CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Coconut palm in scientific term called as Cocos Nucifera in. Coconut palm definitely is one of the most valuable plants in the world. Coconut has been grown in 92 countries in the world such as India, Indonesia, Philippines and Sri Lanka where they are four major countries which contribute 78% of the world production (Gunasekaran et al. 2014). Global production of coconut is 51 billion nuts from a zone of 12 million hectares. The Philippines is considered one of the world’s largest producers of coconuts with its yield of around $8.6 \times 10^6$ nuts annually. However, Malaysia is the fourth important crop in term of acreage, after rubber, oil palm and paddy. Recent, there are large number of coconut consumption such as coconut water, coconut milk, coconut oil and any processing coconut products.

With continuous development of country and urbanization, the generation of waste has been increased accordingly. Most of the non-biodegradable waste will remain in the surroundings for thousands of years. Solid waste management problems is getting serious in Malaysia and usually the method being used is through landfill and somewhat to recycle. There are a total 230 landfill in Malaysia. Masirin et al. (2008) states that the amount of waste generated per year is sooner than the natural degradation process where he noticed that about 7.34 million tons of solid wastes were produced is equivalent to size of the 42 buildings as well as Petronas Twin Tower. Due to increase in urbanization, change in living standards and consumerism, the solid waste volume has been increasing at the rate of 1.5% per year which each person can produce about 1kg of solid waste a day.
Nowadays, coconut shell becoming serious waste disposal problems to the green environment where coconut shells are largely abundantly available surrounding. Theses have causes increasing of landfills to cover all the non-biodegradable wastes as well as a threat to the environment where the toxic gases will release from landfills and harm to human health. For example, toxic gases such as methane gas and carbon dioxide are released to environment when the coconut shell is disposed by open burning. However, the environmental effect can be saved if practicing more sustainable use of this waste. Many researches today was studied that the coconut shell can be reused as material replacement in the construction industry where this may lead to reduction in construction material cost and save the dumping spaces (Gunasekaran et al., 2013). In Nigeria, coconut shell can be a source of energy-biofuel for the boilers, and the rest of coconut shell is used as gravel for plantation roads maintenance. Furthermore, there are some research show that the coconut shell can turn to powder form by undergo the incineration process and it can be used for active carbon production, mosquito repellent coil and as filler in plastic.

According to Madakson et al., (2012), coconut shell ash consists of major chemical composition such as silicon dioxide (SiO₂), aluminum oxide (Al₂O₃), magnesium oxide and iron (III) oxides. Silicon dioxide (SiO₂), aluminum oxide (Al₂O₃) and iron (III) oxides are known to be as hardest substances which can react with the product from the cement hydration process and provide additional strength to the cementitious material. Moreover, coconut shells possess higher resistance against crushing, abrasion and impact compared to normal crushed aggregate (Kukarni et al., 2013). Research indicates that the comparative strength characteristic between coconut shell concrete and palm kernel shell concrete and found that coconut shell concrete has greater compressive strength than palm kernel shell for the same mix proportion. Kambli & Mathapati (2014) investigated that coconut shell can be used as lightweight aggregate which can help to reduce material cost in construction instead of using conventional aggregate which are costly. Therefore, the crushed coconut shell is potentially reused to produce cement mortar by making partial replacement on fine aggregate. In economic and green environment aspect, government and society should concern related issues and put effort towards coconut management issues such as
utilization, storage and disposal. Hence, the research on the suitability of coconut shell as partial replacement of fine aggregate in cement mortar is carried out.

1.2 PROBLEM STATEMENT

The rapid infrastructural development of a country which has creates greater demand of construction material to produce the fast and economic construction. Coconut shell has become the main contributor to the negative effect of environment problem due to poor waste disposal management which annual production of coconut shell waste reaches 3.18 million tones. According to Gunasekaran et al. (2012), coconut shell is a serious waste disposal issue for environment as it occupies around 60% of the domestic waste volume that are being leaving in environment. As a result, the rate of waste disposal is faster than natural degradation of waste in landfill and led to the space of landfill has reached its limitation. From the research studied by Kumar N. & Kumar D. (2014), it mentioned that reuse of waste material in construction such as coconut shell, fly ash and rice husk are one of solution to the reduce waste disposal problems and nowadays there are some countries have start to implement this method. Besides, coconut shell waste material are proved that it can be worked in construction industry instead of leave it aside or disposed as landfill. Therefore, the reuse of waste materials into construction industry shall be stressed in order to reduce the undesirable environmental impact of the industry and also to avoid the excessive usage of natural resources (Shinde & Engg, 2013).

In this research, coconut shell waste has been selected to be partial replacement of fine aggregate in mortar. Conventionally, mortar is made from cement and fine aggregate which this kind of practice is considered as unstainable as it widely utilize natural resources such as sand and also two billions tons of Portland cement per year. It will cause an increase in cost of construction material and depletes of natural resources for long term (Gallala et al., 2016). Hence, the coconut shell waste being left in environment used in mortar or concrete not only can produce an economical construction but also can reduce the waste disposal problem in our country. Using of such waste materials as partial replacement of the natural resources shows an alternative