International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 03 | Mar 2019 www.irjet.net p-ISSN: 2395-0072

Compaction Characteristics of Low Plastic Soil with Addition of Glycerol

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Abstract - *Nowadays ground pollution is noticed in a wide range, which deduce the properties the soil in the geotechnical aspect. Ground pollution occurs by the improper handling and disposal of waste and the impact of industrial activities. In this paper, it is concentrated on the compaction behavior of low plastic soil contaminated by glycerol, which is major constituent and by-product of small scale and large scale industries. The glycerol – soil mix is prepared with different percentage of glycerol solution with 40% concentration.*

Key Words: **Contamination, Concentration, Glycerol, Soil property**

1. INTRODUCTION

A contaminant can be generally described as a chemical element or compound that has ability to impose short term or long term threat on human life or environment. Contaminants can be divided into two groups, organic and inorganic contaminants. Many types of organic contaminants can result from this process and can be found polluting the environment. Soil contamination can occur due to leakage from underground or aboveground storage tanks and accidental spills. The response of the soil to the contaminants depends not only on the local environment but it is also influenced by factors such as particle size, bonding characteristics between particles and ion exchange capacity. There is more chance for fine soil particles are more likely to interact with contaminants than coarse soil particles. When a clay soil is contaminated with chemical compounds, physico-chemical interactions may occur between the soil and the chemical which may result in changing the structure and physical and mechanical properties of the soil. The clay soil structure depends on the type and amount of clay and the physico-chemical properties of the pore fluid such as electrolyte concentration, ion type, anion adsorption, pH, dielectric constant and temperature. The amount of physicochemical interactions in soils can be qualitatively related to the diffuse double layer (DDL). Reduction or depression of the DDL thickness can produce a flocculated structure, while an increase in thickness may produce a dispersed structure (Estabragh A.R. et. al.2014)

2. MATERIALS

Materials used in this study are low plastic clay and glycerol.

2.1. Soil

Low plastic clay for the present study was collected from Thonnakkal quarry. It is having a light pink Shade in appearance. Various tests were conducted to determine the index properties of low plastic clay.

Table -1: Properties of CL soil

PROPERTIES	VALUES
Specific Gravity	2.63
Liquid limit(%)(IS 2720 PART 51985)	44
Plastic limit (%)(IS 2720 PART 51985)	10.76
Shrinkage limit(%)(IS 2720 PART 51985)	17.82
Plasticity index(%)(IS 2720 PART 51985)	20.98
IS Classification	CL
Natural water content(%)	26.48
Optimum moisture content (%) (IS 2720	26.58
Maximum dry density(g/cc) (IS 2720 PART	1.52
Percentage of clay (IS 2720 PART 4)	71
Percentage of silt (IS 2720 PART 4)	20
Percentage of sand (IS 2720 PART 4)	9
UCC Strength (kg/sqcm)(IS 2720 PART 10)	1.940
Shear strength (kg/sqcm)(IS 2720 PART 10)	0.970

Fig -1: Thonnakkal clay

2.2. Glycerol

Glycerol was considered as the contaminating organic material. Glycerol (propane-1,2,3-triol) is an oxygenated organic compound that has been successfully and widely used in the chemical industry in the last decades. Major applications of glycerol can be found in the detergents industry as well as in drug and pharmaceutical production. In this work, a solution of glycerol with a concentration of 40% was used.

Table -2: Properties of Glycerol

PROPERTIES	VALUES
Assay(ex-density)(%)	98
Wt. per ml at 20 degree C	1.255-1.260
Ash content(%)	.02
20% Aq. Solution	Neutral – litmus
Chloride(%)	0.001
Sulphate(%)	0.001
Lead(%)	0.05

3. METHODOLOGY

In preparation of the samples contaminated with glycerol, the degree of contamination was specified as the percentage weight of contaminant with respect to mixture of air-dried soil with contaminant. The degrees of contamination of 0%,2%,4%,6%,8% and 10% were considered for preparing the contaminated samples. The soil was poured in flat layers with thickness of about 50 mm in a tray. A pre-specified volume of fluid was sprayed on each layer and mixing was done carefully. The soil was then flattened and the next layer with the same thickness was added on it, and spraying and mixing was repeated. This procedure was repeated until the last layer. After that, all layers were mixed and covered with a nylon to prevent from evaporation. y. The mixture was then kept in sealed plastic bags for one week so that the soil and glycerol came to an equilibrium condition. Standard compaction tests were conducted on these mixtures. The maximum dry unit weight and optimum water content were determined for each of the materials. The samples for the UCS were prepared at their respective optimum water content that were obtained from a standard compaction test.

4. RESULTS

4.1. Effect of glycerol on low plastic clay

On adding glycerol, the compaction value of low plastic clay showed a change. The OMC increased and the MDD decreased with the increase in glycerol content.

Table -3: Variation of compaction characteristics

Glycerol (%)	OMC (%)	MDD (g/cc)
0%	26.58	1.52
2%	27.94	1.49
4%	28.86	1.46
6%	29.42	1.43
8%	31.25	1.42
10%	33.71	1.39

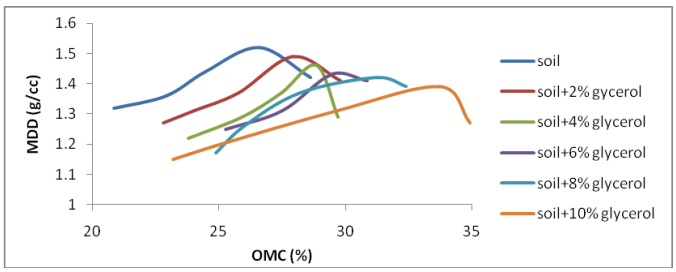

Chart -1: Variation of compaction characteristics

4. CONCLUSIONS

Based on study and experimental investigation following conclusions were found.

- It was observed that with the addition of glycerol in low plastic soil, the compaction values of the soil glycerol changes.
- The maximum dry density of the low plastic soil decreases with the increase in the glycerol content.

- The optimum moisture content of the low plastic soil increase with increase in glycerol content.

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