GEOCHEMISTRY CHARACTERIZATION OF ORGANIC SOIL

KENNY TIONG PING CHIET

A project report submitted in partial fulfillment of the
requirements for the award of the degree of
Master of Engineering (Civil - Geotechnics)

Faculty of Civil Engineering
Universiti Teknologi Malaysia

DECEMBER 2010

To my beloved parents and sibling

ACKNOWLEDGEMENT

Foremost, I would like to express my sincere gratitude to my master project supervisor, Prof. Dr. Khairul Anuar Kassim from of Faculty of Civil Engineering, Universiti Teknologi Malaysia for his encouragement, guidance, and supervision during the development of this project.

I would like express my thankful appreciate to my parents and sibling who always support and encourage me throughout my life .This project would not been possible without their love and their support.

Besides that, I am heartily thankful to all the academic staffs and technicians from Faculty of Civil Engineering who are very professional and dedicated for assisting me during my laboratory works in numerous ways .Their advises, technical support, and knowledge had made this project possible.

Last but not least, my sincere appreciate also extends to all my friends and colleagues especially to Mr Felix Ling Ngee Leh ,Tan Chuan Keat, Tan Jie Ru, Tan Zee Sin, Jane Cho, Benny Tan and Cheryl Yong who helped me directly and indirectly in accomplishing this project. Thank you very much to all of those who supported me in any respect during the completion of the project.

ABSTRACT

The behaviour of organic soil was found to be governed by its chemical properties rather than its physical properties. Hence, it is important to determine the geochemistry properties of organic soils besides its physical properties. The main objective of this study was to characterize the geochemistry properties of organic soils for civil engineering applications. The organic soil specimens were retrieved from three different locations at Batu Pahat, Johor, namely Parit Nipah, Parit Sidek and Batu Puteh using peat auger and undisturbed sampler. The top layer of the peat soil which is rich in non-humified matters was excluded from this study. The geochemistry properties of the organic soils underneath the peat soil were determined through laboratory tests; Total Organic Carbon (TOC), Loss of Ignition (LOI) and etc. Besides it, this study also highlighted the correlation of geochemistry properties of organic soils with its physical behaviors namely strength, moisture content, specific gravity, and Atterberg limits. This study provided a good understanding of organic soils which enable the designer to identify and investigate the effect of geochemical properties towards the soil behaviour.

ABSTRAK

Kelakuan tanah organik adalah ditetapkan oleh sifat-sifat kimia dan bukan sifat fizikalnya. Oleh kerana itu, adalah penting untuk menentukan sifat geokimia dari tanah organik selain sifat fizikalnya. Tujuan utama untuk kajian ini adalah untuk mengkarakterisasi sifat geokimia dari tanah organik bagi kegunaan dalam bidang kejuruteraan awam.Spesimen tanah organik yang diambil dari tiga lokasi yang berbeza di Batu Pahat, Johor, iaitu Parit Nipah, Parit Sidek dan Batu Puteh dengan menggunakan auger khas untuk tanah gambut. Lapisan atas tanah gambut yang mengandungi non-humified adalah dikecualikan daripada kajian ini. sifat geokimia ini dari tanah organik di bawah tanah gambut ditentukan melalui ujian makmal seperti *Total Organik Carbon (TOC), Loss of Ignition (LOI)* dan lain-lain Selain itu, kajian ini juga menghubungkaitkan sifat geokimia tanah organik dengan sifat fizikal iaitu kekuatan tanah, kelembapan tanah, gravity tentu , dan Keplastikan tanah. Kajian ini memberikan pemahaman and pengetahuan tentang tanah organik and juga membolehkan jurutera untuk mengenal pasti dan menyiasat pengaruh sifat geokimia terhadap kelakuan tanah.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDIX

CHAPTER 1

INTRODUCTION

1.1 Background of Study

This study focused on the Geochemistry Characterization of organic soil for geotechnical engineering in Johor state, Malaysia. Many of the researches about geochemistry characterization on the soil had been conducted previously, but most for the research done mainly for the agricultural purpose to improve the quality of soil for the plantation only. It is hardly and almost none of the similar type of research carries out for the engineering purpose especially for the organic soil.

Most of the researchers are more concern about the peat soil instead of the organic soil which consists of lower organic content. It is important to have geochemistry characterization on the organic soil especially in our country, Malaysia. Thus, a study of geochemistry characterization on organic soil was carried out to investigate its physical and chemical properties.

1.2 Problem Statement

Organic soil for example peat soil is one of family of the organic soil which is widely found in Malaysia. Generally, organic soil is a problematic soil to the construction which will cause possible shear failure, low bearing capacity and different settlement.

Due to these problems, removal of the organic soil is a normal practice for the civil engineer whenever this kind of soil is encounter at the site and this will then lead to the increase of the cost of the construction and delayed the duration of completion. Somehow it is impractical and uneconomic to have the removal work when there is more than 10 meters depth organic soil deposit below the existing ground surface.

Besides that, due to the rapid development of our country, many construction is undergo and the lacking of the suitable land cause the construction have to be construct on the organic soil and various construction techniques have been carried out to support embankments over peat deposits without risking bearing failures but settlement of these embankments remains excessively large and continues for many years.

In order to solve the organic soil problem a good understanding of the organic soil are needed and lot of researches are done to solve the problem for the organic soil and it is also important to indentify and investigate the effect chemical compound of organic soil to the soil properties to solve the problem.

1.3 Objectives

Objectives of this study are:

1) To determine the physical and geochemistry properties of organic soils.
2) To characterize the geochemistry properties of organic matter.
3) To correlate the geochemistry properties of organic soil and its physical properties.

1.4 Scope of Study

The study was conducted on organic soil which obtained from three different sites, namely Parit Sidek, Parit Nipah and Batu Puteh in Johore. The geochemical characterization of the organic soil was done on the soil through two type of the test, which was the physical test and chemical test. The physical test such as Atterberg limit test, moisture content, specific gravity test and etc were conducted to determine the physical parameter of the soil. On the other hand, the chemical tests such as Total organic carbon and loss on ignition were conducted to determine the organic content of the soil. Other chemical tests were carried out to determine the pH value, Cation Exchange Capacity (CEC), Sulphate content and Chloride content of the soil. The Sulphate and Chloride content of the soil determined in this study were the water soluble type. The insitu Vane Shear test was conducted to obtain the physical parameters for the soil at the site