bamboo tensile strength is comparable with the best timber type and even steel that used in construction.

In this research, tensile property of the concrete with bamboo fibre as an additive was observed.

1.2 PROBLEM STATEMENT

Generally, concrete is high in compressive strength but relatively low in tensile strength. Tensile strength of plain concrete is typically 8% to 15% of its compressive strength (Vasudev R et al, 2013). Crack of the concrete is usually occurred when there is a stress on the concrete that exceed the tensile strength of the concrete. Concrete would almost fail from tensile stresses even when loaded in compression. Thus, concrete is usually reinforced with material in high tensile strength so that both tensile and compressive strength of concrete are satisfactory. Other than that, fibres are widely used to enhance the performance of concrete from cracking. Fibres are distributed throughout the concrete mix to limit the size and extent of cracks. Bamboo fibre is proven that has high tensile strength where it can attain 370MPa. Bamboo is extracted
into fibres and added into normal concrete mix to investigate further and understand the
behaviour of concrete with bamboo fibres as an additive.

1.3 OBJECTIVES

The main aim of this research is to experiment the structural behaviours of the
normal concrete with various length of bamboo fibres as an additive. The bamboo fibres
will be added into normal concrete mix in this research.

i. To determine the workability of the concrete added with the length of 40mm and
   60mm of bamboo fibres by 2% of the volume of concrete.
ii. To investigate the flexural strength of the concrete added with the length of
    40mm and 60mm of bamboo fibres by 2% of volume of concrete.
iii. To determine the compressive strength of the concrete added with the length of
     40mm and 60mm of bamboo fibres by 2% of volume of concrete.

1.4 SCOPE OF RESEARCH

There were few limitations in this research as listed and explained below.

i. Same concrete mix design will be used for both normal concrete and concrete
   with bamboo fibres as an additive.
ii. 30 MPa will be used for the design strength.
iii. Only Orang Kuat Portland Cement certified to MS 522-1: 2007 ( EN 197-1 :
     2000), CEM I 42.5 N / 52.5 N and MS 522 : Part 1 : 2003 cement will be used.
iv. Bamboo used is collected from bamboo forest in Hulu Langat, Selangor.
v. Bamboo fibres length of 4cm and 6cm will be used.
vi. The diameter of bamboo fibres range from 1 mm to 2 mm will be used.
vii. 2% of bamboo fibres by volume of concrete will be added for the tests.
viii. For flexural strength test, specimen of 100mm x 100mm x 500mm will be used
     and tested on 7th, 14th and 28th day.
ix. For compression test, specimen of 150mm x 150mm x150mm will be used and
    tested on 7th, 14th and 28th day.