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Clay Stabilization using Demolished Waste, Wood Powder and Bagasse Ash

Rineesha P, Sara Varghese, Chinju Ousephkutty

Department of Civil Engineering, CKC, Mannoor, Kerala, India

Department of Civil Engineering, CKC, Mannoor, Kerala, India

Assistant Professor, Department of Civil Engineering, CKC, Mannoor, Kerala, India

ABSTRACT: It is a well known fact that a construction is as strong as its foundations. Nowadays the constructions sites with good soils for foundations are fewer and fewer. One of the most encountered issue on sites is the presence of highly cohesive soils, soils that are easily affected by the change of the water content. Active clay soils present a problematic challenge for civil and geotechnical engineers all over the world. Key aspects that need identification when dealing with expansive soils include soil properties, water conditions, water content variations temporal and spatial, and the geometry of foundations and associated structures built on active shrink or swell soils. Stabilization procedures are available in order to reduce or completely eliminate the swelling potential of expansive clays. Here we are using stabilizers as demolished waste, bagasse ash and wood powder. Clay stabilization is by utilization of wastes. The percentages used are 0% , 2% , 4% , 6% , 8% and 10% for demolished waste, wood powder and bagasse ash. Clay is collected from Kuttanadu, Alappuzha district. To retrieve the Bagasse Ash (BA), first sugarcane straws are sun dried for twenty days. After that, they are burnt and the ash is collected and finely crushed to obtain the final product sugarcane straw ash also known as Bagasse Ash. Wood Powder which is retrieved from hard wood obtained from local furniture manufacturer is composed of cellulose (50%), hemicelluloses, lignin, and extractives. Demolition waste is waste debris from destruction of buildings, roads, bridges, or other structures. Debris varies in composition but the major components by weight in the US include concrete, wood products, asphalt shingles, brick and clay tile, steel, and drywall. There is the potential to recycle many elements of demolition waste. The clay is collected, tested and compared inters of atterbergs limit and UCC.

KEYWORDS: Black cotton soil, Unconfined compressive strength, Optimum moisture content.

I. INTRODUCTION

After the industrial revolution, there was a rapid increase in the standards of living of the society due to mass production of goods, job opportunities and wages. However, the downside of industrialization was the production of byproduct wastes rapidly assumed unmanageable proportions. This resulted in huge problems of pollution, disposal and management. A lot of efforts have been put into effective waste management practices. One avenue for the management of wastes is to find suitable uses for it in various sectors of engineering and manufacturing. Usage of wastes in manufacture of materials has been one of the most effective avenues in the field of Civil Engineering. In the same line, utilization of wastes in soil engineering is being researched heavily in recent times, especially in soil stabilization. The term soil can have different meanings, depending upon the field in which it is considered. To a geologist, it is the material in the relative thin zone of the earth's surface within which roots occur, and which are formed as the product of the past surface processes. To an engineer it is a material that can be built on foundation of buildings, bridges etc. Soil mechanics is a discipline of civil engineering involving the study of soil, its behaviour and application as an engineering material. Engineers are concerned with soils mechanical properties such as permeability, stiffness and strength. These primarily depends on the nature of soil, the current stress, the water content and unit weight. Clay is a finely grained rock or soil material that combines one or more clay minerals with traces of metal oxides and organic matter. It has the smallest particle size of any soil type, with individual particles being so small that they can only be viewed by an electron microscope. One of the problem with clay soil is its slow permeability resulting in a very large water holding capacity. Clay particles

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then absorbs this water, expanding as they do so and further slowing the flow of water through the soil. Geologic clay deposits are mostly composed of phyllosilicate minerals containing variable amounts of water trapped in the mineral structure. Naturally occurring deposits include both silt and clay, clays are distinguished from other fine grained soil by differences in size and mineralogy. Expansive soils have been one of the most frequently encountered and challenging soils by a geotechnical engineer. Such soils are extremely difficult to deal with during construction and have very poor strength and low bearing capacity. The most difficult of its properties is its extremely poor swell shrink characteristics. Expansive soils are the soils which swell significantly.

II. LITERATURE SURVEY

Study on effect on engineering properties of Black Cotton Soil treated with agricultural and industrial waste, Sejal P. Dalala et al. [1], It conducted a study on effect on engineering properties of Black Cotton Soil treated with agricultural and industrial waste. Experiments were carried out in the given BCS sample by adding (a) Combination of Bagasse Ash and Ground Granulated Blast furnace Slag (GGBS) and (b) Wood Powder. Results indicate that both the additives help in improving the above stated properties. The result showed that wood powder gives better improvement in consistency and reduction in activity and plasticity as compared to combined bagasse ash and GGBS. Based on the results, better Compaction can be achieved by adding bagasse Ash and GGBS rather than by adding wood powder. More strength of the BCS sample is achieved by adding Bagasse Ash and GGBS compared to wood powder. It is concluded from his study that the given soil sample had poor strength and stability and both the additives help to improve the engineering properties of the given BCS sample considerably. GGBS and bagasse ash contribute more towards strength and wood powder contributed more towards swelling control.

Study on remediation of Expansive Soils Using Agricultural Waste Bagasse Ash Hayder Hasan et al. [2], They conducted a study on remediation of Expansive Soils Using Agricultural Waste Bagasse Ash. Addition of bagasse ash decreases swelling because of its plastic character. Many re- searchers (e.g. Osinubi et al., 2009; Kharade et al., 2014, and Submarine et al., 2015) have reported limited improvements to the strength and durability of fine grained soils when bagasse ash was used alone. However, the plasticity and shrink-swell potential of expansive soils could be reduced significantly with the addition of bagasse ash. The aim of this research is to utilize the sugarcane bagasse ash as a pozzolanic material to reduce the lime content for curtailing soil movement and improve the compressive strength of compacted expansive soil, while avoiding the adverse health and environmental problems that can be induced due to the disposal of this material.

III. METHODOLOGY

Clay samples were collected from Kuttanad. The tests were conducted as per IS specifications and the codal provisions for all the tests, and the tests are Atterberg's limit and UCC.

IV. EXPERIMENTAL RESULTS

Table 1: Properties of clay sample

Sl No:	Property	Value
1	Initial Moisture Content	48.14%
2	Specific Gravity	2.63
3	Percentage of Gravel	0%
4	Percentage of Sand	2%
5	Percentage of Silt	46%
6	Percentage of Clay	52%

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7	Liquid Limit	56.4%
8	Plastic Limit	21.86%
9	Soil Classification	CH
10	Maximum Dry Density	1.716 g/cc
11	UCC	4.2kN/m ²

Maximum dry density was obtained as 1.716g/cc corresponding optimum moisture content as 14%. The compaction curve is as shown in fig 1.

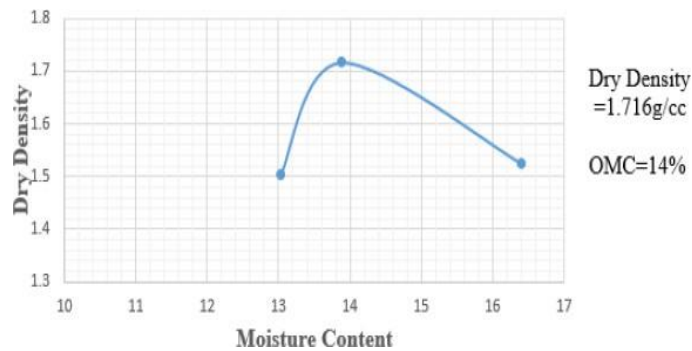


Fig.1. Compaction curve of untreated clay sample

The clay is stabilized with 2%, 4%, 6%, 8% and 10% bagasse ash which is tested by experiments like atterberg's limit and UCC.

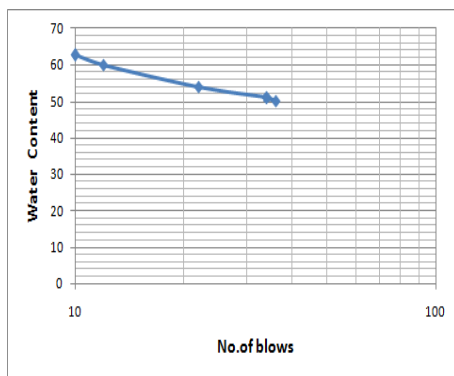


Fig. 2. Flow curve of clay treated with 2% bagasse ash

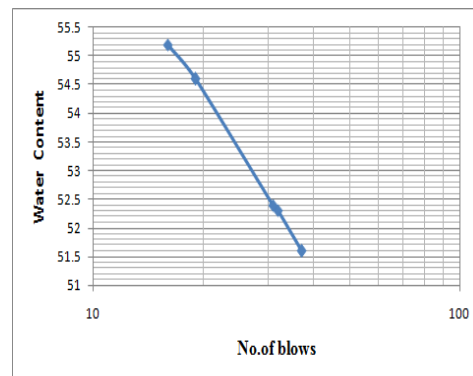


Fig.3. Flow curve of clay treated with 4% bagasse ash

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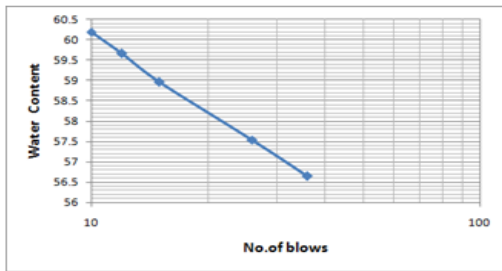


Fig.4. Flow curve of clay treated with 6% bagasse ash

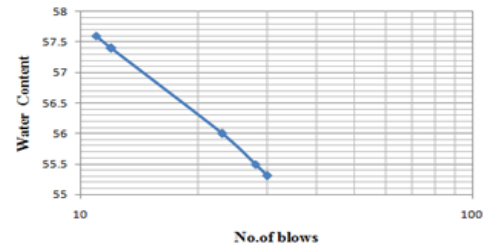


Fig.5. Flow curve of clay treated with 8% bagasse ash

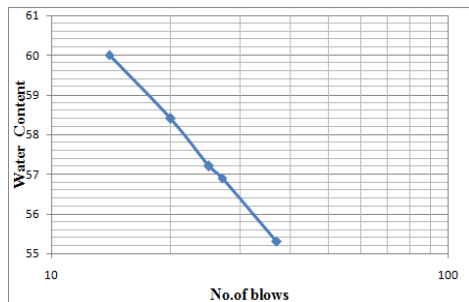


Fig.6. Flow curve of clay treated with 10% bagasse ash

Table 2. Plasticity Index of Bagasse Ash

Percentage	Plasticity Index
2%	9.1
4%	8.1
6%	8.12
8%	19.38
10%	10.6

Variation of UCC for different percentages is as shown in fig .7.

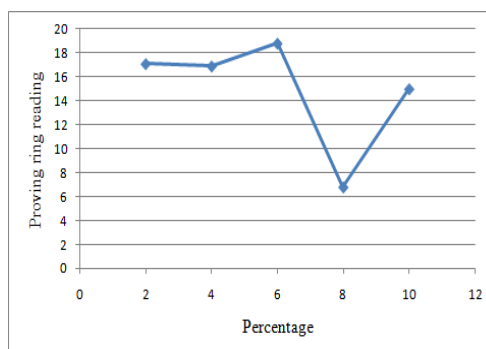


Fig.7. Variation of UCC of clay treated with different percentage of bagasse ash

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Table.3. Plasticity Index of Wood Powder

Percentage	Plasticity Index
2%	3
4%	4.14
6%	19.6
8%	12.08
10%	13.1

Variation of UCC for different percentages is as shown in fig.8.

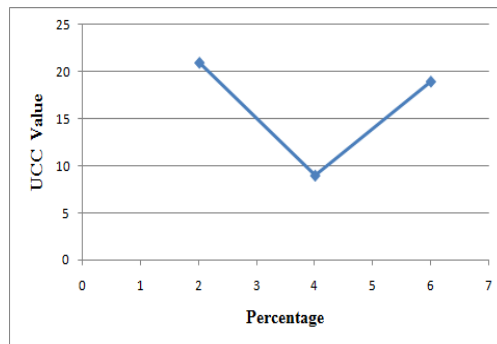


Fig.8. Variation of UCC of clay treated with different percentage of wood powder

Table 4. Plasticity Index of Demolished Waste

Percentage	Plasticity Index
2%	9.9
4%	12.73
6%	2.25
8%	8.02
10%	18.5

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Variation of UCC for different percentages is as shown in fig. 9.

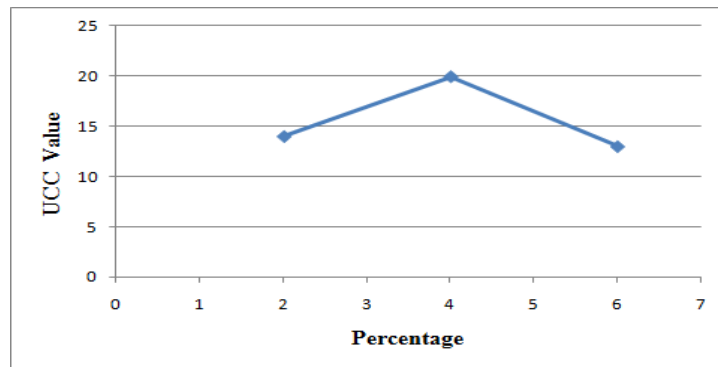


Fig.9. Variation of UCC of clay treated with different percentage of demolished waste

V. CONCLUSION

This study compares the percentages of various waste products such as bagasse ash, wood powder and demolished waste as a stabilizer of clay soil. 0%, 2%, 4%, 6%, 8% and 10% of stabilizers were used in this study. Based on the experimental results it can be concluded that, The UCC value of untreated sample is 4.2 kN/m². The strength of wood powder, demolished. The optimum point obtained in our study is at 2% of wood powder.

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