International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 05 | May -2017 www.irjet.net p-ISSN: 2395-0072

Stabilization of Black Cotton Soil Using Ayurvedic Industrial Waste

R. Aiswarya varsha[1], M. Anvar[2],G. Aswini [3], K.U. Athulya [4], R. K. Ratheesh[5], Gopika Unni[6]

[12345]UG Student, Dept of Civil Engineering, Ahalia School of Engineering and Technology, Kerala, India
[6]Professor, Dept of Civil Engineering, Ahalia School of Engineering and Technology, Kerala, India

---

Abstract - *In recent times, with the increase in demand for infrastructure , raw materials and fuels, soil stabilization has started to take a new shape. With the availability of better research, it is emerging as a popular and cost effective method for soil improvement. Black cotton soil are problematic in nature due to its low bearing capacity,swelling and high compressibility. Due to high plasticity, shrinkage and low strength, the soil is regarded as unsuitable for construction.Thus it is necessary to increase the strength of the soil by stabilizing it and making it more suitable for construction. The main objective of this paper is to investigate the effect of ayurvedic waste on the strength parameters of black cotton soil like compressive strength, CBR etc. These tests are conducted on virgin soil and stabilized soil samples.The results obtained are compared for the two samples and inferences are drawn. Also if the waste material proves to be an environment friendly successful stabilizing agent, it may also prove to be a suitable waste disposal method.*

***Key Words*: Black cotton soil, Ayurvedic waste, Liquid Limit, UCC, Compaction and Plastic Limit**

1.INTRODUCTION

The Black cotton soil covers about 30% of land area in India. The name "Black cotton" has an agricultural origin. Most of these soils are black in colour and are good for growing cotton. Due to it characteristics of high plasticity, excessive swelling, shrinkage and low strength when wet, soil is regarded as unsuitable for construction. Stabilization incorporates the various methods implement for modifying the properties of a soil and improves the engineering properties and performance of soil.

Soil stabilization could be applied to both sandy and clayey soil through mechanical and chemical methods. There are many common methods-mechanical or chemical –found in the literatures that were used to improve the physical properties of the soils.

The paper presents the effect of industrial waste inclusion on the strength of black cotton soil. The mixing of ayurvedic wastes may be considered same as other admixtures used to stabilize soil. The purpose of this paper is to evaluate black cotton soil behaviour induced by ayurvedic waste inclusion.

1. MATERIALS USED

The black cotton soil needed for testing was collected from Ahalia college campus. Ayurvedic waste of ksheerabala waste was used as an industrial waste. Ksheerabala is an ayurvedic drug used to treat arthritis, central nervous system disorders and insomania. The main content of Ksheerabala are kurunthotti and cow's milk.The waste which is obtained after the manufacture of medicine was collected from Ahalia Medicine Manufacturing Unit.

Figure 1 : Ksheerabala waste collected

3. METHODOLOGY

The soil was collected locally and was kept for air drying for 24 hours. The soil was then taken to the Geotechnical Laboratory and various properties like natural water content, free swell index, Specific gravity etc was determined. Then the fundamental properties like liquid limit, plastic limit, shrinkage limit and the particle size distribution was determined.We also conducted compaction test and unconfined compressive strength test and also classified the 0soil. The ayurvedic waste was collected and different percentages of it was added into soil. We conducted the test with soil samples containing 5%, 10% and 15% waste. The results obtained were compared and discussed.

Following tests were conducted on soil samples.

1. Unconfined compression test (as per is-2720(Part-4):1985
2. Standard proctor compaction test (as per IS-2720(Part-7):1980
3. Swell test(as per IS-2720(Part-4):1985
4. Atterberg limit test(as per IS-2720(Part-5):1985

4.RESULT AND DISCUSSION

4.1. Variation of free swell index with various percentage of waste added

The Free Swell Index test has been conducted on plain soil sample. It is observed that, the free swell index value of soil sample is 73.33%,which is very expansive. It cracks up during dry season and becomes sticky when wetted with water. The compound walls and light buildings with shallow foundation around the region having expansive soil show signs of distress like tilting, lifting, cracking etc. From the graph the degree of expansiveness is decreases with the addition of various percentage of waste content. Hence strength of soil increases.

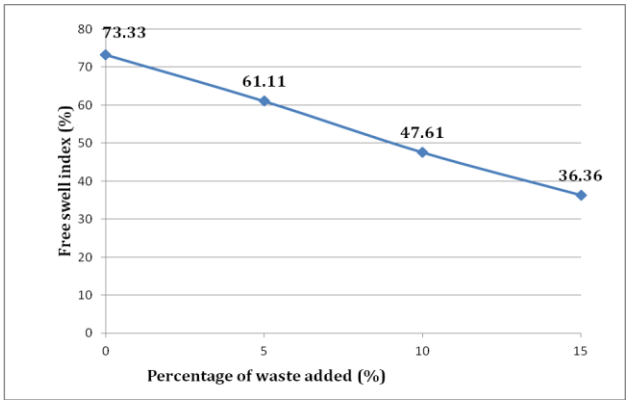

Chart -1: Variation of free swell index with various percentage of waste added

4.2. Variation of liquid limit with various percentage of waste added

The liquid limit has been conducted on soil sample with the addition of 0%, 5%, 10% and 15% of waste content. From the graph the liquid limit value increases with the addition of various percentage of waste content.

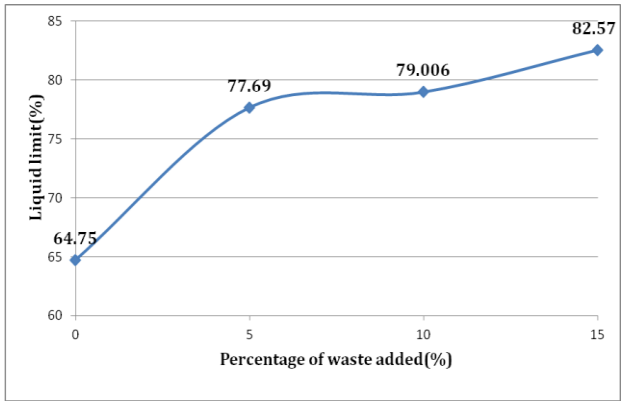

Chart -2: Variation of liquid limit with various percentage of waste added

4.3. Variation of plastic limit with various percentage of waste added

The plastic limit has been conducted on soil sample with the addition of 0%, 5%, 10% and 15% of waste content. From the graph the plastic limit value increases with the addition of various percentage of waste content.

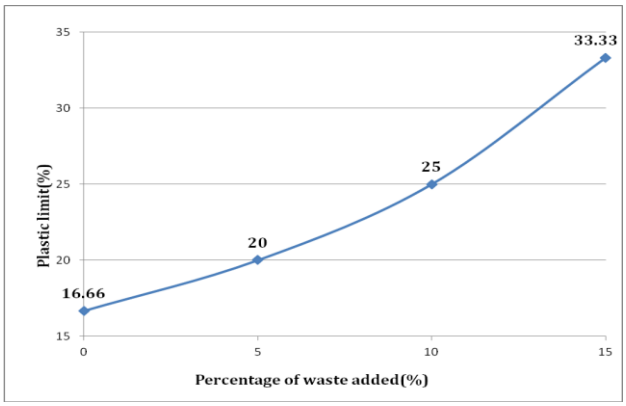

Chart -3: Variation of plastic limit with various percentage of waste added

4.4. Variation of compaction characteristics with various percentage of waste added

The compaction test has been conducted on soil sample with the addition of 0%, 5%, 10% and 15% of waste content. From the graph the maximum dry density value is decreases and optimum moisture content increases with the addition of various percentage of waste content. Weight of waste is less than that of soil at the same volume which lead to decrease MDD and increasing the surface area of mixture (soil+waste) needs more water to reach to the optimum which lead to increase in the OMC.

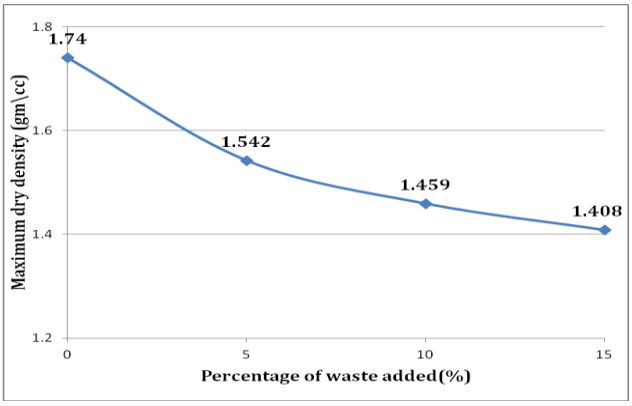

Chart -4: Variation of maximum dry density with various percentage of waste added.

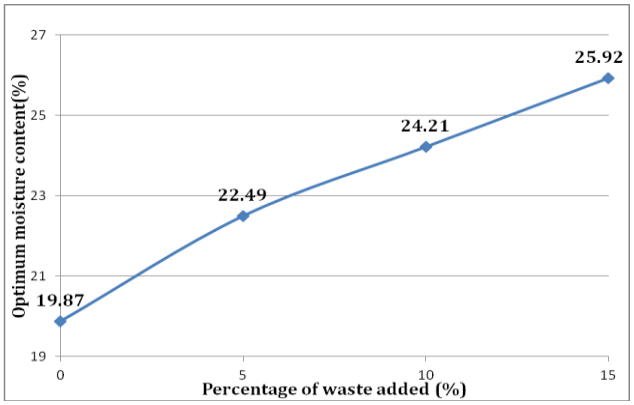

Chart -5: Variation of optimum moisture content with various percentage of waste added.

4.5. Variation of compressive strength with various percentage of waste added

The UCC test has been conducted on soil sample with the addition of 0%, 5%, 10% and 15% of waste content. From the graph the UCC value is increases with the addition of various percentage of waste content and Strength of the stabilized soil is enhanced 3.5 times the virgin soil.

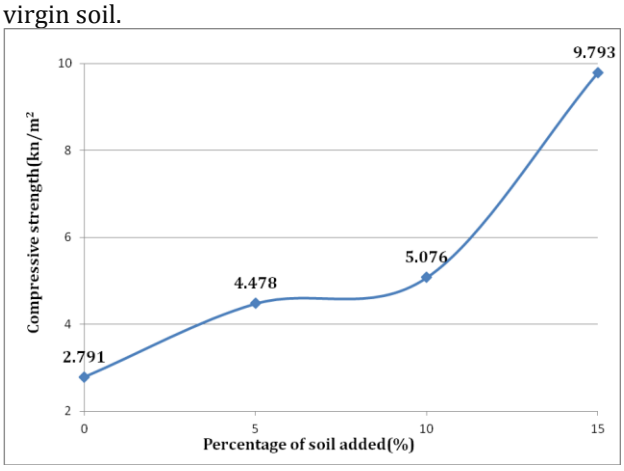

Chart -6: Variation of plastic limit with various percentage of waste added

5. CONCLUSIONS

Stabilization of weak soil using industrial wastes are gaining popularity nowadays due to the abundance in its availability and low cost involved. This study is an effort to stabilize black cotton soil using ayurvedic wastes and to evaluate benefits of stabilization. The use of ayurvedic waste has found to be suitable in behaving volume change behaviour of expansive soil.

The addition of ayurvedic waste has resulted in the improvement of strength characteristics of the black cotton soil. A total of 28 samples were used for carrying out the study. The results showed that the stabilization of black cotton soil using ayurvedic waste is an efficient and economic tool for improving the characteristics of black cotton soil.

The conclusions drawn from the experimental investigations done so as to bring out the effect of stabilization of black cotton soil using ayurvedic waste were:

- Addition of ayurvedic waste in varying percentage resulted in the decrease of maximum dry density.
- They showed a similar trend in the variation of OMC. The OMC curve represented an overall increase in the OMC.
- Addition of waste resulted in the decrease of degree of expansiveness from 73.33% to 36.36%. Hence the strength of soil increases.
- The UCC test results showed a considerable increase in the unconfined compressive strength of the soil from 2.791 kg/cm^2 to 9.793 kg/cm^2
- The strength of the stabilized soil is enhanced 3.5 times the virgin soil.
- The liquid limit of soil is increases from 64.75% to 82.57%
- The plastic limit of soil is increases from 16.66% to 33.33%
- Thus the ayurvedic waste has proved to be a successful stabilizing agent for black cotton soil.

REFERENCES

[1] Amit Tiwari& Mahiyar, "Stabilization of Black cotton soil by Fly ash, Coconut Coir Fibre and Crushed Glass" International Journal of Emerging Technology and Advanced Engineering,(ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 4, Issue 11, November 2014)

[2] Anas Ashraf & Arya Sunil, "Soil Stabilizaton using Raw Plastic Bottles", Proceedings of Indian Geotechnical Conference December 15-17,2011, Kochi (Paper No. H-304)

[3] Anil Kumar& Sivapullaiah, "Soil Stabilization With Waste Materials Based Binder" Proceedings of Indian Geotechnical Conference,December 15-17,2011, Kochi (Paper No. H-119)

[4] Arun Patidar & Mahiyar, "Experimental Study On Stabilization Of Black Cotton Soil Using HDPE Wastage Fibres, Stone Dust and Lime", international journal of advanced scientific and technical research issue 4 volume6,nov.

[5] Ghatge Sandeep Hambirao&P.G.Rakaraddi ," Soil Stabilization Using Waste Shredded Rubber Tyre Chips", International Journal of Scientific & Engineering Research, Volume 5, Issue 12, December-2014 977.

[6] Joydeep Sen& Jitendra Prasad,"Stabilization Of Black Cotton Soil Using Bio Enzyme", International Journal of Innovative Research in Science,Engineering and Technology,Vol. 4, Issue 12, December 2015.

[7] Keerthi.Y&Divyakanthi.P, "stabilization of clayey soil using cement kiln waste" ,International Journal of advanced structures and Geotechnical Engineering ISSN 2319-5347, Vol. 02, No. 02, April 2013

[8] Mandeep Singh& Anupam Mittal, "A Review On Soil Stabilization With Waste Materials", International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 National Conference on Advances in Engineering and Technology (AET- 29th March 2014) .

[9] Monica Malhotra& Sanjeev Naval, "Stabilization Of Expansive Soil Using Low Cost Materials", International Journal of Engineering and Innovative Technology (IJEIT),Volume 2, Issue 11, May 2013.

[10] Pankaj.R & Prakash.B, "Stabilization Of Black Cotton Soil Using Admixtures", International Journal of Engineering and Innovative Technology (IJEIT) Volume 1, Issue 5, May 2012.