CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

The characteristics of Red Gypsum found out through laboratory testing. There are 2 characteristics of Red Gypsum being investigated, such as physical and chemical. Each of these characteristics were tested by different tests. For physical characteristic of Red Gypsum, the particle size distribution test, moisture content test, atterberg limit test, free swell test and Lost on Ignition test were done. Other than physical, the chemical properties of Red Gypsum was determined by carrying out X- Ray fluorescence (XRF) and cation- Exchange capacity (CEC).

Besides the physical and chemical properties of Red Gypsum, SWCC of Red Gypsum can be obtained by many techniques which included osmotic and vapour equilibrium technique. In this chapter, the way to carry out all the tests were discussed.

3.2 SELECTION OF MATERIALS

The soil sample, Red Gypsum, was obtained from Tioxide (Malaysia) Sdn. Bhd., which located at Teluk Kalung Industrial Estate, 24007, Kemaman, Terengganu Darul Iman. The samples were brought back to the laboratory in seal plastic containers as shown in Figure 3.1.

Figure 3.1: Red Gypsum stored in plastic container

3.3 SAMPLE PREPARATION

Samples were crushed and sieved and only the samples which passed through 63 μm were considered in this study. The samples were the kept in plastic seal bags. On the other hand, the slurry specimens were prepared by using RG with deionized water to1.2 times liquid limit value. The slurry specimen was then placed in seal bags prior to being tested.

3.4 PHYSICAL PROPERTIES OF RED GYPSUM

The physical properties of soil indicates that the soil colour, soil texture, soil structure bulk density, horizonation, and soil consistence. The physical properties of Red Gypsum were tested before proceed to the soil suction measurement. The laboratory testing included particle size distribution test, specific gravity test, atterberg limit test, shrinkage limit test, free swell test, loss on ignition test, and specific surface were tested. All the tests were follow different standards as shown in Table 3.1.

Table 3.1: Standard used for physical properties testing

Physical properties	**Testing Method**
Particle size distribution	Simple dry sieving and hydrometer analysis (BS 1377: Part 2: 1990: 9.3)
Specific gravity, G_s	Density Bottle (Small pyknometer) method (BS 1377: Part 2 1990: 8.3)
Liquid limit, LL	(BS 1377: Part 2: 1990: 4.3)
Plastic limit, PL	(BS 1377: Part 2: 1990: 5.3)
Shrinkage limit, SL	Standard Test Method for Shrinkage Factors of Soils by the Wax Method (ASTM D4943 – 08)
Water content, *w*	Oven drying at 105 ˚C (BS1377: Part 2: 1990)
Specific surface area	(BS 4359-1:1984)
Swell index, C_s	Free swell test (Holtz and Gibbs, 1956)
Loss on ignition	(BS 1377: Part 3: 1990: 4.3)
Chemical properties	**Testing method**
Cation exchange Capacity	Ammonium acetate method

3.4.1 Particle Size Distribution Test

This test was follow the BS1377: Part 2 1990: 9.3. For coarse grained soil analysis, the soil has to be oven dried. The oven dried soil sample is sieve by using few sieves with different sieve sizes. The sieve sizes used included 5, 3.35, 1.18, 0.6, 0.3, 0.15, and 0.063mm with the arrangement of largest sieve sizes to smallest sieve sizes and lastly a