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Soil Stabilization Using Coconut Coir and Rubber Tyre Coir

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ABSTRACT
The soil bed should bear all the stresses transmitted by the structure. If the soil is weak and has not enough stability to resist heavy loading, the soil should be reinforced and stabilized. As the quality of the soil is increased, the ability of the soil to distribute the load over a greater area is generally increased. Soil stabilization refers improve the physical properties of soil by adding some external agents. Soil stabilization can be done by different styles like mechanical, chemical stabilization or by using different types of amalgamation Sustainable development cannot be done without adaptation of new technology to make the structure enduring. One of the most provident approaches for soil stabilization by using coir filaments and tyre waste materials. The common advancements of soil stabilization was improving the bearing capacity, strength and reducing the swelling and shrinkage of the soil. A study has been carried out to probe the strength of soil by buttressing with aimlessly distributed waste coir fiber accoutrements and tyre waste with varying probabilities of underpinning by conducting different tests like, contraction test, CBR. The tests were performed as per Indian standard specification. The results attained are compared and consequences are drawn towards their usability and effectiveness to make these waste fiber accoutrements for different geotechnical operation as a cost effective approach. The samples are prepared at their separate outside dry viscosity and optimum humidity content. From the study, it's observed that the disunion angle increases by 26 at fiber content of 0.5 and fiber length of 6mm. The fiber- corroborated low malleability complexion displayed crack fracture and face shear fracture failure modes, inferring that polyester fiber are good earth underpinning material with implicit operations in civil engineering.
Keywords: Core cutter method, Sieve analysis, Standard Proctor, CBR, Triaxial test, Atterberg Limits, Coconut coir, Rubber tyre coir

I. INTRODUCTION

The main aim for soil stabilization was to strong the foundation part which carries the entire load of the structure. In order for the foundation to be strong, the soil around it plays a veritably critical part. In order to work with soil, we need to have proper knowledge about their parcels and factors which affect their geste. The process of soil stabilization helps to achieve the needed parcels in a soil demanded for the construction work. Soils are generally stabilized to increase their strength and continuity or to help corrosion and dust conformation in soils. The main end is the creation of a soil material or system that will hold under the design use conditions and for the designed life of the engineering design. The parcels of soil vary a great deal at different places or in certain cases indeed at one place. colorful styles are employed to stabilize soil and the system should be vindicated in the lab with the soil material before applying on the field.

1.1 METHODS OF SOIL STABILIZATION

The different methods of soil stabilization are given below

1.1.1 MECHANICAL METHOD OF STABILIZATION

In this procedure, soils of different gradations are mixed together to gain the asked property in the soil. This may be done at the point or at some other place from where it can be transported fluently. The final admixture is also compacted by the usual styles to get the needed viscosity.

1.1.2 HYDRAULIC METHOD OF MODIFICATION

Free- severance water is forced out of the soil via rain spouts or wells. In coarse granulated soils this is achieved by lowering the ground water position through pumping from boreholes or flosses; in fine granulated soils the long term operation of external loads (pre-loading) or

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electrical forces is needed. Traditional ways have served from the development of geosynthetics, as in the case of perpendicular rain spouts.

1.1.3 CHEMICAL METHOD OF STABILIZATION

It refers to the addition of cultivated products into the soil, which in proper amounts enhances the quality of the soil. Accouterments were similar to cement, lime, bitumen, and fly aspect were used as chemical complements. When complements are fitted via boreholes under pressure into the voids within the ground or between it and a structure, the process is called grouting. Soil stabilization by hitting the ground and by in duration the ground are both considered thermal styles of revision. Heating evaporates water and causes endless changes in the mineral structure of soils; indicating solidifies part or all of the water and bonds individual patches together.

1.2 PRINCIPLES OF SOIL STABILIZATION

- Assessing the soil parcels of the area under consideration.
- Deciding the property of soil which needs to be altered to get the design value and choose the effective and provident system for stabilization.
- Designing the stabilized soil blend sample and testing it in the for intended stability and continuity values.

1.3 OBJECTIVE OF THE STUDY

- The main objective of this project is to make use of waste fiber materials (tyre waste and coir) to stabilize the soil.
- This is a new technology and also cost effective approach.
- The present study is focused on effect of coir and tyre on soil reinforced with 0.25%,0.5%,0.75% and 1% of coir and 1%, 2%, 4%, 6% and 8% tyre using the laboratory tests such as compaction, unconfined compression test and CBR test.

II. MATERIALS USED

2.1 SOIL

The soil sample was brought from a place near to Synergy College at a depth of 2m below the ground surface. The soil is initially allowed to dry for 2 days and the dried soil is thoroughly grinded. The grinded soil was sieve by the 4.75mm IS sieve and this soil was used for the further study.

Figure 1: Soil

Table 1: Properties of Soil

SL. NO.	PROPERTIES	VALUE
1	Field water content (%)	25
2	Field density (gm/cc)	1.99
3	Dry density (gm/cc)	1.6
4	Liquid limit (%)	49
5	Plastic limit (%)	25
6	Plasticity index (%)	24
7	Optimum moisture content (OMC) (%)	20
8	Maximum Dry Density (MDD) (gm/cc)	1.67

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9	C.B.R (%)	1.95
10	U.C.S (Kg/cm^2)	0.36

2.2 COCONUT COIR

Coconut coir is brought from Cuttack market. The diameter of coir is 0.2-0.3mm. We used 1cm length of coir in the project.

Figure 2: Coconut coir

2.3 RUBBER TYRE

The diameter of the tyre is up to 3mm and length is 1-2cm. The following are the different properties of waste rubber tyre.

Figure 3: Rubber tyre coir

III. DIFFERENT TEST GRAPHS

3.1 STANDARD PROCTOR TEST

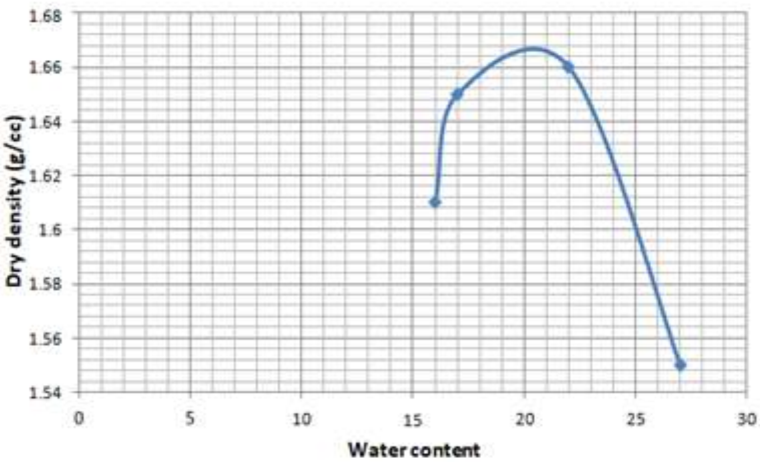

Figure 4: Compaction curve for Soil

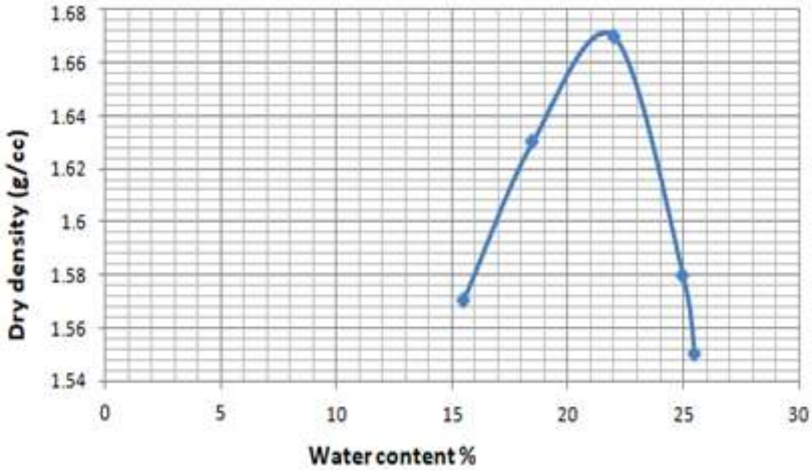

Figure 5: Compaction curve for Soil + 1% tyre coir

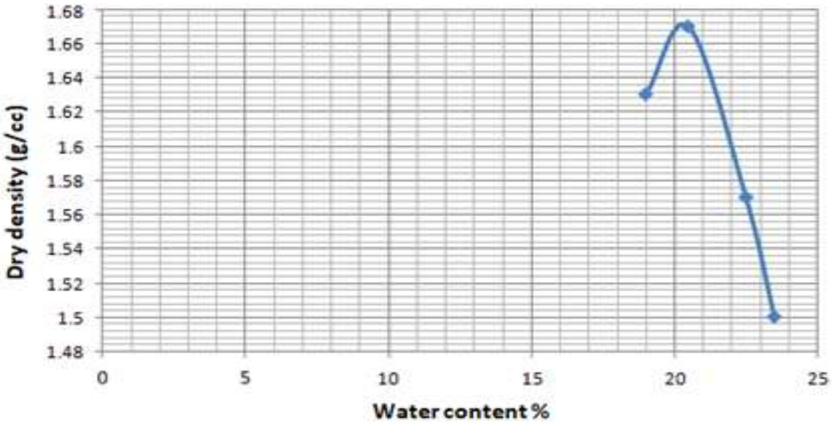

Figure 6: Compaction curve for Soil + 2% tyre coir

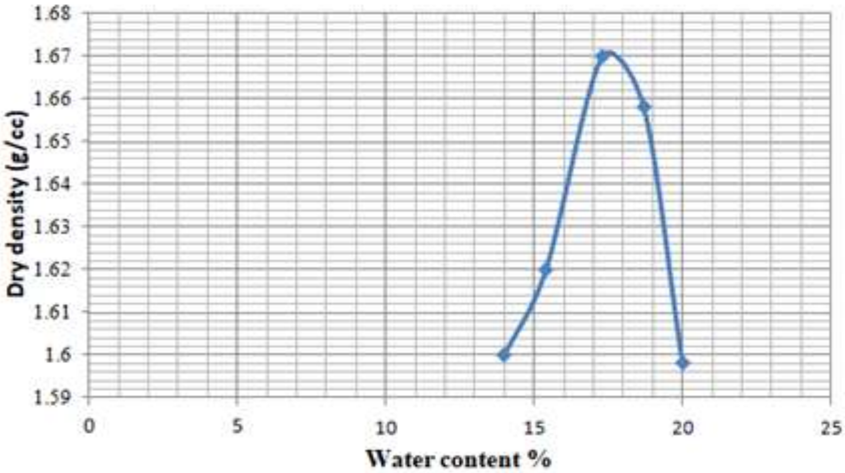

Figure 7: Compaction curve for Soil + 4% tyre coir

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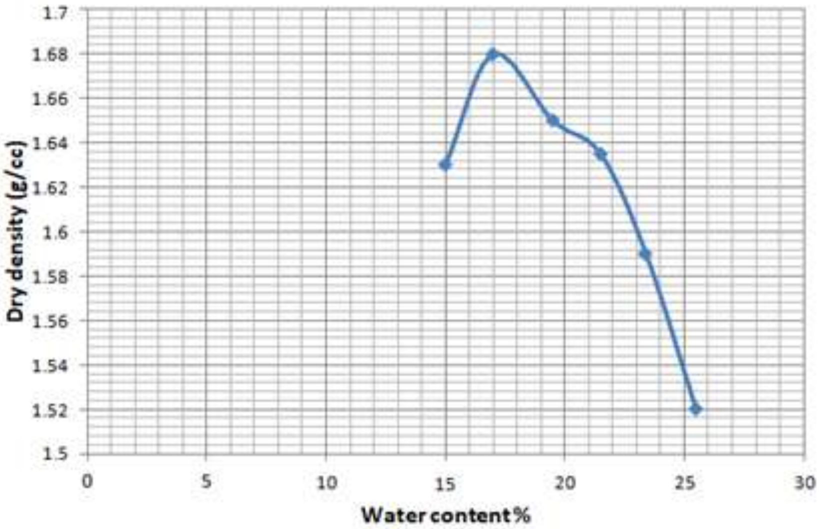

Figure 8: Compaction curve for Soil + 6% tyre coir

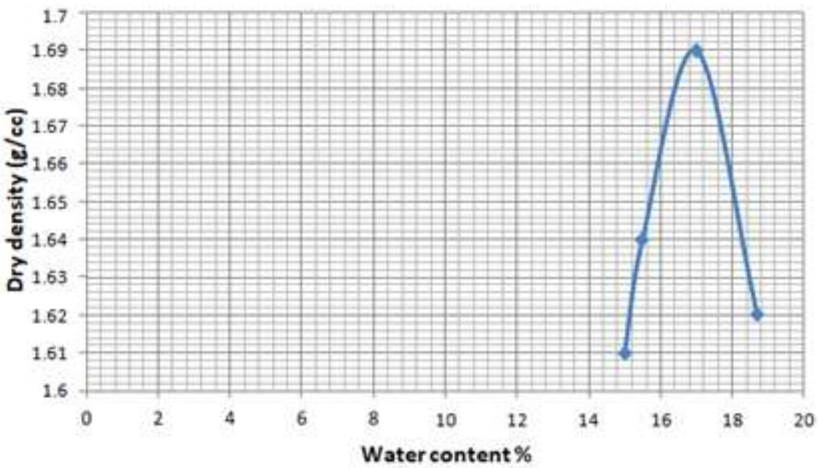

Figure 9: Compaction curve for soil + 8% tyre coir

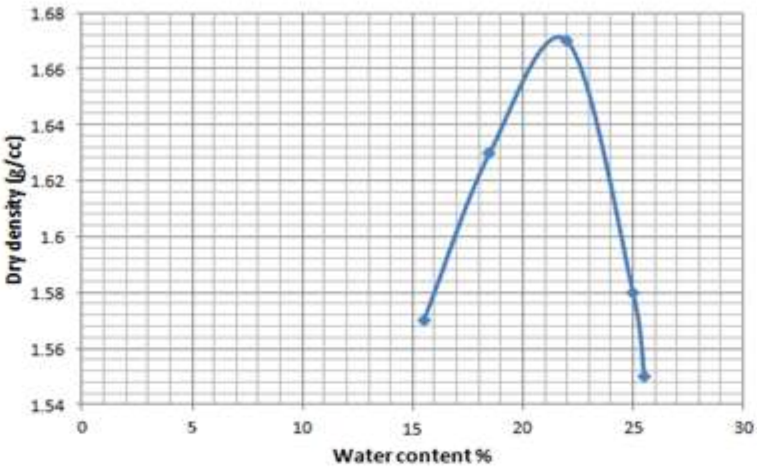

Figure 10: Compaction curve for Soil + 0.25%coconut coir

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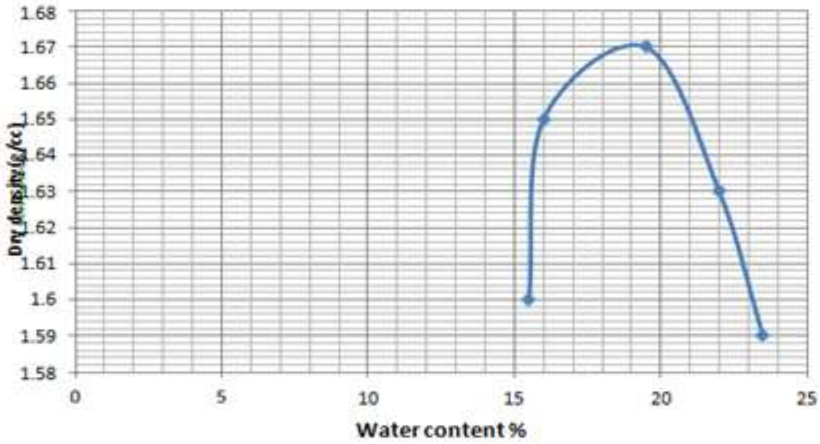

Figure 11: Compaction curve for Soil + 0. 5% coconut coir

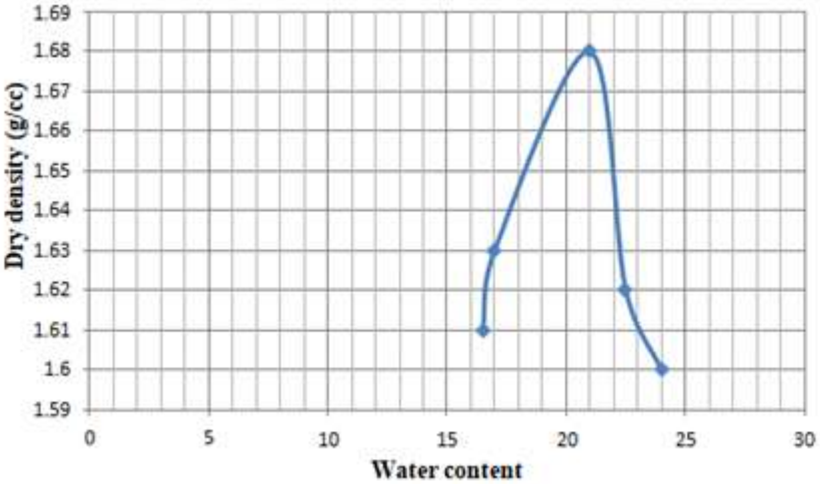

Figure 12: Compaction curve for Soil + 0. 75% coconut coir

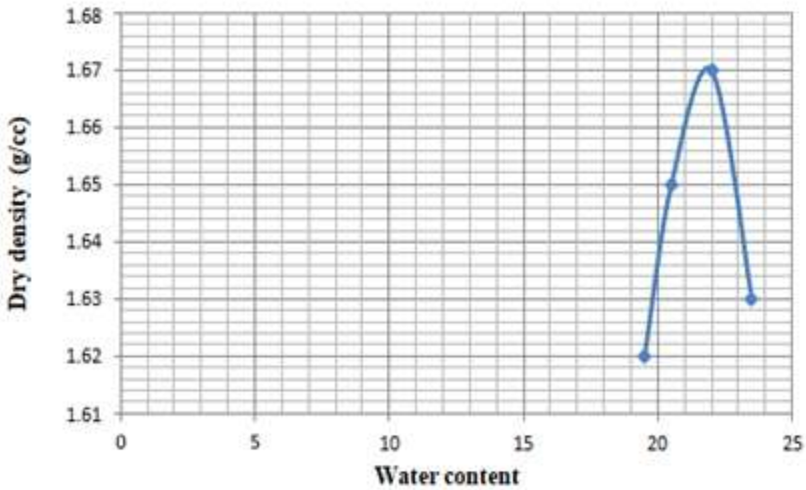

Figure 13: Compaction curve for soil + 1% coconut coir

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3.2 TRIAXIAL TEST

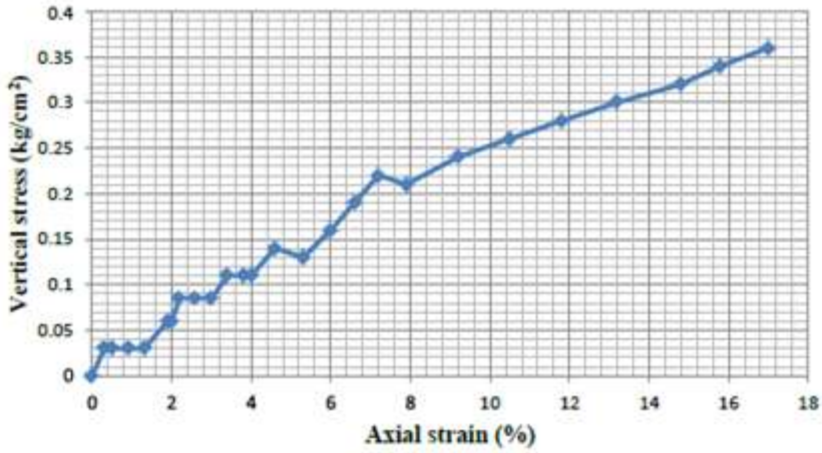

Figure 14: Triaxial curve for Soil

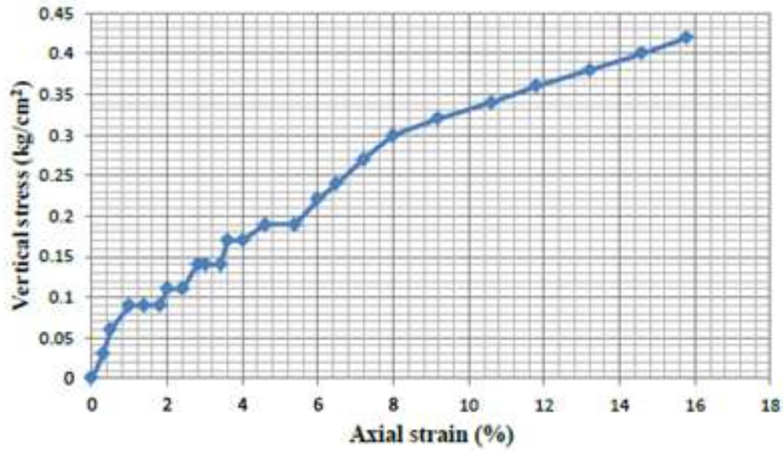

Figure 15: Triaxial curve for Soil + 1% tyre coir

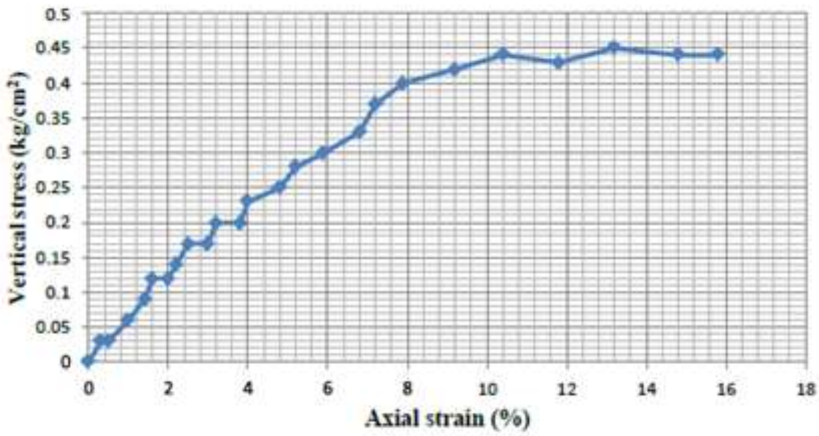

Figure 16: Triaxial curve for Soil + 2% tyre coir

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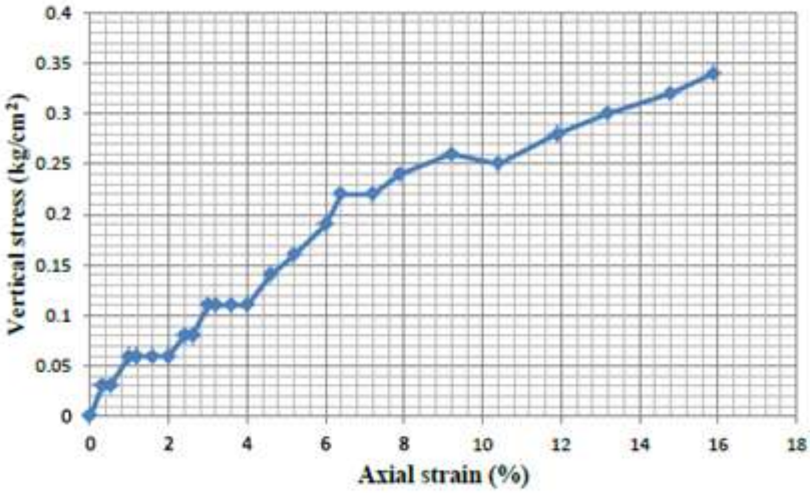

Figure 17: Triaxial curve for Soil + 4% tyre coir

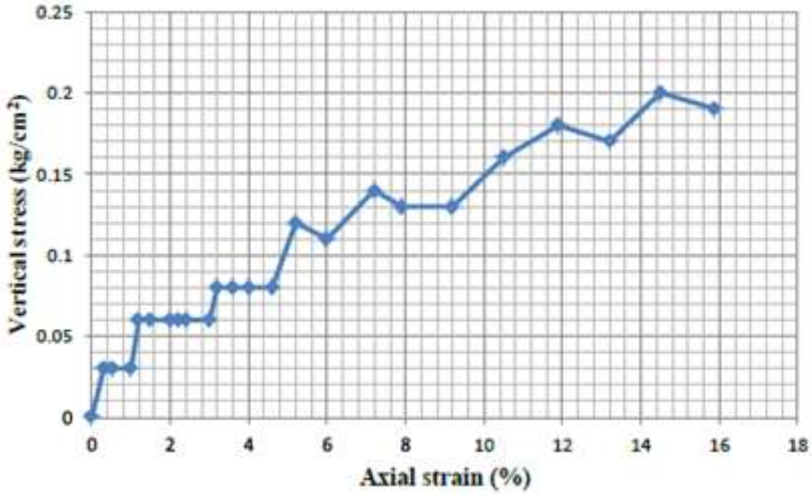

Figure 18: Triaxial curve for Soil + 6% tyre coir

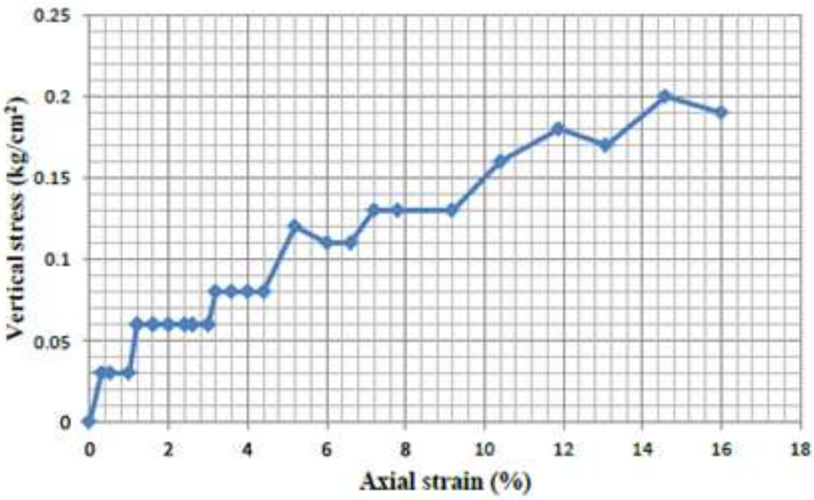

Figure 19: Triaxial curve for Soil + 8% tyre coir

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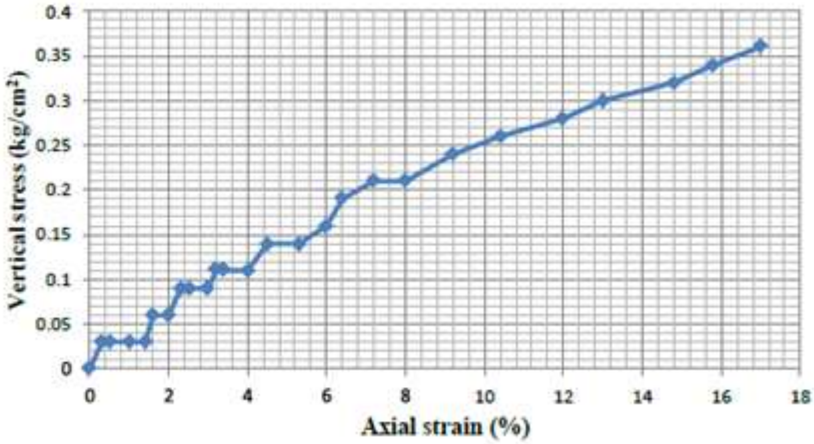

Figure 20: Triaxial curve for Soil + 0.25% coconut coir

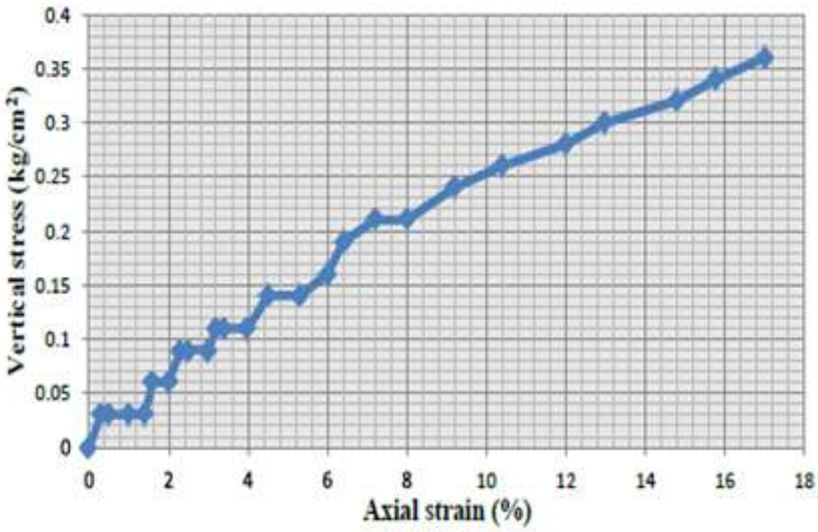

Figure 21: Triaxial curve for Soil + 0.50% coconut coir

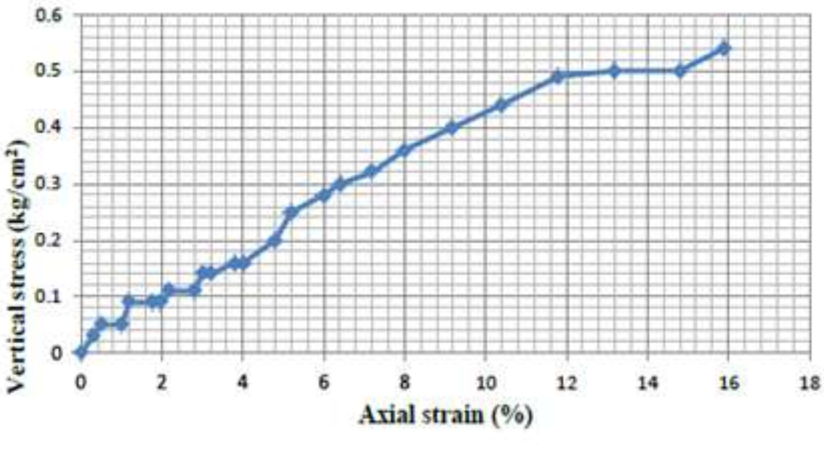

Figure 22: Triaxial curve for Soil + 0.75% coconut coir

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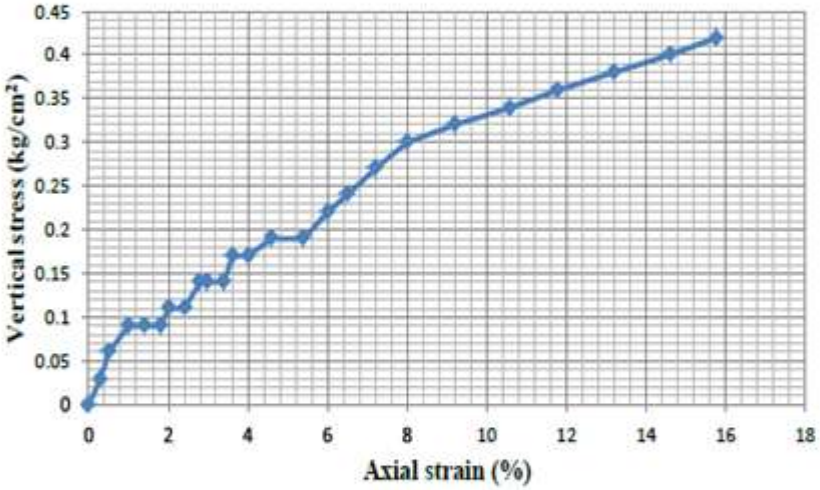

Figure 23: Triaxial curve for Soil + 1% coconut coir

3.3 CBR TEST

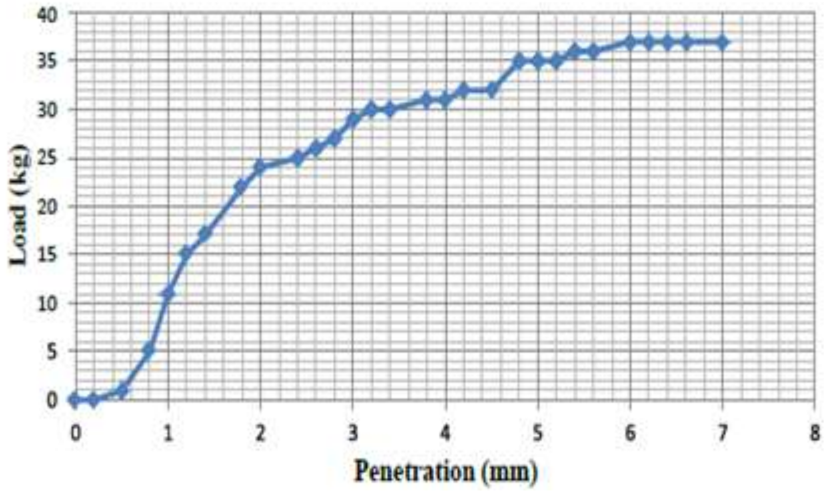

Figure 24: CBR curve for Soil

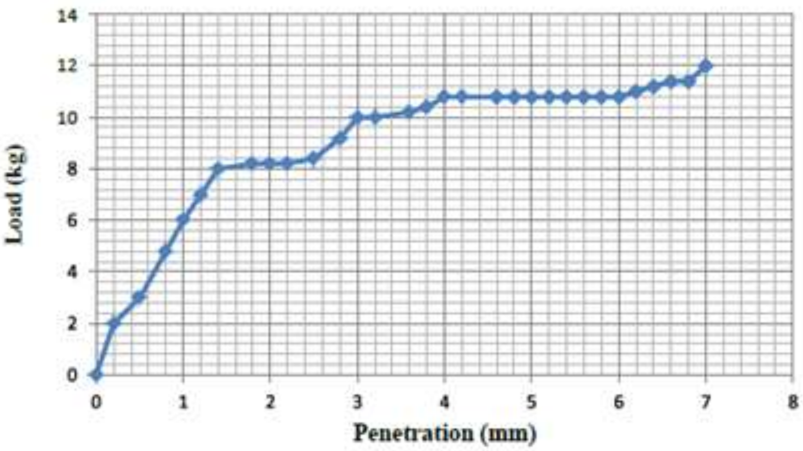

Figure 25: CBR curve for Soil + 1% tyre coir

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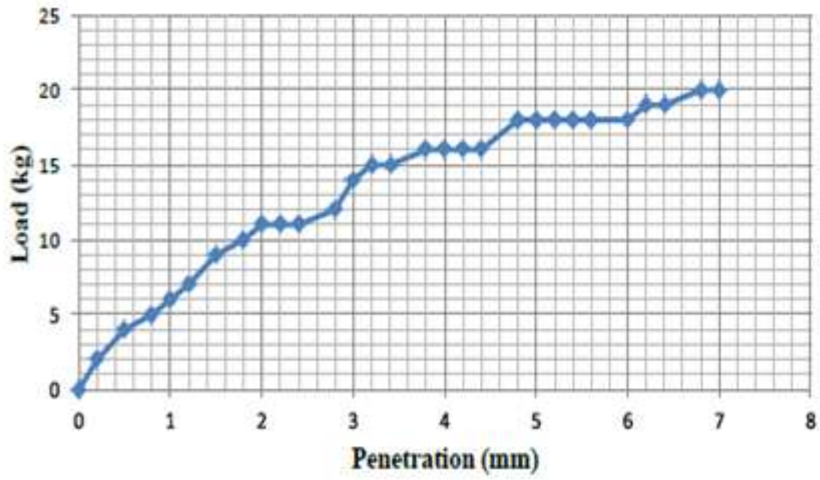

Figure 26: CBR curve for Soil + 2% tyre coir

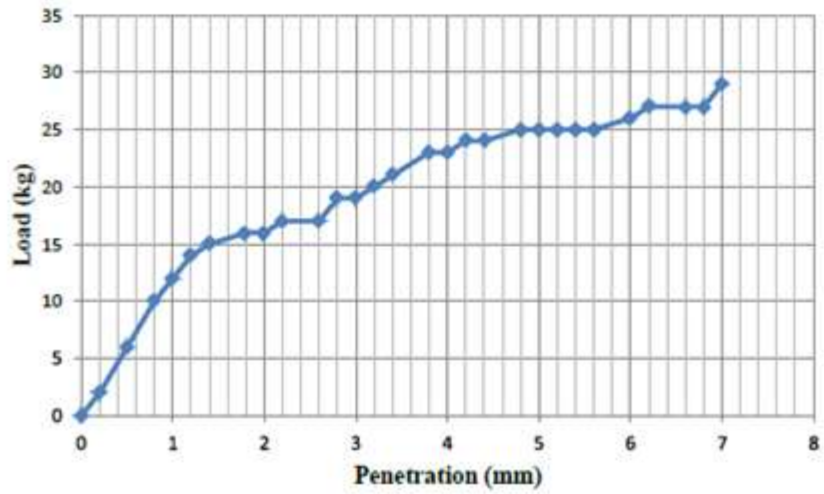

Figure 27: CBR curve for Soil + 4% tyre coir

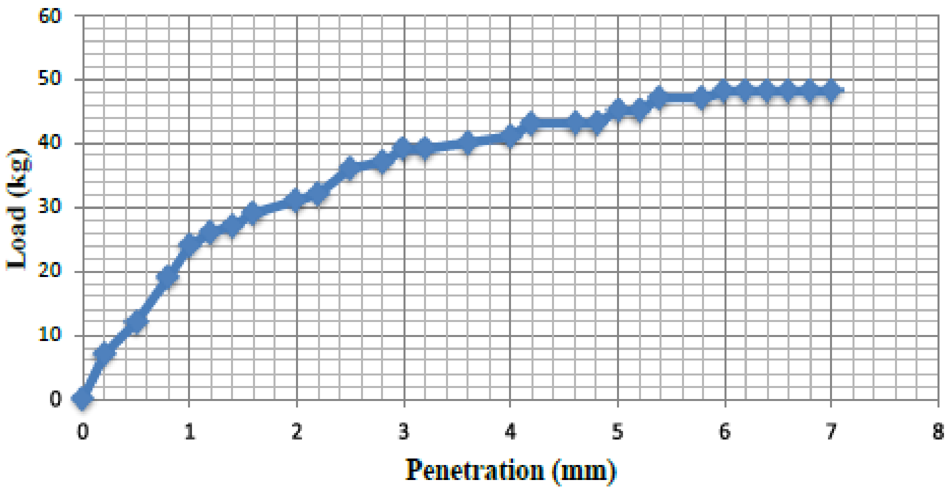

Figure 28: CBR curve for Soil + 6% tyre coir

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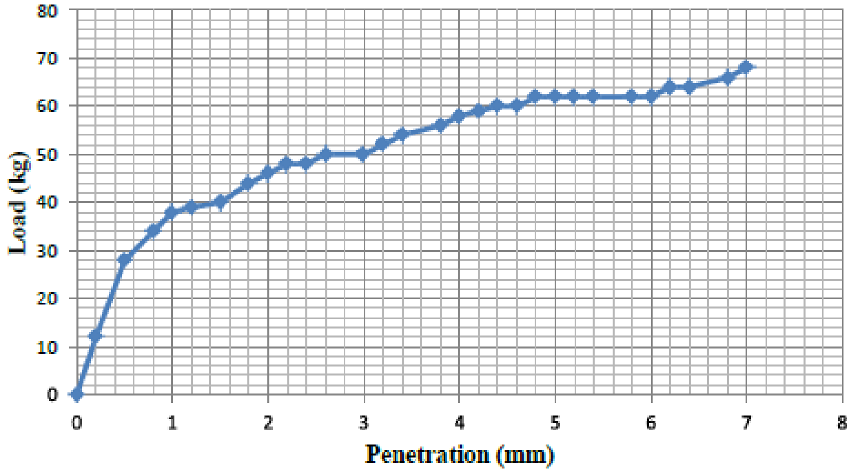

Figure 29: CBR curve for Soil + 8% tyre coir

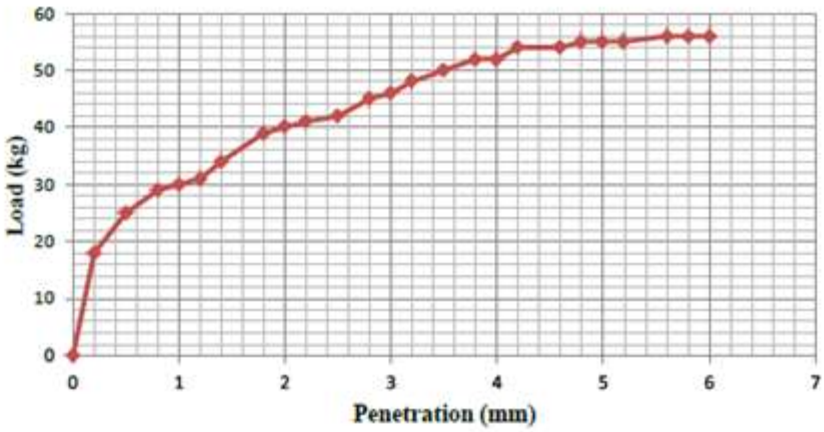

Figure 30: CBR curve for Soil + 0.25% coconut coir

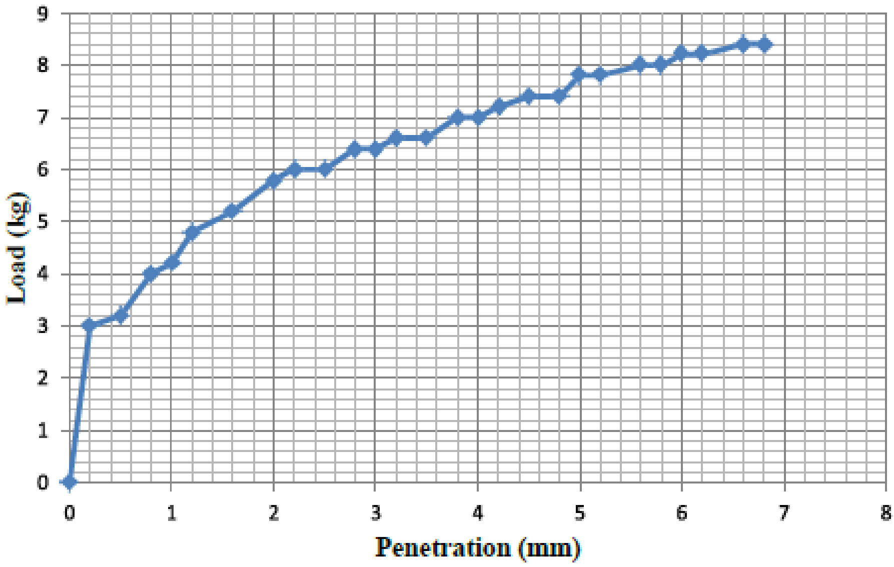

Figure 31: CBR curve for Soil + 0.50% coconut coir

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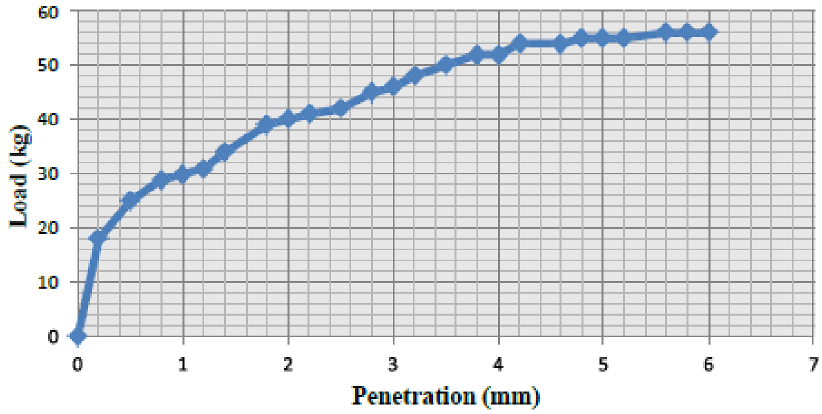

Figure 32: CBR curve for Soil + 0.75% coconut coir

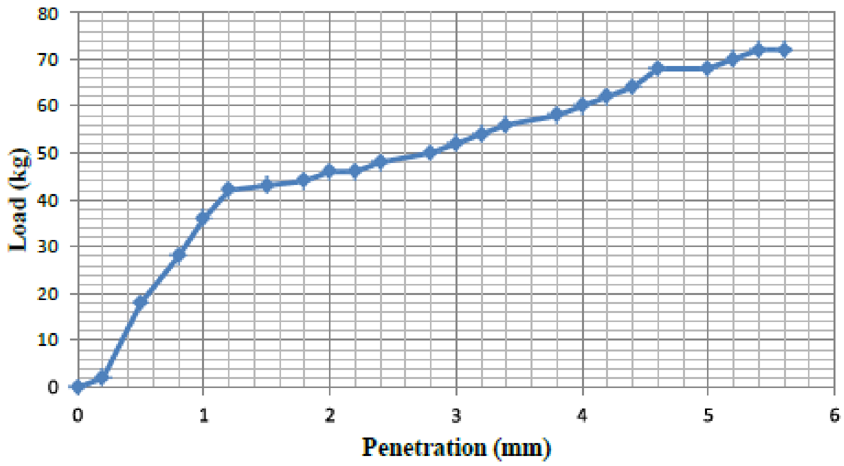

Figure 33: CBR curve for Soil + 1% coconut coir

IV. RESULTS AND DISCUSSION

Table 1: Soil with different proportion of tyre coir

Percentage of coir	MDD (gm/cc)	OMC (%)	Triaxial (kg/cm^2)	C_u (kg/cm^2)	CBR (%)
0	1.67	20	0.36	0.18	1.95
1	1.67	22	0.41	0.21	3.19
2	1.67	20	0.52	0.26	1.1
4	1.67	17.5	0.4	0.2	1.27
6	1.68	17	0.2	0.1	2.65
8	1.69	17	0.2	0.1	3.55

Table 2: Soil with different proportion of coconut coir

Percentage of coir	MDD (gm/cc)	OMC (%)	Triaxial (kg/cm^2)	C_u (kg/cm^2)	CBR (%)
0	1.67	20	0.36	0.18	1.95
0.25	1.67	22	0.48	0.24	3.1
0.5	1.67	20	0.54	0.27	3.2
0.75	1.68	21	0.55	0.28	3.35
1	1.67	22	0.6	0.3	3.8

4.1 COMPACTION TEST

The natural soil MDD vlaue is 1.67 gm/cc. By increasing the reinforcement with tyre up to 4% there is no change in the MDD value. By further increasing the percentage up to 8%, MDD value is increased to 1.69gm/cc, which shows an increment of 1.2%. The optimum moisture content value for natural soil is 20% and increased to 22% at 1% tyre waste. By further increasing the reinforcement up to 8%, OMC decreased to 17%, which shows a decrement of 33.3%.

The natural soil MDD vlaue is 1.67 gm/cc. By increasing the percentage of coir there is no change in MDD value upto 0.5% coir. By further increasing the percentage to 0.75% the MDD value increased to 1.68 gm/cc and again decreased to 1.67gm/cc for 1% coir. The OMC value for natural soil is 20% and is increased to 22% for 0.25% coir and decreases by 10% and reaches a value of 20% at 0.5% coir. By further increasing the percentage of coir up to 1% the OMC is increased to 22%, which is an increment of 10%.

4.2 TRIAXIAL TEST

The triaxial test strength for natural soil is 0.36 kg/cm^2. By increasing the percentage of tyre up to 2% the value of triaxial test is increased by 44.44% and reaches a value of 0.52 kg/cm^2. By further increasing the percentage of tyre up to 8% the triaxial test value is decreased by 62.6% and reaches a value of 0.2 kg/cm^2.

The triaxial test strength for natural soil is 0.36 kg/cm^2. By addition of coir the triaxial value has increased to 0.6 kg/cm^2 up to 1% coir, which is showing an increment of 66.66%.

4.3 CBR TEST

The CBR value for natural soil is 1.95% and increased to 3.19% for 1% tyre waste. By increasing the percentage of tyre to 2% the CBR value is decreased to 1.1%. upon increasing the percentage of tyre waste up to 8% the value of CBR increase to 3.55%.

The CBR value for natural soil is 1.95%. By addition of coir, the CBR value has increased up to 1% coir and reached to 3.83%, which shows an increment of 96.4%.

V. CONCLUSION

MDD of modified soil is maximum at 0.75% coir, which shows an increment of 0.6% and OMC is maximum at 0.25%, which shows an increment of 10%. The triaxial test value of modified soil gets increased with increase in coir content with an increase of 66.66%. The CBR value of modified soil increases with increase in coir content with an increase of 94.8% at 1% coir. MDD increases with increase in percentage of tyre and the OMC gets decreased with increase in percentage of tyre. The use of shredded rubber tyres since reduces the amount of water required for the compaction effort while maintaining a reasonably good maximum dry density. The triaxial test value of modified soil is maximum at 2% tyre, which shows an increment of 44.4%. The CBR value of modified soil is maximum at 8% tyre, which shows an increment of 82.05%. The CBR and triaxial test values of coir at 1% are higher compared to that of tyre. Hence coir is more reliable than tyre.

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