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An Experimental Investigation on Stabilization of Peat soil Using Pond Ash

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Abstract - *For construction of any civil engineering structures, the foundation is very important and has to be strong to support entire structure. In order for foundation to be strong the soil around and below it plays a very important role.Peat soil is said to unsuitable soil for any engineering construction. Hence for any civil engineering construction on peat soil requires either replacement of soil or stabilization*.

The stabilization potential of pond ash (PA) from a coal fired thermal power station on tropical peat soil. Peat or highly organic soils are well known for their high compressibility, natural moisture content, low shear strength and long-term settlement. This study investigates the effect of different amount (i.e., 5, 10, 15 and 20%) of PA on peat soil, mainly compaction and unconfined compressive strength (UCS) properties. The amounts of PA added to the peat soil sample as percentage of the dry peat soil mass. The UCS value of the peat soils increases almost double from original Peat Soil with addition of 20% Pond Ash of weight of Peat soil.

This improvement on compressive strength of tropical peat soils indicates that PA has the potential to be used as a stabilizer for tropical peat soil. Also, the use of PA in soil stabilization helps in reducing the pond volume and achieving environment friendly as well as a sustainable development of natural resources.

Key Words*: *Peat Soil, Pond Ash (PA), Unconfined Compressive Strength (UCS)

1. INTRODUCTION

Soil is one of the world's most important natural resources, Together with air and water; it is basic for life on planet earth. Soil is a natural body that consists of layers (soil horizons) composed primarily of minerals, which differ from parent materials in their texture, structure, consistency, and colour, chemical, biological and other physical characteristics. The end result, soil is the end product of the influence of climate (temperature, precipitation), relief (slope), organisms (flora and fauna), parent materials (original minerals), and time. In engineering soil is referred to as regolith, or loose rock materials. In general, soil is the depth of regolith that influences and has been influenced by plant roots and may range in centimeters to several metres

Peat soil is said to unsuitable soil for any engineering construction. Hence for any civil engineering construction on peat soil requires either replacement of soil or stabilization. Peat soil is known as very soft soil with highly organic consisting almost entirely of vegetative matter in varying states of decomposition.

The stabilization is achieved by mixing peat soil with binding materials such as admixtures or stabilizers. This is the substantial savings in stabilizing existing sub-grade instead of replacing existing sub-grade with suitable materials. During rainy seasons weather related delays can be reduced by stabilizing the soil in order to continue the site work. The soil maximum dry density is found to increase with increase in the Pond Ash, while the optimum water content is found to be decreased. Compressive strength and shear strength of the peat soil is increased by mixing with admixtures than that of original peat. The acidity and organic content of the stabilized peat soil decreases so that it becomes neutral peat soil with low organic content.

2. MATERIALS

2.1. Peat Soil

The Peat soil sample for this study was collected from chikmagalur Dist, Karnataka state. The top Surface of the soil was cleared with all waste materials and collected at a depth of 0.3m to 0.5m in it's natural state.

Figure1. Peat Soil

2.2 Pond Ash

The Pond Ash sample for this study was collected from Thermal power station Kudithini, Bellary Dist, Karnataka state.

Pond ash is the residue after combustion of coal in thermal power plants, so its properties depends upon the coal used and may vary from one power plant to other

power plant. Particle sizes of the ash vary from around one micron to around 600 microns.

3. Formulation of Experiments

3.1Test Results on Peat soil:

Table No. 1: Tabulation of test results on peat soil

Experiments	Results
Grain size Analysis	Well graded
Moisture content	37.74%
Specific Gravity	1.33
Liquid limit	120.33%
Standard Proctor test a) Maximum Dry Density b) Optimum moisture content	1.19 g/cc 16%
Permeability test a) Constant head b) Variable head	6.41×10^{-3}cm/sec 0.0418 cm/sec
pH	3.75
Loss of Ignition test	26.368%

3.2 Test Results on Pond Ash

Table No.2: Tabulation of test results on Pond Ash

Experiment	Results
Specific gravity test	1.73
Fineness test	26.33%

The table 1 shows the different physical properties of peat soil and table 2 shows the properties of pond ash. Here we observe that the specific gravity value of peat soil is very low because it contains a lot of fiber. The table 1 shows that the natural moisture content of the peat soil is quite high. The organic content of the soil sample tested in this study is more than 26.368%. Table 1 shows the natural water content of the peat soil is 37.74%. The specific gravity of peat soil is very low i.e. 1.33 because it contains lot of fibers. The liquid limit value is also higher because the sample contains more fiber or organic content and thus it has high water absorption capacity.

4. Experimental Programme

TABLE NO. 3 UNCONFINED COMPRESSIVE STRENGTH TEST RESULTS

Soil Sample	Test Result
Original Peat	6.67 kg/cm^2
95% Peat Soil + 5% Pond Ash	6.747 kg/cm^2
90% Peat Soil + 10% Pond Ash	8.894 kg/cm^2
85% Peat Soil + 15% Pond Ash	12.235 kg/cm^2
80% Peat Soil + 20% Pond Ash	13.799 kg/cm^2

From Table 3 indicates UCS of untreated and 5%, 10%, 15%, 20% Pond Ash treated peat soil In order to optimize pond ash content in soil UCS test were conducted by compacting soil to optimum moisture content, Maximum dry density. The result shows 20% stabilizer gives optimum value of unconfined compressive strength.

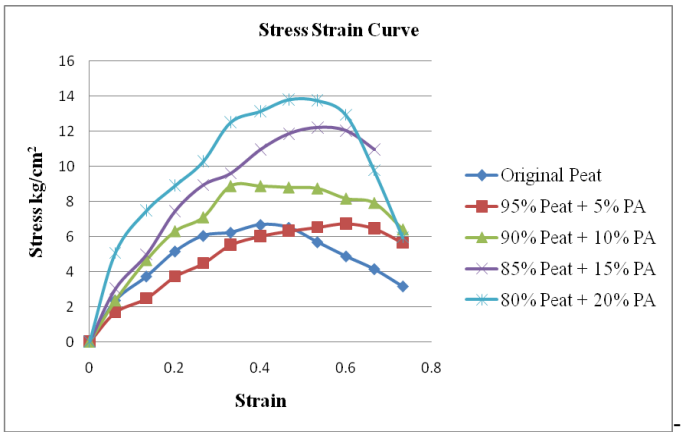

Chart-1 Stress strain Curves for original peat soil and as well as a mixture of peat soil and different amounts of Pond Ash specimens

The result obtained from unconfined compressive strength shown in graph indicates that the addition of Pond Ash to Peat soil increases the unconfined compressive strength values.

From the result of this study it can be concluded that addition of Pond Ash can improve the engineering properties of Peat soil. Use of Pond Ash not only enhances the strength of natural Peat soil, it will also introduce a sustainable development of natural resources by solving the disposal problem of waste byproduct from the thermal power station.

5. CONCLUSIONS

- Peat soil is one the softest soils and is unable to resist construction loads imposed upon it. Different methods are available to improve the bearing capacity of foundation soils.
- UCS test shows the compressive strength for peat and PA mixed sample increases with the increase of percentage of PA (i.e., 5%, 10%, 15% and 20%) added to the original peat sample.
- The compressive strength of peat-PA sample increases almost doubled from original peat soil with addition of 20% PA of weight of peat soil.
- The UCS value for stabilized peat soils with addition of 20% PA by weight yielded the highest average compressive strength of 13.799 kg/cm^2 among the stabilized peat-PA soil samples compare to original tropical peat soil at 6.67 kg/cm^2.
- For the sake of protecting the environment and the better utilization of the industrial waste material for geotechnical purposes it is important to understand its impact on the behavior of soil.
- It is found out that the shape and size of the Pond Ash, particle size distribution, Physical, , chemical constituents etc. are mainly affecting the geotechnical properties of Mix.

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