CHAPTER 1

INTRODUCTION

1.1  BACKGROUND

Concrete was an important building material used all around the world for more than a century. It was composite construction material which normally make out from three major material that was cement, water and aggregate. Concrete widely use in all the constructions work include foundation, structural of a building, bridge, dam, roads, etc. (Patel and Kulkarni, 2013). Concrete was choose to be the major construction material because of it high compressive strength, production step easy, component can get in everywhere and relatively inexpensive (Brandt, 2008). It can be cast in any shape from rectangular beam or column to cylindrical power plant. The advantage of concrete are well common to high compressive strength and low maintenance which have long service life as compare to other construction material (i.e. timber and steel). However this plain concrete material is a quasi-brittle material (poor tensile strength) and easily cracked even small stress induce on it owing to its inherent weakness in resisting external forces (Wang et al., 2011). The disadvantage of concrete is notified since ancient years ago and fibre-reinforced materials started with straw fibres reinforced in mud bricks and horsehair in mortar (Mohsin, 2012).

Now the day with the developing of the world, the normal concrete was not good enough for the construction use already. More and more special concrete was researched to improve the quality of the concrete in term of it durability, compressive strength, tensile strength, flexural strength, etc. One of the special concrete develop for overcome the problem was fibre reinforcement concrete. The major reason of this reinforcement concrete be produce was to overcome the brittle problem of the concrete. In 1900, a technology was invented to produce roofing plates, pipes plates, etc. The technology wan
names as Hatschek technology. After this Biryukovichs wan proposed to use glass fibres for reinforcement of cement paste and mortar (Brandt, 2008). In the 1960s, many alternative fibres such as steel, glass, and synthetic fibres are used as new initiative for asbestos fibre replacement in fibre-reinforced concrete (Mohsin, 2012). Fibers such as steel fibres, glass fibres, carbon fibres, plastic fibres (i.e. polypropylene, graphite etc), and natural fibres (i.e. hemp, kenaf etc) are popular to be found in the market (Mohsin, 2012).

Fibres are used to enhance the properties such as shrinkage, toughness, and the energy absorption capacity and more (Altun et al., 2007; Johnston, 1994). In order to achieve higher tensile and flexural strength, it is important to reduce the brittleness of plain concrete as well as crack control or closure mechanism thus changing the failure mode to one that includes post-cracking ductility (Hannant, 1978). It is important to ensure the bonding between the fibres and the matrix, therefore various sizes and shapes (e.g. deformed) to provide this anchorage effect (Mohsin, 2012). According to Hannant (1978), the maximum particle size in fibre-reinforced concrete is restricted to 20 mm to ensure that sufficient bonding is accomplished. In addition, the post-cracking behaviour can be affected by the number of fibres across a specific crack, effectiveness of fibre orientation, bond strength and the resistance to fibre pull-out.

While polypropylene fibre (PF) was one of the popular fibre used in concrete industry, because through the research show that polypropylene fibres can improve concrete flexural ductility, durability of concrete, compressive strength and spalling resistance (Sun and Xu, 2009). Polypropylene fibers was a kind of chemical fibers, about 4 million tons of this fibres was manufacture every years. Polypropylene fibres were used as admixture in Portland cement concrete since 1960s (Tautanji, 1999, Madhavi et al., 2014, and Prasad et al., 2013). In 1965 polypropylene fibre concrete was meant for the US Corps of Engineers because it was the first time polypropylene fibre was suggest to use as an admixture for construction of blast resistant buildings (Madhavi et al., 2014).
1.2 PROBLEM STATEMENT

In the near future, every country development increases year by year. Many high rise building was built all around the world. While with the increasing of construction, the amount of concrete produce will be increase same goes to cement will increase due to the demand. In a building beam used up a lot of concrete for the structural part. The production of the cement will emit huge amount of carbon dioxide into the environment which will lead to greenhouse effect. Cement production can produce about 7% of the total global loading of carbon dioxide which is 1.6 billion tons of carbon dioxide. Mining large amount of raw material of cement and aggregate for producing concrete will result to the top-soil loss and also extensive deforestation. Furthermore, while producing concrete need a lot of fresh water supply. Beside that ready mixed concrete industry and water curing will used up large quantities of fresh water as wash water. Only for concrete mixing, approximately 1 trillion L of fresh water was used up every years (Mehta, 2001).

As mention above, use of too much concrete will cause environment effect. So with the reduction of the concrete beam in the structure, it help save the used of the concrete and also the environment due to the effect of using concrete. Especially to the high rise building normally deep beam are needed, so more concrete were needed. In a building high of the floor will be determine by the depth of the beam. Cause the high of the ceiling will be set below the beam so the beam can be cover inside the ceiling. Therefore the floor high be reduced cause by the depth of the beam. By reducing the depth of the beam it can increase the clear high of the floor.

Concrete was well known as a brittle material, it was good to resist compressive stress but not good in resist tension or tensile stress. So reinforced steel bar was installed into the concrete to absorb the tensile forces. But most of the time the reinforced steel bar will be corrodes by the ingress of chloride ions. Chloride ion will penetrates into the concrete to promote corrosion and make the steel rusted. When the steel rusted, the volume inside the concrete will increased which will produces large tensile stress in the concrete. This will cause the concrete crack and spalling happening on the surface of the concrete (Brown et al., 2002).