CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Throughout the whole world, the usage of Portland cement on construction is a very basic needs. Due to high demand of Portland cement, the production of the cement has increased from years to years just to fulfill the demand list. But the production of Portland cement will have the side effect which is the emission greenhouse gasses and cause the rise of surrounding temperature. This problem has been start to tackle by introducing more non cement based concrete and one of the study done is the geopolymer concrete where this concrete doesn’t require any usage of cement. Geopolymer concrete become even more environmental friendly due to the usage of the fly ash which is the by-product from the burning of powdered coal in the electric generating power plants. This fly ash is then collected in the dust-collection systems that remove particles from the exhaust gases. The usage of geopolymer concrete not only can reduce the emission of greenhouse gases but it also can achieve early strength compare to using Portland cement.

There is further study related to the behavior of geopolymer concrete to enhance the durability of the concrete so it could use in construction and sustain longer time. Study related to changing the pozzolanic materials, adding admixtures and also shrinkage behavior has been done to improve the durability of geopolymer concrete. Several improvement has been done on the geopolymer concrete throughout the years to make sure the geopolymer concrete can sustain more loads.
1.2 PROBLEM STATEMENT

The introduction of geopolymer concrete start to widely used in industry as a replacement for Portland cement. For an example the University of Queensland’s Global Institute (GCI) used the fly ash based geopolymer concrete to construct the concrete floor parts. The use of geopolymer concrete could reduce the green-house effect yet the characteristics of the geopolymer concrete did not have further research on the self-healing mechanism. The production of geopolymer concrete when undergo heat curing will leads to the formation of cracks inside the geopolymer concrete. Therefore this research was proposed to investigate the crack filling mechanism by adopting self-healing method.

1.3 OBJECTIVES OF THE RESEARCH

The objectives of this study are as follows:

i. To investigate the effect of elevated heat curing temperature on compressive strength of fly ash based geopolymer mortar without post-casting detainment period.

ii. To investigate the effect of elevated heat curing temperature on porosity of fly ash based geopolymer mortar without post-casting detainment period.

iii. To determine the optimum activation temperature for PVA in fly ash based geopolymer mortar.

1.4 SCOPE OF STUDY

The aim of this research is to study the effect of elevated curing temperature on compressive strength of the fly ash based geopolymer concrete and also the pores percentage in it. Six batches of mix are prepared which is with self-healing agent and without self-healing agent for future comparison purposes. Then both mixtures will undergoes oven curing for several elevated temperatures (70ºC, 80ºC and 90ºC) for
24 hours. After oven curing, the geopolymer concrete will be taken out from the oven for air dry curing for 1 and 28 days. Compressive strength test and porosity test will be done on the geopolymer concrete.

1.5 SIGNIFICANCE OF RESEARCH

The main purpose of this research is to determine whether the presence of self-healing agent in geopolymer concrete could increase the compressive strength of the geopolymer concrete during elevated temperature oven curing. Oven curing for geopolymer concrete could form cracks due to possibility of shrinkage and the percentage of voids in geopolymer concrete may have a lower value so it can achieve maximum compressive strength.

1.6 LAYOUT OF THESIS

Chapter one is the brief introduction on the information for this whole thesis where include the background study, problem statement, objectives, significance of research, scope of study. All the elements are described in detail that related to this thesis as well in this section.

Chapter two will consist with literature reviews on the shrinkage behavior of the geopolymer concrete, self-healing agent on cementitious materials, and the effect of elevated heat curing temperature on shrinkage behavior on the geopolymer concrete. First, the characteristic about the geopolymer concrete will be briefly discussed. The review will further discuss with the characteristic on different types of self-healing agents. Next, discussion on the effect of different elevated heat curing temperature on the shrinkage behavior of the geopolymer concrete.

Chapter three consists of the methodology of this thesis on how to prepare the materials and also the preparation process. Then the procedure for the preparation of the geopolymer concrete mixing will be further elaborate in chapter three. Until the last section of chapter three, testing procedure on the geopolymer concrete to determine the