Chapter 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

The research methodology involved in this research is based on the experiments and tests conducted to determine the soil properties for S300 kaolin soil. The soil properties, such as the Atterberg limits of S300 kaolin will be identified and classified based on the Unified Soil Classification System (USCS). In addition, method to conduct the experiment to determine particles size distribution, specific gravity, optimum moisture content with maximum dry unit weight, surface area, and permeability is described too. Besides that, sample preparation of S300 kaolin aggregation is explained and ESEM test is introduced in this section.

3.2 MATERIALS

There are different types of soil that can be found in the industry area. The most common soil types found are gravels, sand, clay, and silt. However so, not all of the soil types are able to create double-porosity and not only that, a specific amount of water is needed to create the best double-porosity feature of the soil. According to Ngien (2012), one of the soil that is suitable to create double-porosity medium is commercially available kaolin, specifically S300 kaolin. Therefore, S300 kaolin clay is used immensely in all of the experiments done for this research. As the aim of the research is to determine the optimum moisture content for aggregation of S300 kaolin, thus 26%, 28%, 30%, 32% and 34% of soil moisture content parameters were set for the experiment.
3.2.1 Kaolin

![Figure 3.1: S300 Kaolin Clay Powder](image)

**Figure 3.1:** S300 Kaolin Clay Powder

Kaolin is a type of fine grained soil. Fine grained soil particles are not visible by human naked eye, totally the opposite of coarse grained soil, such as gravel particles, which can be seen and identified through the naked eye (Suryakanta, 2014). Moreover, according to the Integrated Soil Classification System, soil particles that are finer than 2 μm are classified as clay particles. Hence, S300 kaolin particles are generally marked as clay of fine grained soil.

Kaolin originally is used for making porcelain, which starts in the seventh and eighth centuries, but in this technology era, it can be used to make paint, rubber, cable insulations, fertilizers, medicine and so on. There are different types of kaolin; graded based on their colour, texture and quality. Different grade of kaolin are different from each other. Each type of kaolin has their own properties and characteristics (Ling, Kassim, & Karim, 2011). Therefore, the type of kaolin that is used in this research is S300 kaolin clay, as shown in Figure 3.1.
3.2.2 Water

Water plays an important role in soil aggregation, such that water is the binder between the particles of soil. Potable water is used in this research for contributing in the experiments of soil properties and for preparing aggregation samples. Potable water is crucial for mixing kaolin to become the required sample for the experiment. In the proposed study, to prepare for aggregated S300 kaolin samples, potable water is used to mix with S300 kaolin powder. Potable water will mixed with S300 kaolin powder in different percentage of moisture content, that are 26%, 28%, 30%, 32% and 34%.

Besides potable water, distilled water is also used in this research. Distilled water is used in experiments where it is to determine soil properties, for example, Atterberg Limit Test, Particle Size Distribution Analysis and Particle Density Test. This is because distilled water is water without contaminants; contaminants such as waste materials, minerals, heavy metals, and others (Williams, 2015). The contaminants of water will affect the results of experiment. Thus, distilled water is used for those experiments.