



# Expansive Soil Stabilization by Using Walnut Shell Powder Ash

Rashmi Bade\*, Saqueeb Ali, Sumit Rathod, Mohd. Atif Khan

Department of Civil Engineering, Rashtrasant Tukadoji Maharaj Nagpur, University/ Anjuman College of Engineering and Technology, Nagpur, Maharashtra, India

## ABSTRACT

Black cotton soil is basically an expansive soil which is susceptible to high change in volume as water content fluctuate vary irregularly. The bearing capacity of black cotton soil is too low. High shrinkage and swelling exists. Montmorillonite mineral is found in these type of soil. This variant of soil is frail and need to be improve for construction and foundation work. To improve the SBC of soil by using waste admixtures can add to intensify the index properties of an ungraded soil mostly in an economic way. Percentage of additives to the soil is taken and hence the improvement of soil is observed gradually with increase in percentage of additives. Composition of Walnut shell powder ash is  $SO_3$  (2.2%),  $P_2O_5$  (6.2%),  $SiO_2$  (9.9%),  $Fe_2O_3$  (1.5%),  $Al_2O_3$  (2.4%),  $CaO$  (16.6%),  $MgO$  (13.4%),  $Na_2O$  (1%),  $K_2O$  (32.9%),  $TiO_2$  (0.1%) are acceptable for improvement of expansive soil. To compute index properties of soil tests are to be conduct.

**Keywords:** Walnut Shell Powder Ash, soil Property, Waste utilization

## I. INTRODUCTION

In this modern time lack of resources are observed because of population growth. Due to which the city or town need to expand more even on the areas where low quality of soil exists. These type of soil it is not suitable to be used for construction as well as foundation works. Thus improvement of SBC soil is obligatory. The method of improvement of soil is term as 'Stabilization' as per the aspect of civil engineering. In other words the method of improvement of soil with a purpose that the improved soil can sustain the load of the structure is Soil Stabilization. Stabilization can be classified into two categories i.e. mechanical and chemical stabilization.

Reuse of the waste material is on the main focus entirely. Stabilization by waste material is economical as well as easy accessible. The aim of this project is to improve the SBC of soil by using waste product i.e. Walnut Shell Powder Ash. The shells of walnut are crushed well in a grinder and passed through 425 micron IS sieve and thus a fine powder ash form is obtained

## II. WALNUT SHELL POWDER ASH



Crushed walnut shell is a hard fibrous material ideal as abrasive. Its grit is highly durable, angular and multi-faceted, yet considered a soft abrasive. This very fine particle size passes through 425 mm IS sieve and so a light brown powder is obtained. It is natural, non-toxic, biodegradable, reusable and compatible with anionic, non-ionic & cationic surfactants.

**BEFORE**



**AFTER**



**III. CHEMICAL COMPOSITION**

Table 1

SR. NO.	CHEMICAL NAME	COMPOSITION
1	SO <sub>3</sub> (Sodium trioxide)	2.2
2	P <sub>2</sub> O <sub>5</sub> (Diphosphorous pentaoxide)	6.2
3	SiO <sub>2</sub> (Silicon dioxide)	9.9
4	Fe <sub>2</sub> O <sub>3</sub> (Ferrous oxide)	1.5
5	Al <sub>2</sub> O <sub>3</sub> (Aluminium oxide)	2.4

	oxide)	
6	CaO(Calcium oxide)	16.6
7	MgO(Magnesium oxide)	13.4
8	Na <sub>2</sub> O(Sodium Oxide)	1
9	K <sub>2</sub> O(Potassium oxide)	32.9
10	TiO <sub>2</sub> (Titanium dioxide)	0.1

**IV. OBJECTIVE OF THE PROJECT:**

1. To determine the engineering behavior and geotechnical properties of soil with Walnut Shell Powder Ash.
2. To improve the soil.
3. To reuse the waste material Walnut Shell Powder Ash .

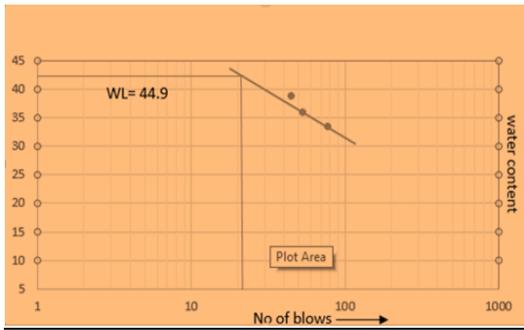
**V. METHODOLOGY**

The methodology undertaken to achieve the objective of this Project is stated as follows. Various experiments have to be done to determine index properties as well as engineering properties of the soil and the changes after addition of additives to the soil are also resolved.

**Results Of Untreated Soil:**

Table 2

Sr. No	Experiment Names	Results
1	Water content of soil	40%
2	Specific gravity of soil	2.1
3	Dry density of soil	15.23
4	Liquid Limit of soil	44.9%
5	Plastic Limit of soil	14.51%
<b>6</b>	<b>Plasticity Index</b>	<b>30.39%</b>



**Graph 1. of Liquid Limit of soil**

**PI = 30.39 > 17**

**Therefore It Is Concluded That:**

1. Soil is highly plastic, highly cohesive soil.
2. Soil is not good for construction as well as foundation material.
3. Strength of soil has to be increased.
4. Walnut Shell Powder Ash was added with soil at proportion of 5%, 10% and 15% and the results are detailed below:

**VI. RESULTS OF CONSISTENCY LIMITS FOR TREATED SOIL.**

**Table 3**

Ratio Of Additive	Liquid Limit	Plastic Limit	Plasticity Index
5%	44.9	24.6	<b>20.3</b>
10%	40	31.74	<b>8.26</b>
15%	37.4	34.44	<b>2.96</b>

**VII. CONCLUSION**

- A. Original soil was highly plastic, highly cohesive therefore additive Walnut Shell Powder Ash was added to the soil.
- B. Addition of Walnut Shell Powder Ash gives the value of plasticity index of treated soil. The plasticity index of treated soil is observed

less than the original soil, hence soil is improved.

- C. Index properties of soil is increased.
- D. Improved soil can be used for construction as well as foundation material.

**VIII. REFERENCES**

- [1]. Increase bearing capacity of soil by using plastic (soft drinks) bottles by lama saini, abhishek gupta, imtiyaz ali. (2016)
- [2]. Strength development of soft soil stabilized with waste paper sludge by V. Surya Teja Sindhuja, G Sai Krishna. (2016)
- [3]. Soil stabilization by using different traditional and non traditional additives by Abhinav Rawat, Anupam Mital (April 2015).
- [4]. Study of soil cement stabilization for pavement base course and sub grade by Bsit Riyaz, Muneeb Hital, Mujtaba Mir, Muneeb Bshir (2015).
- [5]. Abu siddique and Bipradas rajbongshi, "Mechanical properties of a cement stabilized coastal soil for use in road construction", Journal of civil engineering The institution of Engineers" Vol. CE
- [6]. Anil Misra, Debabrata Biswas and Sushant Upadhyaya (13 December 2004), "Physio-mechanical behavior of self-cementing class C flyash-clay mixtures,"
- [7]. Akshaya kumar sabat, radhikesh p. nanda (2011), "effect of marble dust on strength and durability of rice husk ash stabilized expansive soil" international journal of civil and structural engineering volume 1,
- [8]. Dr. Robert M. Brooks (2009)," Soil stabilization with flyash and rice husk ash", International Journal of Research and Reviews in Applied Sciences, Volume 1, Issue 3.
- [9]. Kumara G.H.A.J.J. and Tani K. (2011), "Use of improved clay by paper sludge ash in slope stability of
- [10]. dredged river embankments", annual research journal of SLSAJ vol.