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TO STUDY THE INFLUENCE OF WASTE FIBER MATERIALS AND BRICK KLIN DUST ON THE GEOTECHNICAL PROPERTIES OF SOIL

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Abstract -

Increasing amount of waste fibres have raised a serious concern among the environmental authorities, these are not only non - bio degradable but are also environmental hazard and disposal of the waste fiber has emerged as a major problem. These waste fibers are synthetic or semi synthetic in nature. Although these have some good properties but are potentially harmful for the environment and may cause plastic pollution which adversely effects the land and the environment. In recent years some serious steps have been taken to employ these waste fibers in enhancing the properties of the soil.

The purpose of this work is to study the effect of waste fibers along the brick kiln dust as an additive on the engineering properties of the soil through experimentation and observation. The engineering properties that were studied include basic Atterberg limits viz specific gravity, liquid limit, plastic limit, shrinkage limit, moisture content , optimum moisture content , dry density and maximum dry density, and direct shear strength .

Percentages of polypropylene and BKD were varied by weight and by percentage and improvement in engineering properties of soil was observed with the addition of polypropylene and BKD. Further the properties of the reinforced soil were compared with those of the naturally virgin soil and the difference in the parameters was noted.

It was observed that PPF and BKD together have influenced the engineering properties of the soil.

Key Words: **polypropylene, brick kiln dust, plastic limit, shear strength, unconfined compressive strength.**

1. INTRODUCTION

Stabilisation is the well-established technique used for ground improvement in geotechnical engineering applications. Soil stabilisation is essential, when the soil needed for the construction is found to be undesirable. Soil stabilisation is the modification or alteration of soils to boost their physical and engineering characteristics and to attain the desirable soil properties. The purpose of the soil stabilisation is to attain the essential engineering properties of the soil desirable for the construction work. Soil improvement helps us to catch up with the incapacity of the soil to take up produced shear stresses, which otherwise may cause failure of the soil. Soil stabilisation helps us to increase the bearing capacity of the soil, shear strength, it is used to diminish permeability of the soil and compressibility of the soil mass.

1.1 Materials:

1.1.2 Soil sample

To ascertain in-situ parameters undisturbed samplings were accumulated. Adequate samples of disturbed samples were also collected and transported to lab. Tests was carried out to determine the basic physical and engineering properties of soil samples.

1.1.3 Polypropylene fibre (PP fibre): Polypropylene is the first stereo regular polymer to have attained engineering significance. It is a 100% artificial fibre. It is formed of 86% of monomer propylene. It is the by-product of petroleum. The fibres of PP were incorporated to the textile marketplace in the 1970. Now it has developed fourth most significant fibre classes after polyester, nylon and acrylic

1.1.4 Brick kiln dust

BKD is generally a left-over produced by cutting the fired clay bricks. Presently, the dumping of the dust is a concern to the brick fabrication firm, and hence an environmental pollution worry. The dust was stabilised used with polypropylene fibre to analyse the consequence of the combination of materials on the engineering properties of the soil.

1. 2 Mixing Proportions

Soil, PP fibre and BKD were mixed with uniformity. In this study the percentage of PP fibre used was 0%, 0.25%, 0.5%, 0.75%, 1% and BKD was 15%, 25%, 35%, 45%. These are added in proportions as given in the following table:

Table -1 Mix proportions of Soil(S), PP fibre (PP) and Brick kiln dust (BKD)

S.NO	DESIGNATION (S:BKD:PP)
1	100:0:0
2	85:15:0
3	75:25:0
4	65:35:0
5	55:45:0
6	99.75:0:0.25
7	99.50:0:0.50
8	99.25:0:0.75
9	99:0:1
10	64.75:35:0.25
11	64.50:35:0.50
12	64.25:35:0.75
13	64:35:1

1.3. EXPERIMENTAL STUDIES

The experimental work comprises of the steps as given under.

I. Determination of soil index properties
II. Specific gravity of soil
III. Determination of the maximum dry density (MDD) and the corresponding content (OMC) of the soil by Proctor compaction test.
IV. Determination of the shear strength by:
- Direct shear test (DST)
- Unconfined compression test (UCS)

2. RESULTS AND DISCUSSIONS

2.1 Index properties/Atterberg limits:

Table -2: index properties of virgin and reinforced soil

Parameters	Soil sample
liquid limit of virgin soil	45.71%
Liquid limit of the soil reinforced with polypropylene fibre and BKD	42.10%
Plastic limit of the virgin soil	30.07%
Plastic limit of the soil reinforced with polypropylene fibre and BKD	27.53%
Shrinkage limit of the virgin soil	3.34%
Shrinkage limit of the soil reinforced with polypropylene fibre and BKD	5.86%

2.2 Compaction characteristics:

Table -3: MDD and OMC for soil– BKD– PPF mix

S. No.	Proportion Soil : PPF : BKD	MDD (Kn/m^3)	OMC (%)
1	65 : 35 : 0	24.25	14.70
2	64.75:35:0.25	25.67	15.92
3	64.50:35:0.50	27.67	16.02
4	64.25:35:0.75	28.46	16.99
5	64:35:1	29.46	17.67

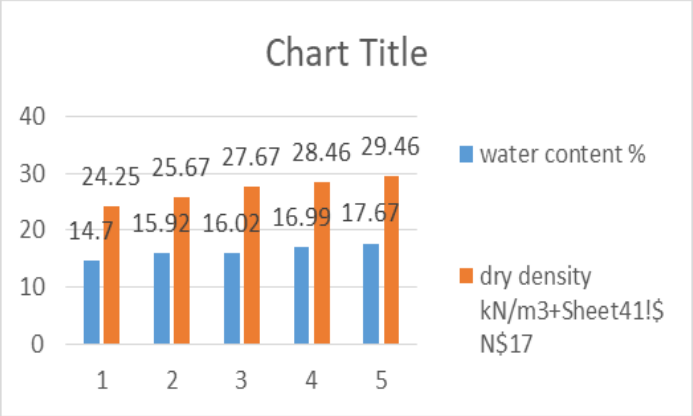

Fig.1 Variation in the dry density with moisture content for soils with varying contents of PPF AND BKD

From the above interferences it was learnt that there exists an inverse relationship between OMC and MDD. On adding PPF and BKD to the virgin soil MDD increased with corresponding decrease in the water content to a certain point and at one point with further increase in the content of PPF AND BKD, MDD showed a decreasing trend while water content showed little increment.

2.3 Direct Shear Strength (DSS) Parameters of the Soil:

The mixed soil specimens reinforced with the fibres of PP and BKD were tested by using the DST apparatus at the MDD (Ɣd(max)), and OMC (w), for the analysis of the direct shear strength parameters and the results for the same has been tabulated as given below.

Table -4Values of DSS Parameters mixed with PPF and BKD.

S.NO	PROPORTION OF SOIL:BKD:PPF	ANGLE OF INTERNAL FRICTION ϕ	COHESION C (kg/cm^2)
1	65 : 35 : 0	30.66	0.45
2	64.75:35:0.25	27.66	0.39
3	64.50:35:0.50	28.99	0.423
4	64.25:35:0.75	31.72	0.47
5	64:35:1	30.50	0.457

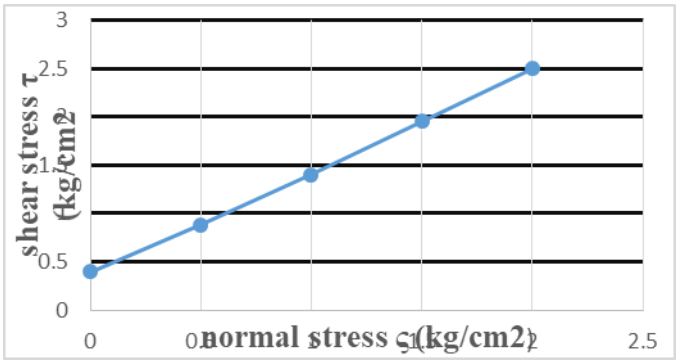

Fig.2 graph for the angle of internal friction and cohesion for soil, PPF and BKD.

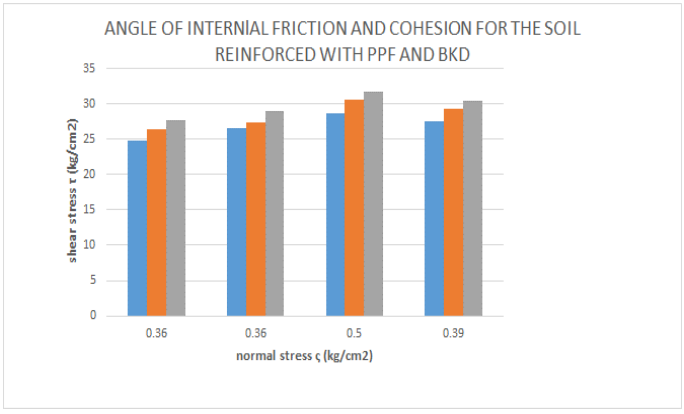

Fig.3 ANGLE OF INTERNAL FRICTION AND COHESION FOR THE SOIL REINFORCED WITH PPF AND BKD

2.4 discussion:

From the above interferences it was learnt that the strength of the soil gets enhanced with addition of the PPF and BKD. So the use of PPF and BKD should be encouraged in future civil engineering purpose.

3. CONCLUSIONS AND FUTURE SCOPE

3.2 CONCLUSIONS

On the basis of the experiments, results obtained from the experimental investigations show encouraging results and based up on these experimental investigations the following conclusions can be made.

- The combination of PP fiber and the BKD have greatly influenced the soil properties.
- Specific gravity of a soil mixed with fibers (PPF) increased by 0.5%. Strength of the soil is directly proportional to specific gravity, more is the specific gravity more will be the strength of soil.
- With the addition of the PP fiber and the BKD the liquid limit of the soil decreases efficiently from 45.1% to 42.10%.
- The plastic limit when explored also displayed a substantial reduction with the application of the PP fiber and the BKD. The plastic limit of the soil sample decreased by this decrease in the plastic limit causes the soil to swell and shrink less. The plastic limit decreased by a percentage of 2.84%
- With the addition of 0.75% and 35% PP and BKD the MDD of the soil increases and the corresponding OMC decreased, same pattern was observed at different percentages of PP and BKD. This increase in maximum dry density was mainly due to the decrease in the number of voids.
- The direct shear strength parameters of the soil reinforced with waste fibres of PP and BKD employed for the enhancement of the engineering properties of the soil with 20 mm length and weight of polypropylene by weight of dry soil sample, is found as increase in the angle of internal friction (Φ) and increase in cohesion (c).

3.2 future scope

1) From the above results and discussions it is highly recommended that the potential use of PP fiber and BKD should be encouraged.
2) More and more possibilities need to explored in future to make the most effective use of PP fiber and BKD in soil engineering.
3) A part of from the enhancement in soil properties more possibilities for their efficient use should be thoroughly examined.

4) The use of these materials should be extended to other engineering problems.

5) Since these are mainly waste materials which are either dumped effecting the soil fertility and or either thrown out adversely affecting the environment, so proper utilisation of these should be planned and also these easily available and low of cost. Effective use of these may retard their environmental consequences.

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