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Study On Effects Of Sawdust On Liquid Limit, Plastic Limit And Plasticity Index Of Bentonite

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Abstract: ***Huge quantity of saw dust is being generated worldwide due to the rapid urbanization. The disposal of saw dust in open areas or landfills is not an environment friendly solution. Utilization of saw dust in geotechnical applications is likely provides a better solution. This study investigates effect of sawdust addition on atterberg limits of the Soil-Bentonite mixture. A series of tests were performed on bentonite with 1%, 2%,…, 6% sawdust contents. The results showed that application of sawdust reduced liquid limit and plastic limit and increased plasticity index of highly expansive bentonite.***

Keywords: Atterberg limit, Highly expansive, Sawdust.

I. INTRODUCTION

Soil stabilization is modifications or adjustments of the soils properties in order to fulfill the specified engineering requirements. The ways to stabilize the soil are compaction and usage of admixtures. Commonly used stabilizers for altering the properties of soils are lime and cement. Recent studies indicates the use of solid waste materials like fly ash and rice husk ash for soil stabilization by means of or devoid of lime or cement.

saw dust is one of the byproduct from timber industries and wood cutting factories. Saw dust by itself has little cementitious value but in presence of moisture it reacts chemically and form cementitious compounds and attribute to the improvement of strength and compressibility properties of soils.

the present study was carried out in order to achieve the need of improvement in the geotechnical properties of clayey soil and make use of industrial wastes. Also the purpose of this study is to determine the effect of sawdust stabilizer on geotechnical properties of clayey soils.

II. Materials used

materials used in this study are sodium bentonite soil and sawdust.

2.1 Bentonite Clay

Bentonite for the present study was collected from associated chemicals, kochi. Sodium bentonite was taken from there.the properties of soil were tested and tabulated in table 1. Based on indian standard classification system (iscs), the soil is classified as clay of high compressibility (ch). Unconfined compression test was conducted to confirm the soil is medium. The grain size distribution of clay was found out using hydrometer analysis (is: 2720 (part 4)- 1983) is shown in fig. 3.

Fig. 1. Sodium bentonite

Table 1. Properties of clayey soil

Soil properties	Values obtained
Specific gravity	2.59
Liquid limit (%)	332
Plastic limit (%)	50
Shrinkage limit (%)	24.6
Plasticity index (%)	282
Is classification	Ch
Omc (%)	38
Percentage of clay (%)	80
Percentage of silt (%)	11.8
Percentage of sand (%)	8.2
Ucs (kpa)	0.866
Coefficient of permeability (cm/s)	$0.2x\ 10^{-7}$

2.2 Sawdust

The sawdust used in the study was collected from a local woodmill site in poovar, thiruvananthapuram, kerala, india. The collected sawdust was first dried and screened over sieve size 4.75mm to remove any impurities. The properties of sawdust were tested and tabulated in table 2. The grain size distribution of sawdust was found out by sieve analysis (is: 2720 (part 4)- 1983) is shown also in fig.3.

Fig. 2. Sawdust

Table 2. Properties of sawdust

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Soil properties	Values obtained
Specific gravity	1.1
Effective size d10(mm)	0.075
D60(mm)	0.55
D30(mm)	0.15
Co-efficient of curvature, c_c	0.55
Uniformity co-efficient, c_u	7.33

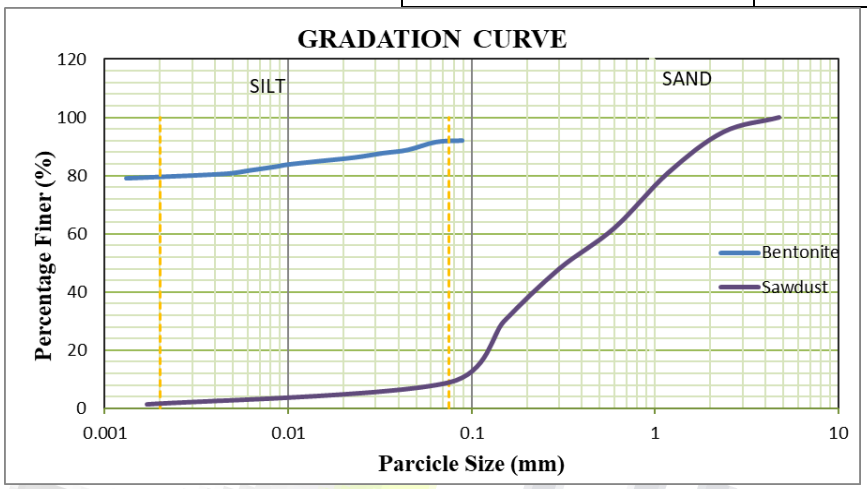

Fig. 3. Grain size distribution curves for clayey soil and sawdust

III. Methodology

The test to determine the index properties of soil were done as per is 2720 (part v). The variation in liquid limit, plastic limit, and plasticity index were studied with the addition of various percentage (1, 2, 3, 4, 5 & 6%) of sawdust on soil individually.

IV. Results And Discussions

4.1 atterberg limits

The liquid limit, plastic limit and plasticity index values of clayey soil treated with different percentage of sawdust is given in table 3. And the variation of ll, pl, pi are given in fig. 4.

Table 3. Atterberg limits of bentonite-sawdust mixes

Soil mix	Liquid limit (%)	Plastic limit (%)	Plasticity index (%)
Bentonite	332	50	282
Bentonite + 1% sawdust	330	47	283
Bentonite + 2% sawdust	329	46	283
Bentonite + 3% sawdust	328	44	284
Bentonite + 4% sawdust	327	43	284
Bentonite + 5% sawdust	326.5	42	284.5
Bentonite + 6% sawdust	326	41	285

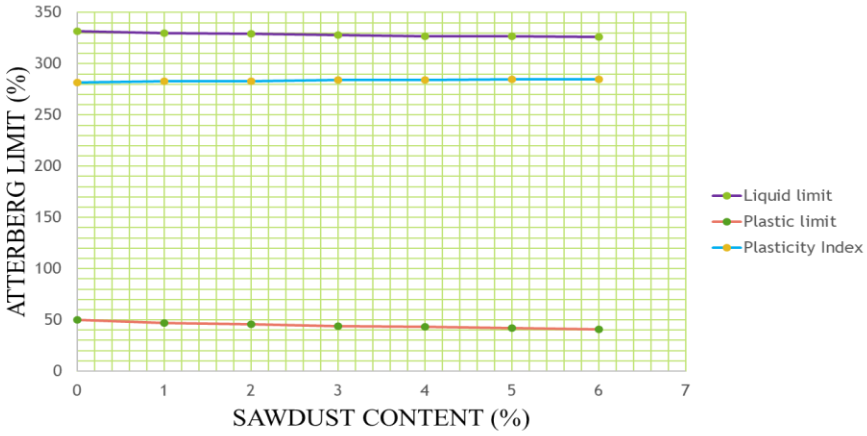

fig. 4. Variation in ll, pl & pi with varying percentages of sawdust in clayey soil

The liquid and plastic limits decreased, while the plasticity index of the bentonite surprisingly slightly increased as its sawdust content increased. This may be due to the extremely high plasticity of the bentonite.

V Conclusions

- Addition of sawdust causes reduction in plasticity of bentonite, thereby reducing shrinkage and expansive potential of clay.
- Sawdust can be used to improve the workability of highly plastic soils that are difficult to work with during earthwork construction.

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