Utilization of Fly-Ash and coir fibre in soil reinforcement, A Review

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Abstract:- Use of Coconut coir Fibre for improving soil property is advantageous because they are cheap, locally available and eco-friendly. In this study, the stabilizing effect of Coconut coir Fibre (Natural Fibre) on soil properties has been studied. Civil Engineers are in search of new competitive material, which can be suitable and effectively used to face many challenges that have cropped up with time in the world. The fly ash is one of the waste materials of thermal power stations ,a Coir fibre (CF) is an abundantly available waste material in coastal India. The poor engineering properties of the local soils may present many difficulties for construction and therefore need to improve their engineering properties. Stabilization techniques can be used to improve the properties of soil. Soil stabilization improves various engineering properties e.g. bearing capacity, compressibility, strength, and various other properties of soil.

Key-Words:-Fly-Ash, Coir Fibre, Strength of Soil, etc.

Objective:-To check Viability of fly-ash and coir fibre as soil reinforcement.

Introduction

Soils are complex mixtures of minerals, water, air, organic matter, and countless organisms. Various types of soil available in India like alluvial soils, black cotton soils, laterites soils, mountain soils, desert soils, red soils. Soil is the upper most part of earth and it is cheapest and readily available construction material. Soil is generally categorizes into four basic types (such as): Gravel, Sand, Clay and Silt. Out of them, few possess montmorillonite in high amount resulting in sudden swelling and shrinkage upon contact with water. Soil is defined as an unconsolidated material, composed of soil particles, produced by the disintegration of rocks and chemical decomposition. On the basis of shear strength, soil can be divided into three types: cohesion less soils, purely cohesive soils and cohesive soils. Soil reinforcement is a wide field of research in the current times. This is because there are several cases where the soil at shallow depth is not of good quality, and deep foundations may be expensive. There are several cases where the soil is not of good quality even at greater depth; and replacement of the soil may not be feasible. Thirdly, there are situations of underground constructions such as tunnels, or underground air base and bunkers for defence purposes; in such situations the soil has to be able to take the overlaying pressure of unsupported walls. The use of coconut fibres can prove to be a highly efficient means of soil reinforcement. Coconut fibres are of two types-brown fibres and white fibres. Brown fibres are obtained from mature coconuts while the white fibres are obtained from immature coconuts. This paper focuses on the use of brown fibres because these are thick, coarse, strong, durable and have high abrasion resistance. Also, the use of coconut fibres can be particularly advantageous to India because of the widespread cultivation of coconut in the country. According to survey, fly ash is lightweight material and self depleting substance in comparison to raw soil. Additionally fly ash comprises of non-plastic silt size particles of moderately low permeability than sand. Fly ash has been effectively utilized as Concrete Production, in Cement Clinkers, Substitute Material in Brick and Mineral Filler in Bituminous Concrete etc. It is also mixed with clayey soil to construct different civil engineering works like sub grade, foundation base and embankments. The utilization of fly ash as additive in soil stabilization is advantageous because it is moderately economy, compare with cement and lime. Utilization of fly ash advances feasible construction through lessening of vitality utilizes and decreases of greenhouse gases.

Review of Literature

Beeghly J. H. et al. (2003) investigated for appropriate soils, lime- fly ash can offer cost saving by reducing material cost by up to 50% as compared to Portland cement stabilization. For low cohesive soil used with lime and fly ash stabilization can be economically engineered for long term performance.

Deepjyoti Das(2016), concluded an increase in the value of angle of internal friction, on utilisation of reinforcement. The maximum increase in the parameter is 21.70%, corresponding to an optimum fibre content of 2.1%. Beyond the optimum content, a reduction in the angle of internal friction is obtained, thus coconut fibre can be utilised for enhancing the shear strength parameter of sandy soils, and its easy availability due to widespread cultivation of coconut in the country can prove to be an efficient and economic measure of reinforcement of sand.

Mamta Mishra(2016),Concluded that the reinforcement of soil mixed with fly ash further increases the strength of soil used for construction activity. Fiber reinforced soil can be considered to be good ground improvement technique specially in engineering projects on weak soils where it can act as a substitute to deep/raft foundations, reducing the cost as well as energy. Both the length and content of coir have important role in developing the strength properties of stabilized soil. But the strength properties are mostly affected by coir content than by size of coir fiber.

Nithin and Sayida (2012) reports the results of the laboratory study performed on silty sand admixed with fly ash and reinforced with coir fibres and demonstrates that discrete and randomly distributed coir fibres are useful in improving the bearing capacity of soil. The silty sand (low plasticity soil) has been considered using different percentage of fly ash ranging from 5 to 20% by weight of given soil and the impact of curing period is also considered. Coir fibres are added ranging from 0.5 – 5% and having different aspect ratio such as l/d=40, 80, 120, 160 to investigate the relative strength gain in terms of unconfined compression.
Swati Sucharita Rout(2017), OMC increase with increases of fly ash and percentage of coir fiber. Percentage of fly ash increases with the increase of MDD value. MDD estimation of soil decreases, when the percentage of fiber increments. The inclusion of fly ash is improving UCS and CBR value of all the mixed proportion, but there is an abrupt hike in CBR at 10% fly ash content. Addition of coir fiber increases the CBR value and UCS value in soil+10% fly ash.
Shukla Devdatt(2015), Concluded the addition of Coconut coir Fibre into the Expensive soil has changed the compaction parameters. The OMC of the Expensive soil has decreased and the maximum dry density (MDD) increased with the addition of Coconut coir Fibre. The soaked CBR values have also increased significantly with the addition of Coconut coir Fibre content. The addition of 1% Coconut coir Fibre into the Expensive soil, increase the CBR values from 3.9 % to 8.6 %.

Methodology
The soil sample is tested for different tests listed below:
- Sieve Analysis
- Pycnometer test for Specific Gravity
- Liquid Limit
- Plastic Limit
- CBR test

Conclusion
On the basis of existing review of literature it can be concluded that the reinforcement of soil mixed with fly ash further increases the strength of soil used for construction activity. Fiber reinforced soil can be considered to be good ground improvement technique specially in engineering projects on weak soils where it can act as a substitute to deep/raft foundations, reducing the cost as well as energy. The C.B.R. value is increased. Therefore the inclusion of fiber is helpful in augmenting the soaked CBR and hence, resulting in less thickness of pavement crust in high rainfall area. The Engineering properties of soil vary with the addition of coir waste but further studies need to be conducted before its implementation in the field.

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