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Behaviour of Expansive Soil By Using Low Cost Material Carbide Sludge

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ABSTRACT:-Expansive soil have the tendency to swell or shrink depending on its moisture content. Due to such expansive characteristics of soil, the structures constructed over this may develop some cracks in due course of time. It is there for essential to stabilize such soils, prior to any construction work carried out on this to improve its engineering properties. At present waste materials like carbide sludge from fertilizer industries in all over India. These wastes not only create health problems but also its disposal is a great problem for our society. This paper deals with a feasibility study carried out to find the suitability of using waste material i.e. carbide sludge as stabilizing material for improving the engineering properties of expansive soil. Various tests like atterberg's limit, standard proctor test were performed on the soil samples prepared by using carbide sludge mixed with expansive soil at different percentages.

KEYWORDS:- Expansive Soil, Soil Stabilization, Carbide Sludge,Atterberg's Limit, OMC, MDD.

I. INTRODUCTION:-Expansive soil also known as Kali Mitti, mainly found in the central India and Deccan plateau such as Maharashtra, Western Madhya Pradesh, Chhattisgarh, Andhra Pradesh, Karnataka etc. A carbide sludge is also known as lime sludge and hypo sludge.Geotech engineers are constantly searching for new and suitable engineering methods for improving the engineering properties expansive soil. In the developing country like India there is lack of and to dispose the waste that reason engineers are consistently looking for using these waste as stabilizing material for expansive soil. In this Paper present a study, carried out on soil stabilization using carbide sludge for improving the property of expansive soils. Various tests like liquid limit, plastic limit, plasticity index and standard proctor test were performed on the soil samples prepared by using carbide sludge with expansive soil at different percentages. On the basis of the results obtained from these tests, it may be concluded that the strength of expansive soil can be substaintially improved by mixing carbide sludge as stabilized materials.

II. LITERATURE REVIEW:-

Xiong(bill)Yu. et al. (2010) studiedbeneficial utilization of lime sludge for subgrade stabilizationof soil including low plastic clay soil and high plastic clay soil.Utilization of lime sludge in transportation presents an opportunity to achieve sustainable utilization of a precious natural resource.

JayeshkumarPitroda et al. (2013) studied that use of paper industries waste (hypo sludge) in design mix concrete.The cement has been replaced by waste paper sludge accordingly in the range of 0% (without Hypo sludge), 10%, 20%, 30% & 40% by weight for M-25 and M-40 mix. Concrete mixtures were produced, tested and compared in terms of strength with the conventional concrete.

Akshaya Kumar Sabat et al. (2014) an expansive soil stabilized with rice husk ash and lime sludge on following percentage respectively 5 to 20 and 5 to 15 for 0,7,28 days. The lime sludge waste is utilized for pavement design and it also reduce the construction cost of pavement.

III. EXPERIMENTAL PROGRAM:-

a) Particle Size Distribution: The percentage of particle i.e. clay, silt and sand (fine grained or coarse grained) in the soil was found after conducting laboratory experiments as per IS: 2720 (Part V) – 1985.

b) Atterberg Limit: Liquid limit, plastic limit, plasticity index and shrinkage limit was determined as per IS: 2720 (Part IV) – 1985 in the laboratory.

c) Specific Gravity: Specific gravity of soil is obtained as per IS: 2720 (Part III) – 1980 with the help of pycnometer method.

d) Standard Proctor Test: The standard procedure of standard proctor test is followed as per IS: 2720 (Part VII) – 1980 to determined optimum moisture content and maximum dry density of soil.

IV.MATERIAL USED –

- Expansive Soil:- A soil sample for the present was collected from Borkheda, Kota, Rajasthan.

Table -4.1 Properties of Expansive Soil

S.No.	Property	Value
1	Fines (<75µ)	80.88%
2	Liquid Limit (L.L.)	40.35%
3	Plastic Limit(P.L.)	17.77%
4	Plasticity index (P.I.)	22.53%
5	Soil Classification	CI
6	Specific gravity (G)	2.65
7	Max. Dry Density (Ɣd)	1.68 g/cm3
8	O.M.C.	18.35%

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- Carbide Sludge:-A carbide sludge sample was collected from Caustic Soda Plant of DCM Shriram Fertilizers, Kota, Rajasthan.

Table -4.2chemical composition of carbide sludge

S. No.	Chemical Constituent	Chemical composition (%) Carbide Sludge
1	Moisture Content	68.09
2	LOI	24.88
3	Acid Insoluble	0.075
4	Mixed Oxide(R2O3)	2.47
5	Cao	51.66
6	Mgo	0.42
7	Sulphur	2.2

- Virgin expansive soil were mixed in varying percentages of carbide sludge by the weight of soil sample & the details are given in Table 4.3

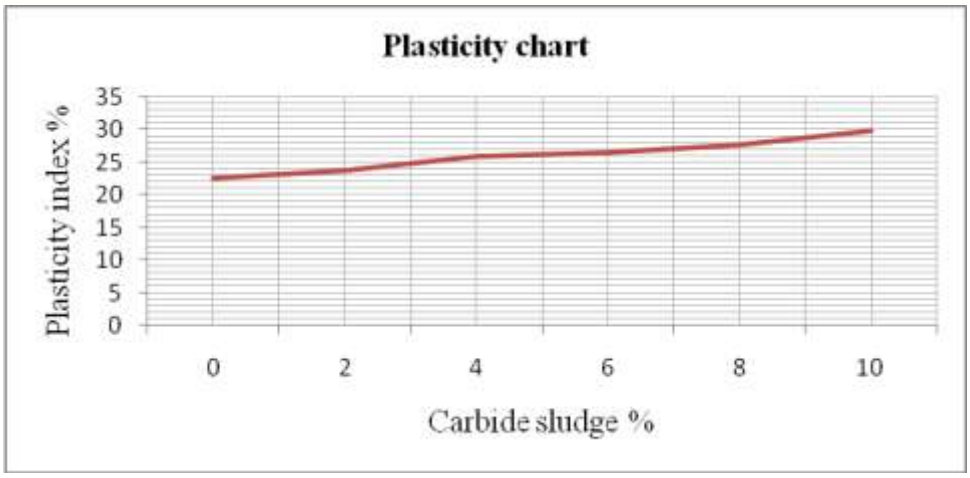
Table no. 4.3 Percentage of virgin soil mixed with carbide sludge

S.No.	Mixing Proportion
1	Expansive soil+ 2% carbide sludge
2	Expansive soil+ 4% carbide sludge
3	Expansive soil+ 6% carbide sludge
4	Expansive soil+ 8% carbide sludge
5	Expansive soil+ 10% carbide sludge

4.1 Atterberg Limit Test:- L.L, P.L, P.I tests were conducted to find the atterberg limits of virgin soil samples and also the soil samples mixed with various percentage of carbide sludge as given in Table 4.2. for these tests procedure is given in IS: 2720 (Part IV) – 1985. The test results are given in Table 4.4. Liquid Limit, Plastic Limit & Plasticity Index of virgin soil were found to be 40.30%, 17.77%, 22.53% respectively.

Table 4.4Attereberg Limit test result with percentage of Virgin soil mixed with Carbide Sludge

S.No.	Mix proportion	Liquid Limit(%)	Plastic Limit(%)	Plasticity Index
1	Expansive soil	40.35	17.77	22.53
2	Expansive soil+ 2% carbide sludge	42.48	18.84	23.64
3	Expansive soil+ 4% carbide sludge	45.84	20.01	25.83
4	Expansive soil+ 6% carbide sludge	47.36	20.76	26.60
5	Expansive soil+ 8% carbide sludge	49	21.21	27.79
6	Expansive soil+ 10% carbide sludge	51.28	22.40	29.88

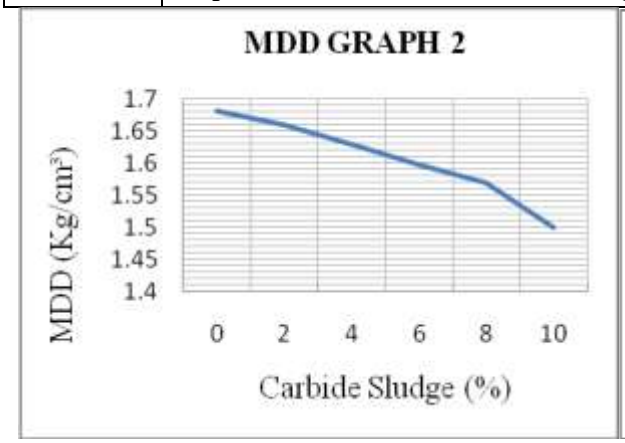


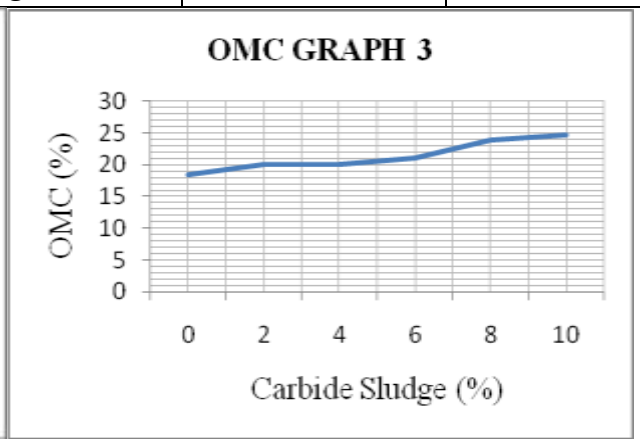
Graph no.1 plasticity chart on various percentage of carbide sludge

4.2 Standard Proctor Test – Proctor tests were conducted to find out the OMC & MDD of the virgin soil samples and also the soil samples mixed with various percentages of carbide sludge as given in Table 4.3. For these tests procedure is given in IS 2720 (Part7) 1980. The test results are given in Table 4.5. OMC & MDD of virgin soil were found to be 18.35% and 1.68kg/cm3 respectively.

Table 4.5 Standard Proctor test result with percentage of Virgin soil mixed with Carbide Sludge

S.No.	Material	MDD(kg/cm³)	OMC(%)
1	Expansive soil	1.682	18.35
2	Expansive soil + 2% carbide sludge	1.66	19.93
3	Expansive soil + 4% carbide sludge	1.63	20.04
4	Expansive soil + 6% carbide sludge	1.597	21
5	Expansive soil + 8% carbide sludge	1.57	23.8
6	Expansive soil + 10% carbide sludge	1.5	24.63





Graph No. 2, 3 Results of MDD and OMC with various percentage of carbide sludge.

IV. CONCLUSION:-From the results it is clear that a change of the expansive soil texture takes place. When carbide sludge is mixed with the expansive soil, the Plastic limit and liquid limit increases by mixing carbide sludge which increases plasticity index. As the amount of carbide sludge increases there is apparent reduction in maximum dry density and increase in optimum moisture content (as shows in graph no.2,3).

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