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VARIATION OF STRENGTH PARAMETERS OF EXPANSIVE SOIL EMPLOY THE POLYETHYLENE WASTE AND FERRIC CHLORIDE

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The objective of the present investigation aims to explore the performance of different percentages polyethylene (0.2%, 0.4%, 0.6% & 0.8%) material reinforced with expansive clay and ferric chloride (0.2%, 0.6%, 1.0% and 1.4%) also a binding material and compared with unreinforced soil and conducting different laboratory experiments. It was observed that the optimum value of polyethylene and ferric chloride at 0.6% and 1.0% and tested the modal foundation beds by plate load test using different composition.
Keywords: Expansive soil, chemical, polyethylene, Strength parameters, CBR.

1. MATERIALS USED:

1.1 Expansive soil: Soil

The black cotton soil collected from 'mummidivaram' village near Amalapuram, East Godavari District in India. The properties of the soil are given in

Table.1. Properties of Expansive Soil

S.No	Property	Value
1	Grain size distribution Sand (%) Silt (%) Clay (%)	 3 18 79
2	Atterberg limits Liquid limit (%) Plastic limit (%) Plasticity index (%) Shrinkage limit (%)	 79 38 41 12
3	Compaction properties Optimum Moisture Content, O.M.C. (%) Maximum Dry Density, M.D.D (g/cc)	 23.20 1.40
4	Specific Gravity (G)	2.71
5	IS Classification	CH
6	Soaked C.B.R (%)	2.1
7	Differential free swell (%)	134
8	Permeability (cm/sec)	1.829×10^{-7}
9	Shear Strength Parameters Cohesion (C) (Kg/cm²) Angle of internal friction (ø)	 0.46 2º

1.2. Chemical (Ferric Chloride):

Chemical modification by adding lime and lime-pozzolan mixes has been practiced for the last two decades. However, due to low solubility (about 1.2 g/lit @200c) of lime and mixing problems involved, use of strong electrolytes like KCl, CaCl2 and FeCl3 were tried by various researchers. Further, a group of researchers reported that CaCl2 could be an effective alternative to conventional lime treatment due to its ready dissolvability to supply adequate calcium ions for exchange reactions.In this work taken a ferric chloride as a binding material, which is very effective among all anther chemicals.

1.3.Polyethylene:

Development for the minimization of environmental degradation.

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Plastic as a synthetic polymer substitute natural materials in almost every aspect of our life and become an essential part of our society. Nature has witnessed a considerable intensification in the production of plastics in last few decades and simultaneous increased consumption of plastic materials. With time, stability and durability of plastics have been improved continuously, and hence these groups of materials are now considered as a synonym for materials being resistant to many environmental constraints (Shah,A.A.,Hasan, F.,Hameed,A., and Ahmed, S. 2007). The basic properties viz. durability, resistance to chemicals, safety and hygienic nature, relative inexpensiveness to produce, thermal and electrical insulations, and lighter weight than the competing materials helped plastics to be indispensable in every aspects of life. Plastics compromise diverse group of chemically complex compounds. Plastics are formed into any number of products and different plastic resins are difficult to differentiate. This leads to problems in collection, separations, and recycling. Because of its durability, plastics accumulate and remain persistent in the environment at the rate of 25MT per year.2 Moreover, converting plastics down to their original chemical constituents is often technologically infeasible or otherwise unprofitable. Management of plastics found in municipal solid waste (MSW) is most critical sector because of continuous increase in plastic proportion (Orhan, Y. and Buyukgungor, H. 2000) in MSW, its non-biodegradability, and direct harmful effect to society Banerjee, T. and Srivastava, R.K. (2009) Basically, problems related to solid waste persist beyond merely its disposal. In addition to technical and environmental complications, there are administrative, economic, and societal tribulations that must be addressed. The scientific efforts to sort out all these complications are usually referred as waste management. In this aspect, the management encompasses planning, design, and operation of facilities for collecting, transporting, processing, recovering, and finally disposing of waste.

2. OBJECTIVE OF THE STUDY

The objectives of the present study are as follows.

To evaluate the performance of expansive Clay when treated with polyethylene as a admixture.

To evaluate the performance of expansive Clay treated with ferric chloride coated polyethylene

3. RESULTS AND DISCUSSIONS:

Table:1 Effect of polyethylene and ferric chloride on MDD&OMC of expansive soil

Particular	MDD(g/cc)	OMC (%)
Expansive Soil	1.40	23.20
Expansive Soil + 0.2% polyethylene + 0.2% ferric chloride	1.45	20.30
Expansive Soil + 0.4% polyethylene + 0.6% ferric chloride	1.53	17.22
Expansive Soil + 0.6% polyethylene + 1.0% ferric chloride	1.68	14.23
Expansive Soil + 0.8% polyethylene + 1.4% ferric chloride	1.66	15.20

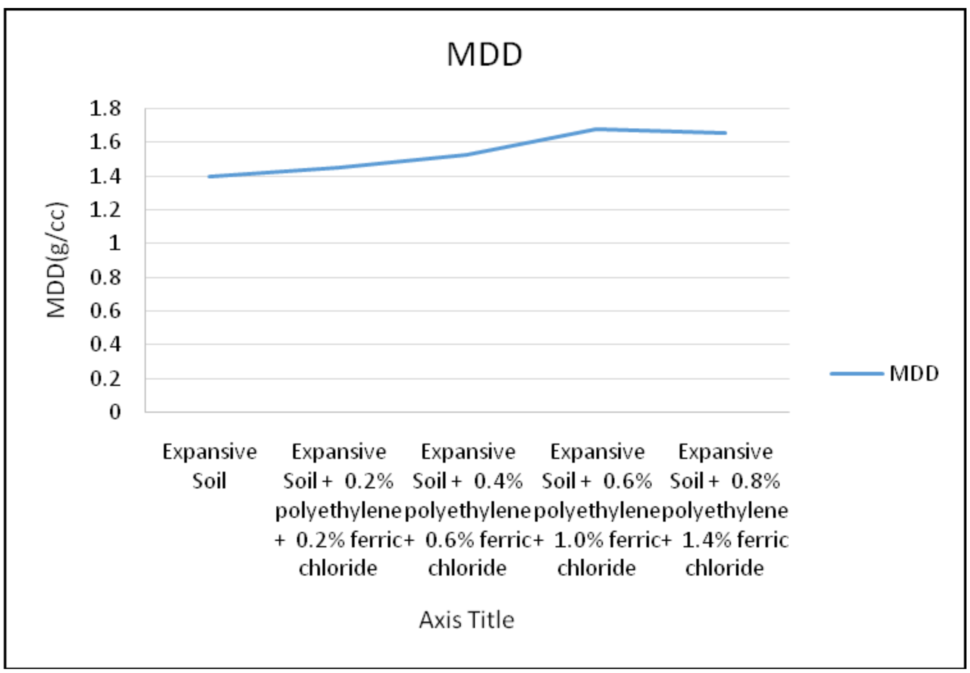

Fig.1 shows the variation of MDD Value w.r.t Polyethylene and FC

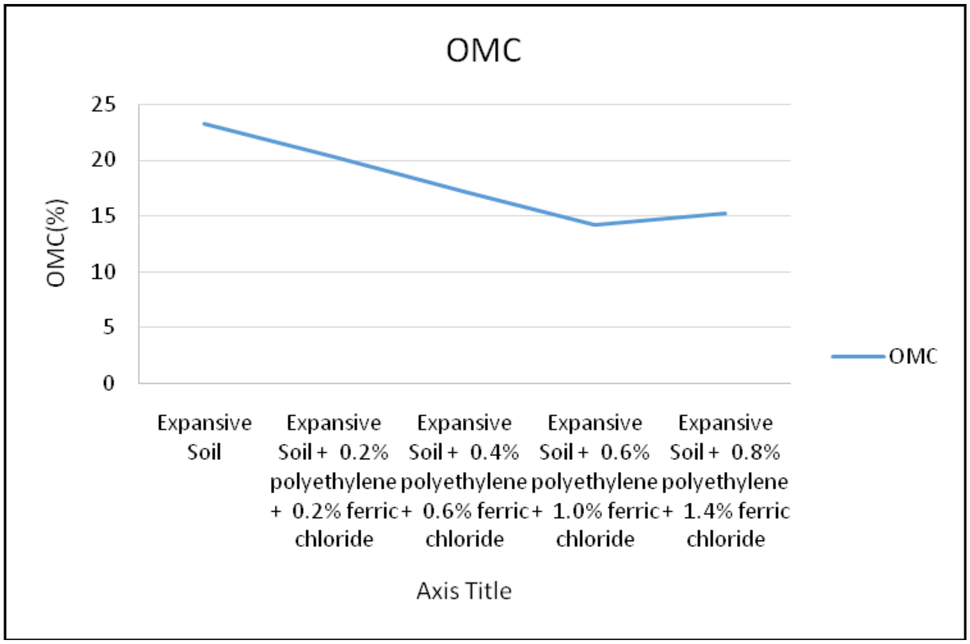

Fig.2 shows the variation of OMC Value w.r.t Polyethylene and FC

Table 2: Effect of polyethylene and ferric chloride on CBR of expansive soil

Particular	CBR (%) (soaked)
Expansive Soil	2.1
Expansive Soil + 0.2% polyethylene + 0.2% ferric chloride	3.8
Expansive Soil + 0.4% polyethylene + 0.6% ferric chloride	5.5
Expansive Soil + 0.6% polyethylene + 1.0% ferric chloride	8.1
Expansive Soil + 0.8% polyethylene + 1.4% ferric chloride	8.0

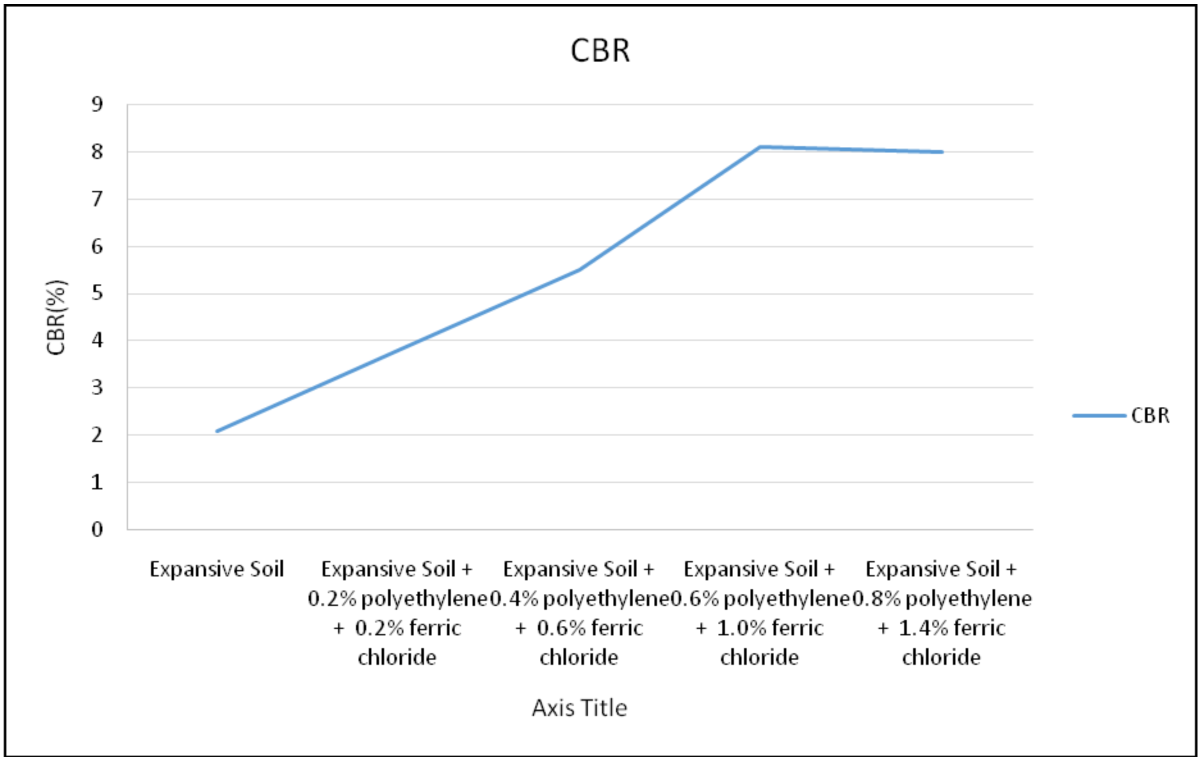

Fig.3 Shows the variation of CBR Value w.r.t Polyethylene and FC

3.1 Effect of Additives on CBR

Fig.3. shows the variation of CBR of stabilized expansive clay with addition of different percentages of additives. It is can be seen that the CBR is increasing with increasing percentage of additives added to the expansive soil. Significant increase in CBR is recorded in stabilized expansive clay with addition of chemical upto 0.6% polyethylene and ferric chloride, beyond this percentage the increase in CBR is marginal. The increase in the strength with addition of additives may be attributed to the cation exchange of polyethylene and ferric chloride between mineral layers and due to the formation of silicate gel. The reduction in improvement in CBR beyond optimum may be due to the absorption of more moisture at higher additive content.
Table 3: Variation of Shear strength parameters with the addition of polyethylene and ferric chloride to the expansive clay

Particular	Shear Strength Parameters (KPa)					
	1 day		7 days		14days	
	Cohesion, Cu (kg/cm2)	Angle of internal friction, ϕ, (Deg.)	Cohesion, Cu (kg/cm2)	Angle of internal friction, ϕ, (Deg.)	Cohesion, Cu (kg/cm2)	Angle of internal friction, ϕ, (Deg.)
Expansive Soil	0.56	20	--	--	--	--
Expansive Soil + 0.2% polyethylene + 0.2% ferric chloride	0.98	60	1.46	30	1.53	20
Expansive Soil + 0.4% polyethylene + 0.6% ferric chloride	1.28	40	1.75	20	1.85	20
Expansive Soil + 0.6% polyethylene + 1.0% ferric chloride	1.48	30	1.98	20	2.2	10
Expansive Soil + 0.8% polyethylene + 1.4% ferric chloride	1.47	30	1.98	20	2.1	10

3.2 Effect of Additives on Shear Strength Properties
The undrained shear strength parameters of the remoulded samples prepared at MDD and optimum moisture content with addition of polyethylene and $FeCl_3$, to the expansive soil are presented. The prepared samples are tested after 1day, 7 days and 14 days. Significant change in undrained cohesion and marginal change in angle of internal friction is observed with addition of additives to the expansive clay. The increase in the shear strength parameters with addition of chemicals may be attributed to the cation exchange of additives. The shear strength parameters are increases upto 0.6% polyethylene and ferric chloride addition , beyond this percentage there is a considerable decrease is observed may be due to the absorbtion of more moisture at higher additive content.

4. CONCLUSIONS
The Significant change in untrained cohesion and marginal change in angle of internal friction is observed with addition of polyethylene and ferric chloride to the expansive clay.
It was noticed that when the expansive Clay was treated with 0.6% polyethylene +1% ferric chloride the CBR values are increased by 175.71% respectively when compared with untreated expansive Clay.
It was noticed that when the expansive Clay was treated with 0.6% polyethylene +1% ferric chloride the MDD values are increased by 20% respectively when compared with untreated Expansive Clay.

5. FURTHER SCOPE OF WORK
The following areas are identified as the scope of further work in this direction, based on the experience of present work.
Similar work can be done using other additives and also admixtures to arrive the optimum combination used in construction of foundation beds on expansive clay.
The reinforcement Technique can be adopted for higher load bearing capacity of the foundation beds.
The technique can also be done with a combination of chemicals like potassium chloride, ferric chloride, calcium chloride and some other fibers etc.
Advanced cyclic Tri axial tests may be conducted for further confirmation of test results.

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