

# Effect of Natural fiber on Clayey soil

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**Abstract** - Fiber is a naturally occurring material. In this study two type of fiber are used bamboo fiber and banana fiber both are dried and cut in to equal length. The main objective is to use naturally occurring waste material for soil improvement. In this study different percentage of bamboo fiber and banana fiber are added to the soil and the optimum parentages found out.

**Keywords**- Stabilisatio;bamboofiber;bananafiber;ucc; compaction;cbr.

## 1. INTRODUCTION

Soil stabilization is the process of varying the properties of soil to improve its engineering properties. So that it can be used in civil engineering works. The soil over which the construction is to be carried out should be strong enough to carry the design load, neither failure may occur. This problem mainly occurs when construction is to be done on clayey soil. Nowadays various methods are available for improving the properties of clayey soil from which the natural fiber are used in this study, since it is locally available and reduces the cost of work. Fiber when mixed with soil it binds the soil particles together by interlocking mechanisms as one unit. In this present study different percentage of fiber are added to soil and the optimum amount of fiber is found out.

### 1.1 Objective of the Study

- To determine the optimum amount of fiber required for soil stabilization.
- To compare the effect of different fiber on improving the properties of soil.
- To increase the strength of soil by using different percentage of fiber.

## 2. MATERIALS

Material used in this study is being listed below

### 2.1 Soil

Experiments were carried out on clayey soil taken from Thonackal in Trivandrum district, Kerala. Figure 1 shows the sample of clayey soil and Table 1 shows the properties of soil.

**Table -1:** Properties of Soil

| Properties                                      | Soil                    |
|---|-------------------------|
| Specific Gravity                                | 2.64                    |
| Liquid limit, W <sub>L</sub>                    | 61%                     |
| Plastic limit, W <sub>P</sub>                   | 40 %                    |
| Plasticity index, I <sub>P</sub>                | 21%                     |
| Shrinkage limit, W <sub>s</sub>                 | 25%                     |
| Percentage of clay                              | 70%                     |
| Percentage of silt                              | 30%                     |
| Unconfined compressive strength, q <sub>u</sub> | 0.28 kg/cm <sup>2</sup> |
| California bearing ratio                        | 2.13%                   |
| USCS Classification                             | CH                      |



**Figure -1:** Kaolinite

### 2.2 Banana fiber:

Banana fiber is extracted from Banana by decortications by using knife and is kept for drying for 2 days and then cut into needed size. Fiber was obtained from Trivandrum. Table 2 shows properties of banana fiber and Figure 3 shows Banana fiber.

**Table -2:** Properties of Banana fiber

| Parameter             | Values      |
|-----------------------|-------------|
| Colour                | Light Brown |
| Average diameter (mm) | 0.73        |
| Average length (mm)   | 25          |



Figure -2: Banana fiber

### 2.3 Bamboo fiber:

The bamboo fiber is made from the starchy pulp of bamboo plants. Fiber was obtained from Trivandrum. Table 4 shows the properties of bamboo fiber and Figure 4 Shows the Bamboo fiber.

Table -3: Properties of Bamboo fiber

| Parameter             | Values      |
|-----------------------|-------------|
| Colour                | Light Brown |
| Average diameter (mm) | 0.85        |
| Average length (mm)   | 25          |



Figure -3: Bamboo fiber

### 3. METHODOLOGY

Laboratory tests (Atterberg's limit, compaction, UCC,CBR) were carried out on clayey soil sample, and on combination of soil with Banana fiber and Bamboo fiber to determine the properties of soil sample.

The stabilization of clayey soil with bamboo fiber is carried out by blending the soil with different percentages of Bamboofiber(0.25%,0.5%,0.75%,1%,1.5%)and Bananafiber(0.5%,1%,1.5%,2%), and optimum amount is found out.

### 4. RESULTS AND DISCUSSIONS

After the determination of basic properties of clayey soil, soil stabilized with Bamboo fiber and Banana fiber, the strength parameters like MDD, and UCC were determined by conducting compaction, and UCC (unconfined compressive stress) tests.

#### 4.1 Results of MDD for clayey soil stabilized with Banana fiber

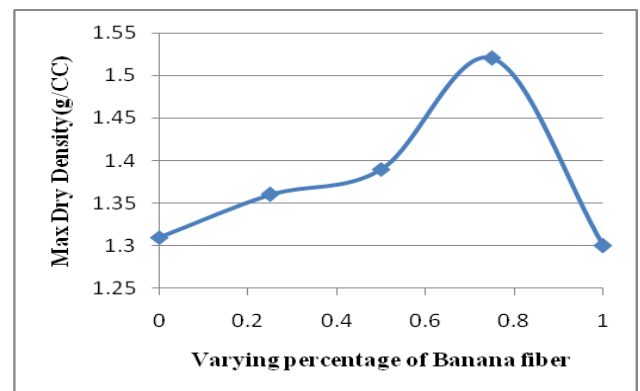


Figure -4: Graph showing % of Banana fiber v/s MDD

From the Figure 4 the maximum dry density is obtained when 0.75 % of banana fiber is added to the clayey soil. After adding more percentage of banana fiber to the clayey soil the MDD is decreasing.

#### 4.2 Results of unconfined compression test for clayey soil stabilized with Banana fiber

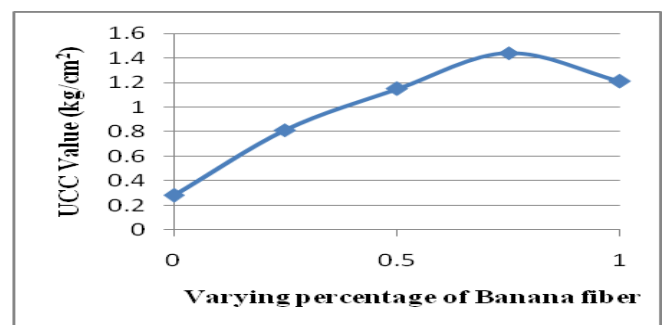


Figure -5: Graph showing % of Banana fiber v/s UCC

From the Figure 5 the maximum UCC value is obtained when 0.75 % of banana fiber is added to the clayey soil. By adding more percentage of banana fiber to the clayey soil the UCC value is decreasing.

### 4.3 Results of California bearing ratio test for clayey soil stabilized with Banana fiber

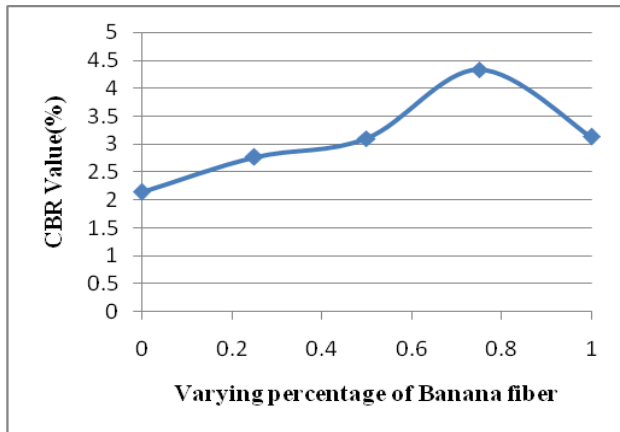


Figure-6: Graph showing % of Banana fiber v/s CBR

From the Figure 6 CBR value is obtained when 0.75 % of banana fiber added to the clayey soil. By adding more percentage of banana fiber to the clayey soil the UCC value is decreasing.

### 4.4 Results of MDD for clayey soil stabilized with varying percentage of Bamboo fiber

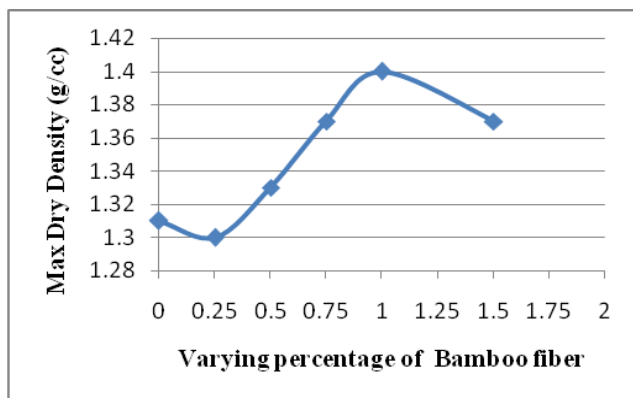


Figure -7: Graph showing % of Bamboo fiber v/s MDD

From the Figure 7 the maximum dry density is obtained when 1 % of Bamboo fiber is added to the clayey soil. After adding more percentage of Bamboo fiber to the clayey soil the MDD is decreasing.

### 4.5 Results of unconfined compression test for clayey soil stabilized with varying percentage of Bamboo fiber

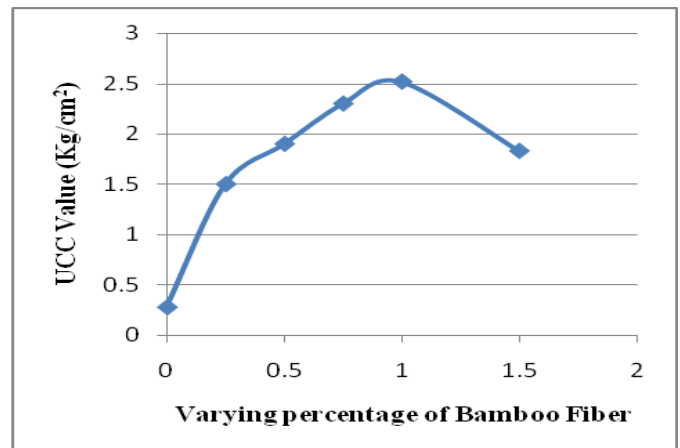


Figure-8: Graph showing % of Bamboo fiber v/s UCC

From the Figure 8 UCC value is obtained when 1% of Bamboo fiber is added to the clayey soil. By adding more percentage of Bamboo fiber to the clayey soil the UCC value is decreasing.

### 4.6 Results of CBR for clayey soil stabilized with varying percentage of Bamboo fiber

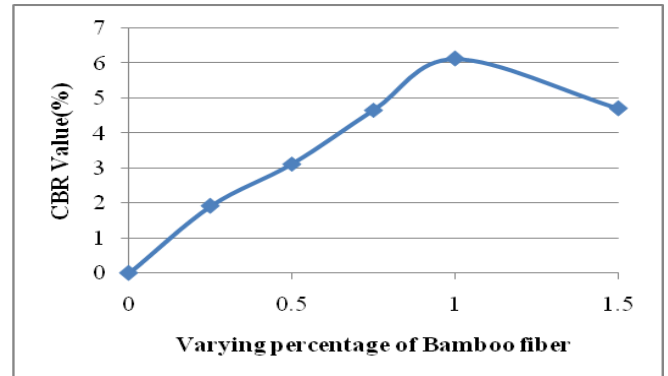


Figure -9: Graph showing % of Bamboo fiber v/s CBR

From the Figure 9 UCC value is obtained when 1% of Bamboo fiber is added to the clayey soil. By adding more percentage of Bamboo fiber to the clayey soil the UCC value is decreasing.

## 5. CONCLUSION

The following conclusions can be drawn on the basis of the result obtained from this work.

- There was an increase in optimum moisture content with increase in percentage of bamboo fiber and banana fiber to the soil.

- The maximum dry density increases and Optimum moisture content decreases with increase in percentage of fiber.
- Addition of various percentages of fiber shows increased value for unconfined compression strength up to 1% for bamboo fiber and 0.75% for banana fiber.
- The CBR value increases as amount of bamboo fiber increase upto 1% and banana fiber up to 0.5% then decreases on further addition. So 1% of bamboo fiber and 0.75% of banana fiber was taken as optimum percentage.

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