

STABILIZATION OF EXPANSIVE SOIL USING METAKAOLIN AND GRANITE POWDER

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Abstract: The clay soil is a problematic soil which cannot be directly used for the construction of structures because it has high shrinkage. Various techniques are available to stabilize the soil to make better foundation for structures. Soil stabilization is the process of improving the engineering properties of the soil and thus making it more stable. This project deal with stabilization of clay soil by using Metakaolin like with constant proportion of 10%, 20%, 30% and granite powder with proportions of 10%, 20%, 8%. After the conclusion made from the laboratory test liquid limit, Plastic limit, MDD, OMC and CBR test value are to be determined. CBR value increase the bearing capacity of the soil. From these tests it increases the strength and it improves the behavior of the Expansive soil using these admixtures.

1. INTRODUCTION

The expansive soils possess low strength and undergo excessive volume changes, making their use in construction very difficult. In monsoon season soils absorb water, swelling of soil become soft. So that the bearing capacity of the soil is reduced. In dry season these soils shrink due to the evaporation of water and the soil becomes harder. Due to the swelling, shrinkage, high plasticity, low strength in wet condition of the soil it reduces the strength of the soil and it is unsuitable for construction. To increase the bearing capacity of the soil various admixtures are to be used. Stabilization of expansive soil by various admixtures available are Metakaolin and Granite powder are most widely used for the stabilization of expansive soil. Among these we used Metakaolin and Granite powder to improve the safe bearing capacity of the soil.

2. MATERIALS

Properties of Expansive soil

Expansive soil covers about 30% of the land area in India. Expansive soils expand when they are wetted and shrink when dried. These soils swell by absorption of water during rainy season and shrink in summer when water evaporates out. Lightly loaded structures founded on these types of soils like single and two storied buildings, pavements, canal bed and linings, retaining structures etc. are damaged severely. Black soils are highly argillaceous and are enormously rich in CaCO_3 .

Properties of Metakaolin

Metakaolin is a dehydroxylated form of the kaolinite. Stone that are rich in kaolinite are known as kaolin, traditionally used in the manufacture of porcelain. The particle size of Metakaolin is smaller than cement particles, but not as fine as silica fume. The quality and reactivity of Metakaolin is strongly dependent of the characteristics of the raw material used. Metakaolin can be produced from a variety of primary and secondary source containing Kaolinite.

Properties of Granite powder:

The granite powder is a by-product produced in granite factories while cutting huge granite rocks to the desired shapes. About 3000 metric ton of granite powder is produced per day as a by-product manufacturing of granite tiles and slabs from the raw blocks. Economic way of stabilization because granite which is available in huge quantity from granite industries. The properties of waste depend upon the granite from which it is taken.

3. METHODOLOGY

The soil sample used for this study was collected by method of disturbed sampling at average depth of 1.0. The preliminary tests of identification of the natural soil and the geotechnical properties of the soil treated with Metakaolin Expansive soil is mixed with Metakaolin and granite powder in different proportions. For the present study, the various tests are performed along with a brief description of the procedure have been included. The tests include the index test for soil, granite powder & Metakaolin, the engineering tests to understand the behavior of the soil. These tests were performed on locally available Expansive soil.

The test performed are:

- Specific gravity test
- Liquid limit test
- Plastic limit test
- MDD test
- OMC test
- CBR test

Percentage of Metakaolin and Granite Powder:

SOIL PARTICULARS	PERCENTAGE OF SAMPLE	SYMBOLUSED
NATURAL SOIL	0	NS
SOIL SAMPLE 1	NATURAL SOIL + 10% (METAKAOLIN + GRANITE POWDER)	S1
SOIL SAMPLE 2	NATURAL SOIL + 20% (METAKAOLIN + GRANITE POWDER)	S2

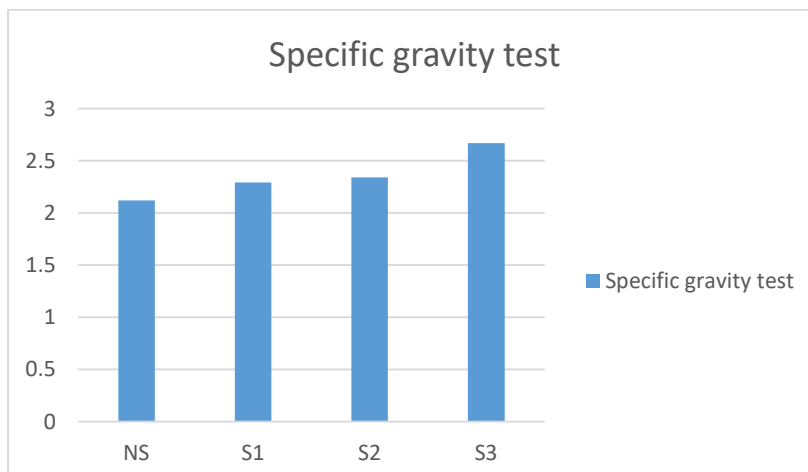
4. RESULTS AND DISCUSSIONS

Following table shows overall result of liquid limit, Plastic limit test, MDD test, OMC test, CBR test

DESCRIPTION	NS	S1	S2	S3
Specific gravity test	2.12	2.29	2.34	2.67
Liquid limit test %	80	45	32	19
Plastic limit test %	25.51	20.78	15.17	9
MDD test g/cc	1.73	1.46	1.24	1.22
OMC test %	12	11.8	10	7
CBR test %	9.2	9.47	11.79	12

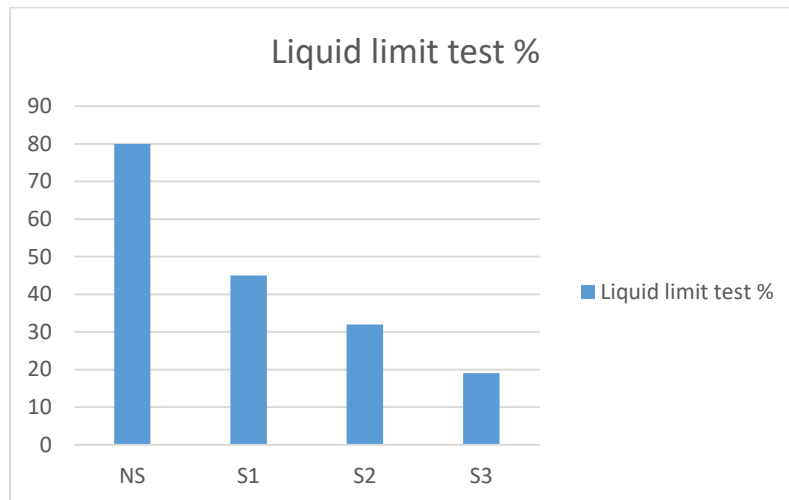
SPECIFIC GRAVITY TEST

Chart 1 shows Specific gravity for soil goes on increasing with addition on Metakaolin and Granite powder.



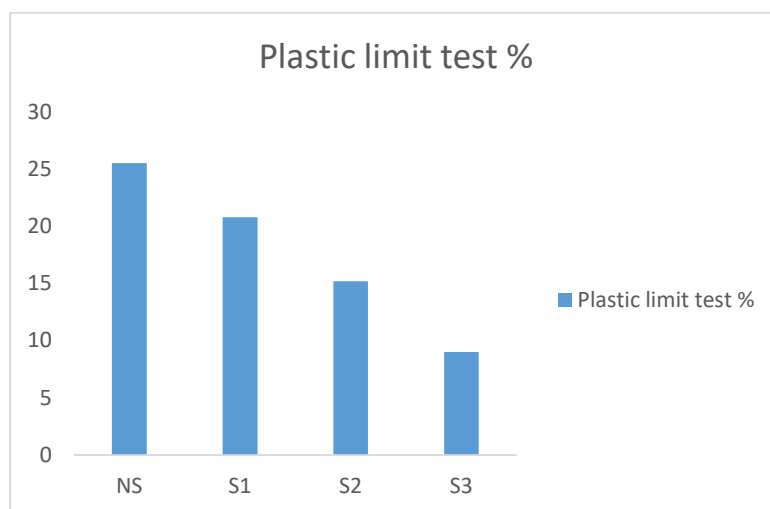
LIQUID LIMIT

Chart 2 shows liquid limit goes on decreasing with addition of Metakaolin and Granite powder.



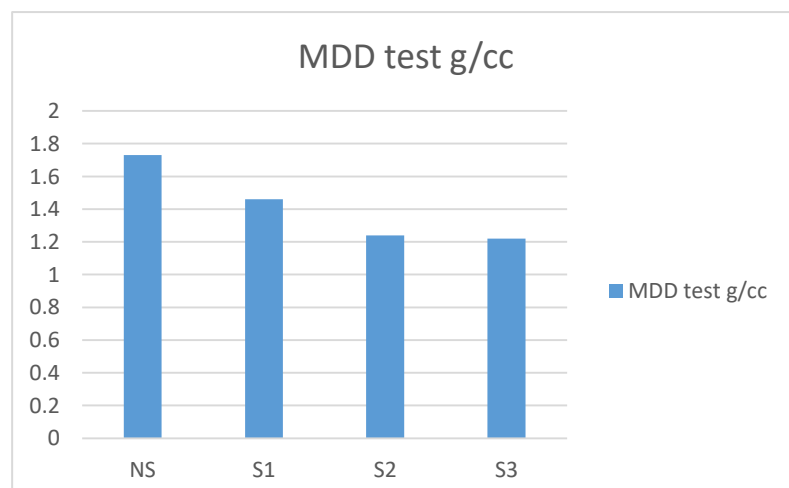
PLASTIC LIMIT TEST

Chart 3 shows plastic limit test goes on decreasing with addition of Metakaolin and Granite powder.



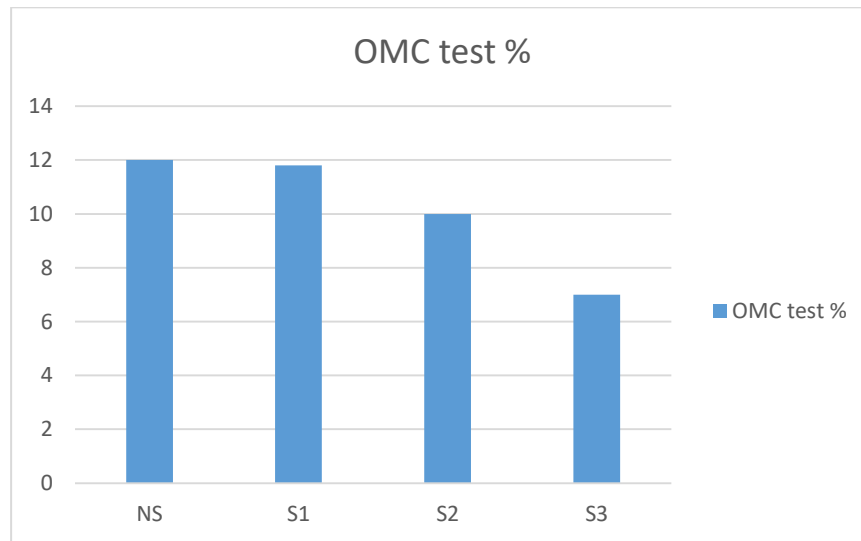
MAXIMUM DRY DENSITY TEST

Chart 4 shows MDD test for soil goes on increasing with addition Metakaolin and Granite powder.



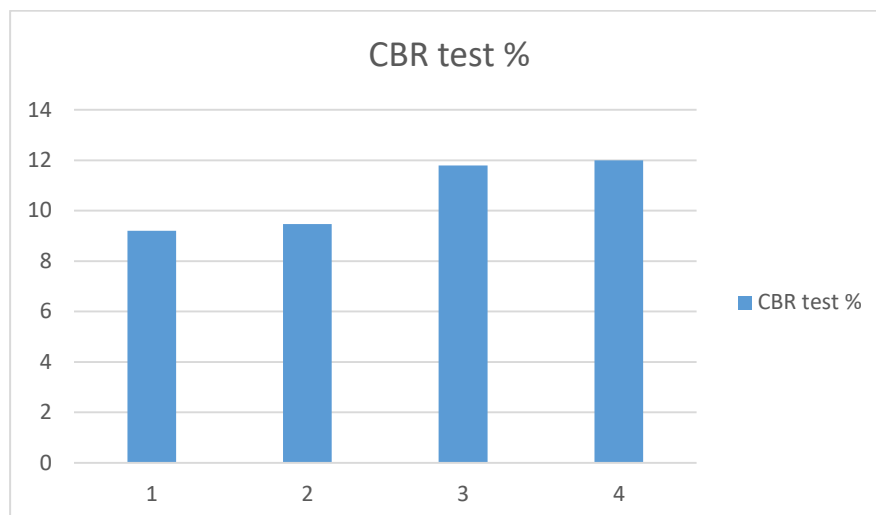
OPTIMUM MOISTURE CONTENT TEST

Chart 5 shows the OMC test goes on with decreasing with addition of Metakaolin and Granite powder.



CALIFORNIA BEARING RATIO TEST

Chart 6 shows the CBR test goes on increasing with addition of Metakaolin and Granite powder.



5. CONCLUSION

From the series of test conducted on Expansive soil mixed with Metakaolin and Granite powder the following conclusions are drawn:

- Specific gravity of Expansive soil increased with the addition of Metakaolin and Granite powder, this increment of specific gravity value may be due to the addition of plasticity character of Expansive soil.
- It has been observed that the liquid decreased from 80 to 19% with the addition the addition of Metakaolin and Granite powder from 10 to 30%.
- California bearing ratio test improve in Expansive soil after adding 20% Metakaolin and Granite powder.
- Addition of different ratio of Metakaolin and Granite powder to the Expansive soil gets stabilized, thus the Maximum dry density increases and Optimum content goes on decreases.
- Coefficient of curvature and coefficient of uniformity goes on increasing on addition of Metakaolin and Granite powder.

REFERENCES

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- [8] Expansive soil covers about 30% of the land area in India (Wikipedia.org).
- [9] About 3000 metric ton of granite powder is produced per day (Wikipedia.org).