Effect of Marble Dust on Soil Properties

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***Abstract*- The main objective of this study is to investigate the use of waste marble dust in geotechnical applications and to evaluate the effects of marble dust on OMC & MDD and CBR values of unsaturated soil by carrying out Standard Proctor Test and CBR test on different soil samples. The results obtained are compared for the three different percentage of marble dust and inferences are drawn towards the bearing strength of soil with different combination of marble dust. In this study, the waste material of marble industry, were used for stabilization of clayey soils.**

Key Words- Soil stabilization, standard proctor test, MDD & OMC, CBR values, clayey soil

I. INTRODUCTION

The Engineering Properties of soil are depended on the many points like minerals, water table, soil water behavior etc. which vary as per area to area. Due to which we can't get desire properties suitable to our needs of construction. To resolve this problem we have technique called stabilization which means to stable or to modify or to improve the soil properties in positive manner. So we can have a construction works which fulfill our needs and objective [8].

"Soil stabilization can be explained as the increasing or maintaining the soil properties by physical and chemical alteration of soil to enhance their engineering properties."

Stabilization allows for the establishment of design criteria as well as the determination of the proper chemical additive and admixture rate to be utilized in order to achieve the desired engineering properties. Benefits of the stabilization process can include higher resistance values, reduction in plasticity, lower permeability, reduction of pavement thickness, elimination of excavation material hauling or handling.

A. NEED OF SOIL STABILIZATION

Soil properties vary a great deal and construction of structures depends a lot on the bearing capacity of the soil, hence, we need to stabilize the soil which makes it easier to predict the load bearing capacity of the soil and even improve the load bearing capacity. The gradation of the soil is also a very important property to keep in mind while working with soils. The soils may be well-graded which is desirable as it has less number of voids or uniformly graded which though sounds stable but has more voids. Thus, it is better to mix different types of soils together to improve the soil strength properties[9]. It is very expensive to replace the inferior soil entirely soil and hence, soil stabilization is the thing to look for in these cases.

B. MATERIAL AND METHODS

The clayey soil for this is study was taken from bank of a small pond near Goner village of Jaipur district and the marble dust was taken from the "**Makrana marble industry**" of Makrana village in Nagaur district.

C. EXPERIMENTAL METRIX

Liquid limit test, plastic limit test, Standard Proctor Test, California bearing ratio(CBR) test were carried out for both natural soils and with the addition of marble dust with three different percentages (10%, 15%, 20%).

RESULTS:

Soil condition	Liquid limit (%)	Plastic limit (%)	OMC (%)	MDD (kg/m3)	CBR (%)
Soil	38.85	15.70	22.46	1.674	2.40
Soil + 10% MD	42.97	20.11	18.32	1.7461	10.81
Soil + 15% MD	41.03	20.14	18.14	1.7403	14.60
Soil + 20% MD	42.10	19.59	18.54	1.734	13.21

Table 1: various results with different combination of marble dust

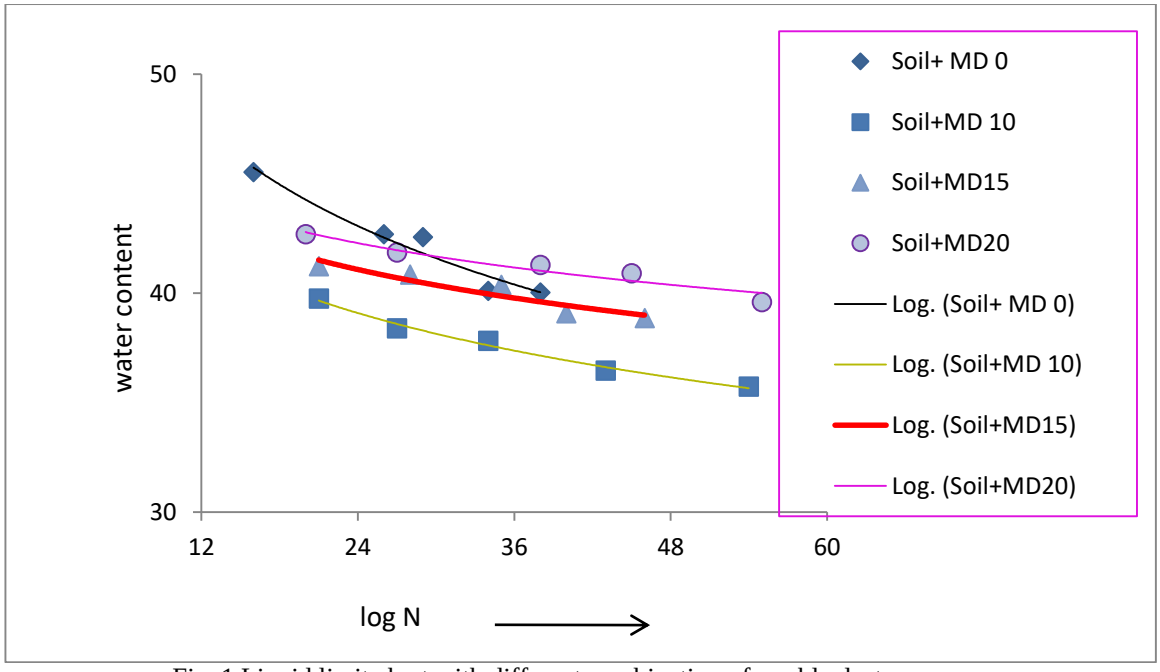

Fig. 1 Liquid limit chart with different combination of marble dust

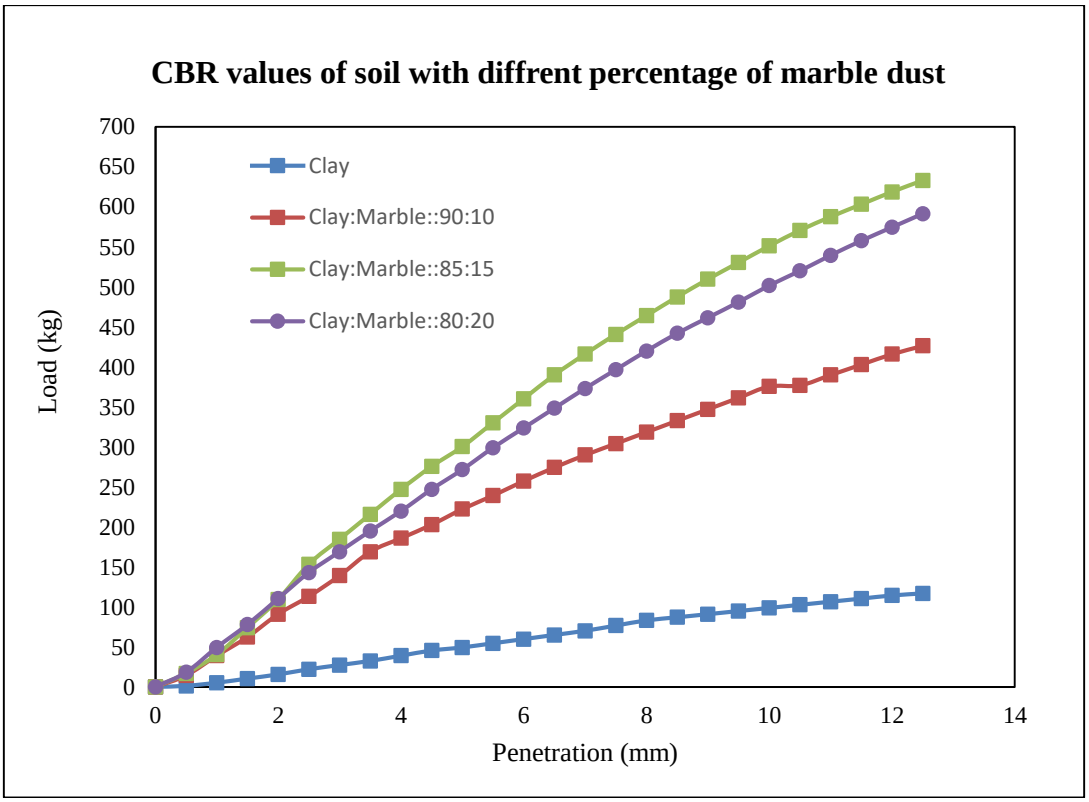

Fig: 2 CBR test results with different combination of marble dust

II. LITERATURE REVIEW

Parte Shyam Singh, R. K. Yadav [1], has studied about Effect of Marble Dust on Engineering Characteristics of Black Cotton Soil. They concluded that the addition of marble dust into the black cotton soil has changed the Procter compaction parameters. The OMC of the BC soil has decreased and the maximum dry density (MDD) increased with the addition of marble dust. And the soaked CBR values have also increased significantly with the addition of marble dust content.

Okagbue and Onyeobi [2], showed that the geotechnical parameters of red tropical soils are improved substantially by the addition of marble dust. Plasticity was reduced and strength and CBR increased. The highest strength and CBR values were achieved at 8 % marble dust . Results also showed that normal 28 day curing improved the strength of the marble dust - treated soil over 80% strength gain achieved after 7 to 10 days of normal curing. Eskioglou [3] has studied about Soil stabilization with cement has resulted to decreasing of the plasticity less than the lime, increasing of the strength and of the angle of internal friction and of true cohesion. This increase is relatively lower in the loam soil.

P. Eskioglou, P. N. Eskioglou[4] has studied about stabilization of soil using fly ash and found a decrease of the maximum dry density and an increase of the moisture with an increase of the fly ash content in the soil. Dharma Prakash Sharma and Gokul Prasad Sharma[5] has studied about stabilization of soil with marble dust on highway shoulder and found that The addition of the marble dust to the soil reduces the clay contents and thus increases in the percentage of coarser particles. It reduces the liquid limit, raises the shrinkage limit and decrease in the plasticity index of the soil and thus swelling percentage.

Tarkeshwar Pramanik, S.Kishor Kumar and J.P. Singh[6] has studied about the behaviour of Soil for Sub Grade by using Marble Dust and Ground Granulated Blast Furnace Slag and found that The characteristics of soils vary significantly with Marble dust-GGBS content. The Optimum Moisture Content (OMC) increases and Maximum Dry Density (MDD) decreases with increase in percentage of Marble dust-GGBS and With increases 20%-20% of Marble dust and GGBS percentage compressive strength of soil increases.. CBR value for soaked and unsoaked condition increases with increases in percentage of Marble dust and GGBS. Swami and Biswas et al[7] studied the utilization of rice husk with lime in subgrade soil for a rural road. They concluded that a very little amount of lime (3%) added to clayey soil with rice husk; improve the CBR value and compaction characteristics to a great extent.

III. CONCLUSION

In this study stabilized artificial soil samples were obtained by adding 10, 15, and 20 % of marble slurry and then the effect of waste type on the consistency limits, compaction parameters and CBR values of the samples were examined. The following conclusion was drawn from the result of the laboratory tests.

- The addition of the marble dust to the soil reduces the clay contents and thus increases in the percentage of coarser particles.
- It reduces the liquid limit, reduce the shrinkage limit and increase in the plasticity index of the soil and reduce the swelling percentage because of change in gradation of clayey soil by mixing marble dust.
- The characteristics of soils vary significantly with Marble dust. The Optimum Moisture Content (OMC) increases and Maximum Dry Density (MDD) decreases with increase in percentage of Marble dust.
- As compared to untreated soil, the percentage increase in OMC at 15% addition of Marble dust is 22.39% due to change in plasticity index and liquid limit.
- The increasing percentage of marble dust with soil increases the plasticity index and reduces the swelling properties of soil. This is very helpful to control volume changes in soil due to clayey particles.
- The CBR value of the soil is increased with increasing order of marble dust percentage. The optimum results were found when soil was stabilized with 15% marble dust. The CBR value is increased from 2.36% to 14.86%.
- Above results of CBR test and MDD of soil with 20% marble shows that the CBR results of this soil is good enough to construction for medium traffic volume roads. So we can utilize more marble waste in stabilization process.

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