CHAPTER ONE

INTRODUCTION

1.1 Introduction:

As defined by Ramaji (2012)[71] Soil stabilization is the process of maximizing the suitability of soil for a given construction purpose.

Jimmy et al (2010) [34] state that in recent years, environmental issues have driven interest to utilize industrial by product as an alternative construction material. The well-established industrial by-product, such as fly ash, slag, mine tailing, have been obtained and mixed with lime and cement to improve the geotechnical properties of problematic soils

As outlined by Cyr et al (2009) [15] It is important to realize that the generation of wastes is an inherent part of productive systems. The quantities and characteristics of the waste generated depend on the technologies used by companies. Sometimes companies need to restructure their productive systems in order to treat the waste they generate and many times its elimination is not easy, especially in sectors where production technologies are much matured. In this context, one of the possibilities for the recovery of these materials is their reuse and recycling in the construction sector. The construction sector annually consumes large volumes of materials, which clearly gives this sector potential to absorb and give value to the large quantities of wastes produced in the industry. On the one hand, this situation can achieve the environmental protection demanded by Society, and on the other hand it allows the companies to operate more sustainable productive systems. The reuse of waste may enable the attainment of a “sustainable construction” procedure, which can be defined

as a set of constructive actions which take into account technical, economical, environmental and social aspects.

According to Heeralal and Praveen (2011)[29], plastic-waste materials are produced plentifully such as polyethylene terephthalate (PET) plastic bottles, polypropylene (PP) of plastic sacks, and polypropylene (PP) of carpets. But such materials have been used little for engineering purposes, and the overwhelming majority of them have been placed in storage or disposal sites. Ibrahim (2005)[32] stated that the amount of PET bottles waste average per year amounted to 38336 *Tons* then and was estimated to reach 500000 *Tons* by year 2015.

Also day by day increasing demand of cement results in intense collection of kiln dust from cement plants. The disposal of this fine dust becomes an environmental threat. In order to overcome this problem, Keerthi et al (2015)[42] stated that research is being carried out in different parts of the world to find out the economical and efficient means of using cement kiln dust (CKD) in various applications like soil stabilization, cement production, pavements, waste product stabilization, and agriculture and cement products.

1.2 Statement of the Research Problem:

For the construction of any kind of structure resting on weak soil, there are many problems such as cracks and settlement. For example clayey soil has been used as soil material or embankment material for increasing road way level before road structure being constructed. Some types of clay are expansive soil, and these have been contributing to pavement failures and subsequently causing increased annual maintenance expenditure of the road.

Also as stated in (1.1) above currently there are large volumes of materials considered as wastes or by-products produced by industrial activities. In most cases, these wastes have no possibility of reuse, or low economic value for the companies that generate them. This adds to the cost of their management and disposal. As some of these wastes are acceptable as soil stabilizers and since soil stabilization is a basic requirement of safe construction, a study of the possibility of soil stabilization using these wastes would be of great benefit.

1.3 Objectives of Study:

The main objective of this study is to investigate the strength developed of stabilized soil using waste-based, cement as chemical stabilizer and fiber glass and plastics waste (PET: Polyethylene Teraphathalate) as soil reinforcement**.**

The specific objectives are:

1. To determine the most effective waste – based stabilizers and dosage rates of stabilizers to increase the strength of soft clay soils.
2. To determine the strength and mechanical behavior of randomly distributed waste of fiber glass and plastic PET bottles waste.
3. To utilize local materials and reduce the pollution which comes from accumulation of (plastics waste (PET: Polyethylene Teraphathalate),cement kiln dust and waste of fiber glass)
4. To investigate the effect of materials waste on clay soil properties such as optimum moisture content, maximum dry density and shear strength parameters (cohesion and angle of friction)

1.4 Methodology of Study:

The methodology of this research adopted to achieve the objectives was through the following phases:

- **Phase 1:** ***Literature Review:***
  - Where state of the art and basic concept was revised and related Literature and relevant data was collected and studied from library search, collecting various data and information through various sources including books, journals and different references and historical documentary including previous case studies, international studies and papers, and from internet and other sources. Then the main features of the proposed work will be pointed out.

Phase 2: ***Experimental work:***

As a basic finding from literature reviewed, the Laboratory tests, generally following ASTM standards, were used to determine:

- Particle Size Analysis of Soils
- Specific gravity
- Compaction test (Optimum Moisture Content (OMC) and Maximum Dry Density (MDD))
- Triaxial Test (compressive strength)
- The Plastic Limit and Plasticity Index of Soils
- The shrinkage limit
- X. Ray diffraction for Cement waste
- California Bearing capacity test (CBR).

- Tensile strength test for fiber waste.

1.5 Thesis Outlines:

The structure of this thesis is organized as follows:

Chapter one: Introduction to the background of the problem explaining the need for the investigation of soil stabilization, research problem statement and a description of the objectives and methodology of this study

Chapter two: A review of the literature of soil classification. Definition and mechanism of stabilization, Techniques for Stabilizer Selection and Types of Waste Considered as Stabilizers. And the review of literature of wastes are relevant to the present topic of research such as, cement kiln dust, plastic and fiber wastes.

Chapter three: contains a description of materials were considered for beneficial reuse in soil stabilization applications, these materials included cement kiln dust as chemical stabilizers, fiber glass waste and plastic waste as soil reinforcement. These materials were selected based on their engineering properties, availability in Sudan, and their potential for use in geotechnical applications.

Chapter four: presents the results of compaction test, shear strength properties and CBR test and the discussion of results

Chapter five: includes conclusions and recommendations as a result of this study