

Comparative Study of Shear Strength of Soil by Addition of Fertilizers

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Abstract - Soil is an important factor to be considered while constructing a civil engineering structure. Nowadays construction land is used for construction of different structures. Soil in these lands is mixed with various amounts of chemical fertilizers. This chemical fertilizer alters the geotechnical properties of soil. So it is important to check how the added chemical fertilizer affects the properties of soil. Here we use clay from Kuttanad region of Kerala, and Nitrogen, Phosphorous and Potassium as fertilizer components for the study. Tests for determining initial properties, Atterberg limits and unconfined compressive strength were conducted for different percentages of nitrogen, phosphorous and potassium namely NPK respectively. Analysis of result showed that the chemical content influence the Atterberg limits and compressive strength of clay.

Key Words: atterberg limits, chemical fertilizers, civil engineering structures, clay, geotechnical properties, NPK fertilizer,

1. INTRODUCTION

Due to high population growth the natural resources are reducing and it reflects in the availability of land for the construction. In this situation most of the cultivation lands were converting in to construction sites. In the case of cultivation land once cultivated large scale and for that the chemical fertilizers, mostly NPK fertilizers were widely used. Later construction was done in this chemical mixed soil. NPK fertilizer applied to the soil to increase crop yield modifies the soil properties. This modified soil behaves differently from the parent soil. So it is becomes necessary to study the chemically treated soil to understand how NPK fertilizer affects the engineering properties of soil. So it is necessary to check the chemical content in soil and how it affects the geotechnical parameters of soil. In consequence of the effects of synthetic fertilizer on the physical properties of soil, this paper appraises the geotechnical properties of clay modified with NPK fertilizer and also the three main chemicals present in fertilizer (Nitrogen, Phosphorus and Potassium) separately. Analysis of test results showed that the chemical content influence the liquid limit, plastic limit and shear strength of the clay.

2. MATERIALS

The materials used for the study are Kuttanad clay, fertilizer components (Nitrogen, Phosphorous, Potassium), equipments needed to testing geotechnical properties.

2.1 Clay

The soil used for the study is clay collected from Kuttanad region in Alappuzha district of Kerala in India. The soil was partially air dried before the commencement of the experiment.

2.2 Fertilizers

Different percentages of nitrogen, phosphorous and potassium namely NPK.

3. INITIAL PROPERTIES OF CLAY

Table -1: Initial Properties of clay

Sl no	Initial properties	Value
1	Specific gravity	1.82
2	OMC	25%
3	MDD	0.605 kg/m ³
4	LL	84%
5	PL	75.5%
6	UCC	0.033 N/m ²

4. RESULTS AND DISCUSSIONS

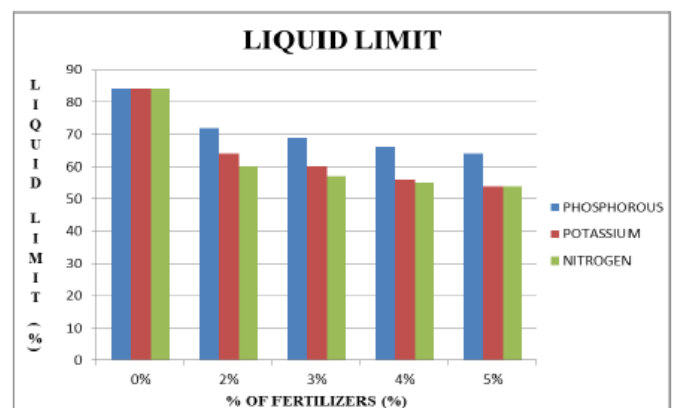


Chart 1. Different percentages of fertilizers with the variation of LL

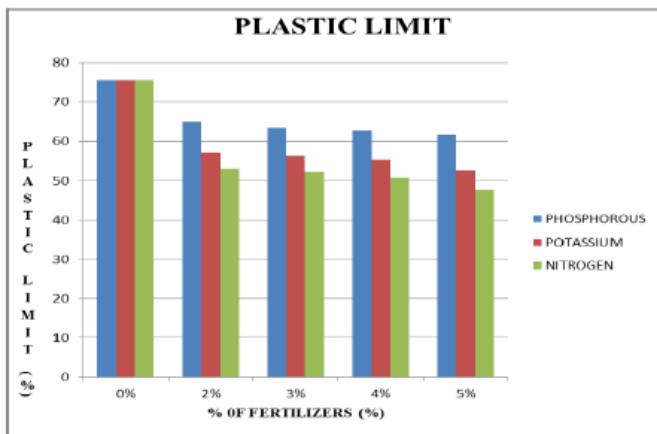


Chart 2. Different percentages of fertilizers with the variation of PL

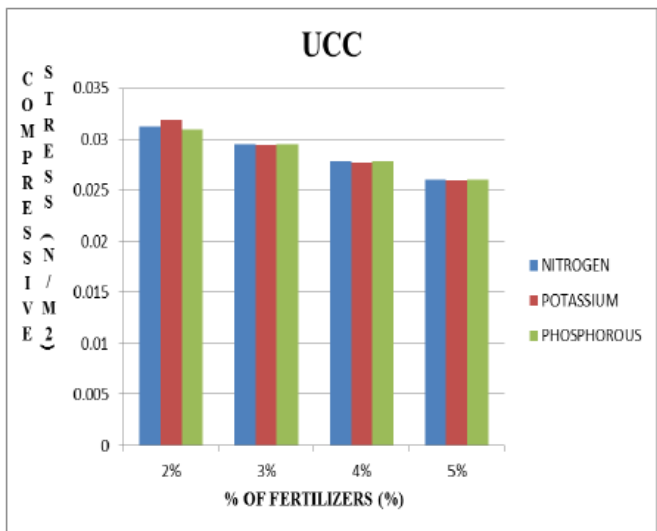


Chart 3. Different percentages of fertilizers with the variation of strength

5. CONCLUSIONS

From the study it was found that the addition of fertilizer to soil affects the Atterberg’s limits properties of the soil. It reduces the liquid limit and the plastic limit of soil. Liquid limit of untreated soil is 84% and liquid limit of soil at 5% nitrogen, phosphorous, potassium are 54%,64% and 54%. Plastic limit of untreated soil is 75.5% and plastic limit of soil at 5% nitrogen, phosphorous and potassium are 47.66%, 61.66% and 52.6%. Compressive stress of untreated soil is 0.033N/m² and compressive stress at 5% nitrogen , phosphorous and potassium are 0.0260N/m²,0.0260N/m² and 0.0259N/m². From the three chemicals nitrogen shows more variation in test results.

From the three major chemicals in fertilizer potassium shows much variation in test results. The potassium in soil reacts with water and gets oxides. This potassium oxide

attaches on the surface of clay particles. This may reduce the surface area of clay particles to absorb the water. When the potassium oxide attach on the clay particles it may also reduce the cohesion between the particles. The nitrogen and phosphorous show less variation. When Nitrogen added to soil it converts in to nitrates. This nitrate is highly soluble in water and leaches in to ground water.

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