CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Due to the increasing population and rapid development of the world, the amount of waste generated continues to increase. Less than 5% of the waste is being recycled and this will cause a massive amount of waste disposal to the landfills. Despite the continuously increase of waste disposal, the waste management standards are still poor. These include the inefficient storage and collection system, poor management of municipal wastes with toxic and hazardous waste disposal and inefficient utilization of disposal site space in landfills. These will lead to the contamination of soil at the landfill. The ammonia gas produced from the waste will also cause air pollution to the surrounding. One of the alternatives used to solve the problems is by using the natural sources that are clays. Clays act as environmental barriers around waste disposal site where they are used as liners and capping materials for landfills sites. The clay liners act as barriers to water and containment flow in landfills and other waste containment facilities. Highly plastic clays are used as barriers in landfills and nuclear waste repository (Daniel, 2003; Pusch, 2005). Furthermore, clays also used for geo-environmental application in remediation, treatment and control of waste (Sharma & Reddy, 2004).

Clays are used for barriers because of its hydraulic properties. One of the hydraulic properties is the soil-water characteristic curve (SWCC), which shows the relation between matric suction and water content. SWCC can be used to estimate the soil properties such as volume change characteristic, permeability and shear strength functions (Fredlund, 2006).
This research study focuses on the laboratory tests to measure the water retention characteristics of SPV 200 Bentonite clay. Bentonites have been considered due to their low permeability, high sorption capacity, self-sealing characteristics, and durability in a natural environment (Pusch, 1982; Muller-Vonmoos et al., 1994; Romero, 1999; Pusch and Yong, 2005; Plotze et al. 2007).

1.2 PROBLEM STATEMENT

The suction-water content soil-water characteristic curves (SWCCs) provide useful information for predicting the engineering behaviour of soils (shear strength, volume change behaviour, and permeability). It is very important to establish the suction-water content SWCC of soils. SPV200 is an alternative form of MX80 bentonite which is considered as reference material for bentonite. Bentonite is being used in many engineering applications particularly in geo-environmental engineering application, thus establishing the wetting and drying suction-water content SWCC for SPV200 is very useful for predicting its engineering behaviour.

1.3 OBJECTIVE OF STUDY

There are two objectives in this study that are:

1) To determine the physical properties of SPV 200.

2) To establish drying suction-water content SWCCs for SPV 200.
1.4 SCOPE OF STUDY

In this research, we will study the water retention behaviour of the bentonite clay. The bentonite clay that is SPV 200 from US will be considered in this study. SPV 200 is a type of sodium bentonite. It is a hydrous aluminum silicate comprised principally of the clay minerals montmorillonite. It contains a small portion of feldspar, calcite and quartz. In order to get the SWCC, drying and wetting tests will be conducted for suction applied of 0.1 MPa – 300 MPa using osmotic and vapor equilibrium techniques.

1.5 THESIS LAYOUT

This thesis consists of five consecutive chapters. Chapter 2 presents the literature review conducted that are related to this research study. This chapter includes application of bentonite, clay mineralogy, soil suction and water retention behaviour.

Chapter 3 is methodology. This chapter explains the methodologies adopted in this study. This chapter covers all steps and procedures required for the sample preparation, determination of bentonite clay properties (specific gravity, initial water content, Atterberg limit, particle size distribution and soil mineral properties), and determination of drying and wetting behaviour in bentonite clay.

Chapter 4 consists of results and discussion obtained from the study. This chapter includes the outcome obtained through the tests done in the determination of bentonite properties. It also include the results obtained from the wetting and drying process of the bentonite clay which are then will be used to discuss the behaviour of suction in bentonite clay, and to develop the SWCC.

Chapter 5 is the conclusion and recommendations. This chapter summarizes the whole purpose of this study, the significance and important of this study for future references.