

Comparative Study on Stabilization of Shedi Soil using Sulphur Sludge and Silica Fume

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Abstract

The earth has numerous characteristic sources one of them the most essential is soil. Soil has numerous attributes and numerous structures as the place fluctuates soil compose and the dirt qualities likewise change. Accordingly it is considerably more important to think about the dirt structures and qualities similar to a Geotechnical design. Shedi soil has numerous inconveniences than the other soil, as this examination manages the issues of Kham Thana town close Bidar soil. Accordingly this test work includes the examination on the engineering conduct of Shedi soil utilizing Sulphur Sludge and Silica Fume. OMC and MDD were ascertained for every one of the extents by Standard Proctor test. For UCS test treated examples (Separate and combined) were set up with the coveted OMC and MDD and kept in hermetically sealed desiccators for the curing times of 3,5,7 and 10 day and test was directed with particular the curing time frames. It has been observed that adding 20% of Sulphur Sludge with 2% of Silica Fume Separately to soil will increases the unconfined compressive strength values for 3,5,7 & 10 days. This investigation additionally reinforces the week soil by Stabilization utilizing Sulphur Sludge for building up the quality properties.

Keywords: Shedi Soil, Sulphur Sludge, Silica Fume

I. INTRODUCTION

Shedi soil has incredible fondness towards water, in rainy season when it interacts with water, it loses its quality and its shrinks in summer season. In this way it is hard to do development on such sort of soil. Shedi soil is hard, solid and permeable. At the point when Shedi soil is completely immersed, it does not have any building property. There are numerous strategy accessible to defeat such issues which requires additional cost. Soil Stabilization by changes is the best and modest strategy which can be embraced to defeat such issues.

In this examination we are utilizing Sulphur Sludge as stabilizer which is the mechanical waste. Sulphur Sludge as a rule happens in light yellow, weak and crystalline strong. It has black out trademark smell however no taste. Sulphur is exceptionally dissolvable in carbon disulphide and sparingly solvent in liquor and ether. It has low softening point (104°C). It is insoluble in water. In this investigation we are including change level of Sulphur Sludge (10%,15% and 20%).

Another stabilizer utilized as a part of this investigation is Silica Fume which is brought from Anand chemicals Hyderabad. Silica Fume has been generally utilized for motivation behind adjustment. Silica Fume is accessible in white hued powder shape. Numerous specialists reasoned that Silica Fume enhances the file properties of soil. It likewise enhances ideal dampness substance and most extreme dry thickness. It is furthermore upgrades the nature of the earth. Silica Fume is added to the dirt with a specific end goal to enhance its properties, especially compressive quality, bond quality and scraped area protection. It additionally diminishes the penetrability of Shedi soil.

II. EXPERIMENTAL DETAILS

A. Materials:

1) Shedi Soil

Shedi soil which has incredible fondness towards water causes problems during the time of construction, to avoid that the soil has to be stabilized to improve its characteristics. The soil sample was taken from Kham Thana village, 10 kilometers from Bidar, Karnataka. The sample has been taken from 10 mts below natural ground level is tabulated in table 1.

Table – 1
Shows the physical properties of clay soil

Types of Test	Values
Specific Gravity (G)	2.45
Liquid Limit (%)	28
Plastic Limit (%)	16
Plasticity Index (%)	12
OMC (%)	18
MDD (Kg/cc)	1.33
Unconfined Compressive Strength (Kg/cc)	1.08

2) Sulphur Sludge

Sulphur sludge have been brought from Vintage Industries at Bidar. Sulphur Sludge usually occurs in yellow, crystal solid. It does not have taste and faint odour. Sulphur has been used in many industries and can be used to stabilize the soil.

3) Silica Fume

Silica fume have been brought from Anand Chemicals at Hyderabad. It is smooth, white color powder. Silica fume increases strength of the soil which can be used for sub grades. It also increases OMC and MDD of soil.

Table – 2
Shows the physical properties of Silica Fume

Sl No	Parameters	Test value
1	Silica As SiO ₂ , % by mass	89.8
2	Total Sulphur Content as SO ₃ , % by mass	0.56
3	Lime as CaO, % By mass	7.87
4	Magnesia as MgO, % by mass	4.04
5	Alumina as Al ₂ O ₃ , % by mass	Nil
6	Iron Oxide as Fe ₂ O ₃ , % by mass	Nil

B. Preparation of Sample

Eleven extents of the soil sample were readied 10% SS +Shedi soil, 15% SS + Shedi soil, 20% SS+ Shedi soil, 1% SF+ Shedi soil, 2% SF+ Shedi soil, 10%SS+1%SF+Shedi soil, 10% SS+ 2% SF+ Shedi soil, 15% SS+1% SF+ Shedi soil, 15% SS+2% SF+ Shedi soil, 20% SS+1% SF + Shedi soil and 20%SS+2%SF+Shedi soil. At that point UCS example were made for each extent and kept for curing time of 3, 5, 7 and 10 days, in a hermetically sealed desiccators, at that point test were directed regarding curing periods.

C. Experimental Work

Following tests were carried out specific gravity test, moisture content test, atterberge limits where carried out for only Shedi Soil, standard proctor test, unconfined compressive test.

III. RESULT AND DISCUSSIONS

A. OMC and MDD Results for Treated for Different Blending Proportions of the Soil

Table – 3
Describing result for OMC and MDD for varying percentage of Sulpur Sludge and Silica Fume.

SL No	Description	OMC (%)	MDD (g/cc)
1	Shedi soil	18	1.33
2	1% SF + Shedi soil	6.1	1.51
3	2%SF + Shedi soil	9.2	1.54
4	10% SS+ Shedi soil	12.6	1.46
5	15%SS+Shedi soil	12.7	1.41
6	20%SS+Shedi soil	20.6	1.37
7	10%SS+1%SF+Shedi soil	17.8	1.28
8	10%SS+2%SF+Shedi soil	19.1	1.3
9	15%SS+1%SF+Shedi soil	16.4	1.32
10	15%SS+2%SF+Shedi soil	17	1.35
11	20%SS+1%SF+Shedi soil	17	1.5
12	20%SS+2%SF+Shedi soil	25	1.6

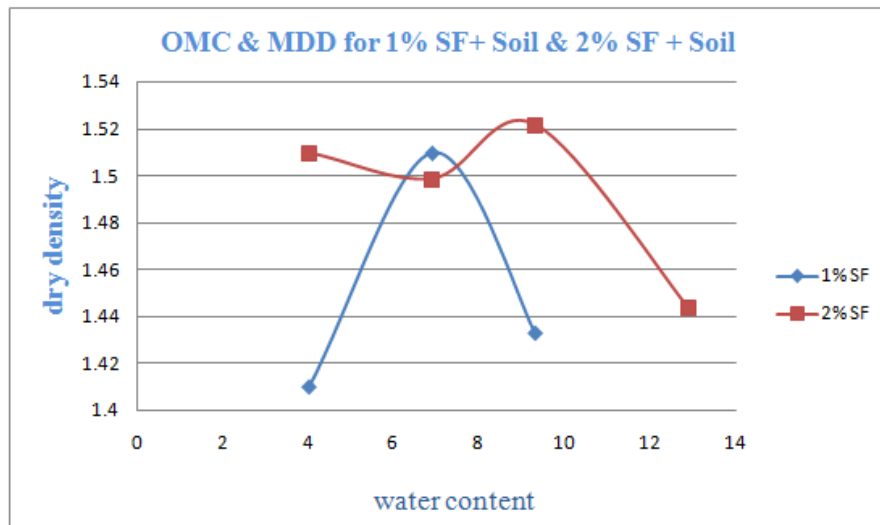


Fig. 1: indicating the results for Comparison of OMC for different % of Sulphur Sludge and Silica Fume.

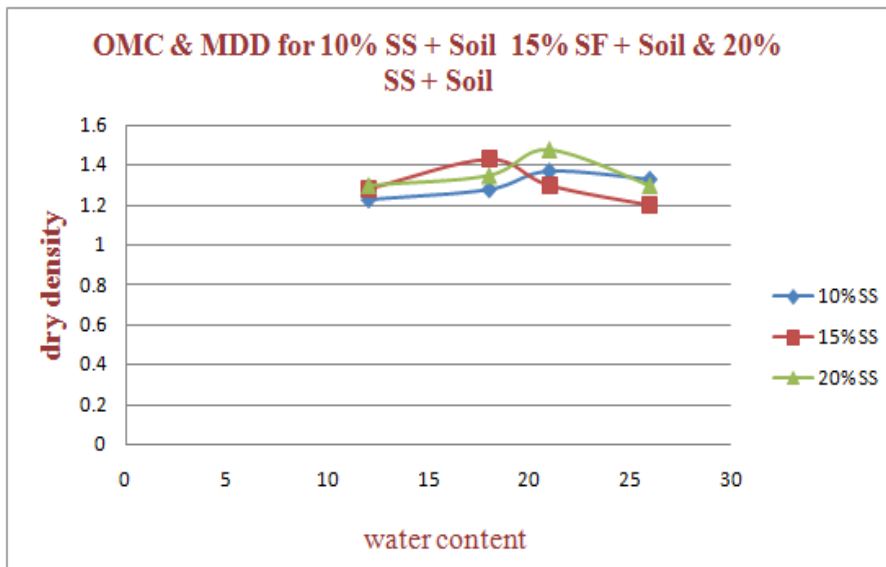


Fig. 2: indicating the results for Comparison of MDD for different % of Sulphur Sludge and Silica Fume.

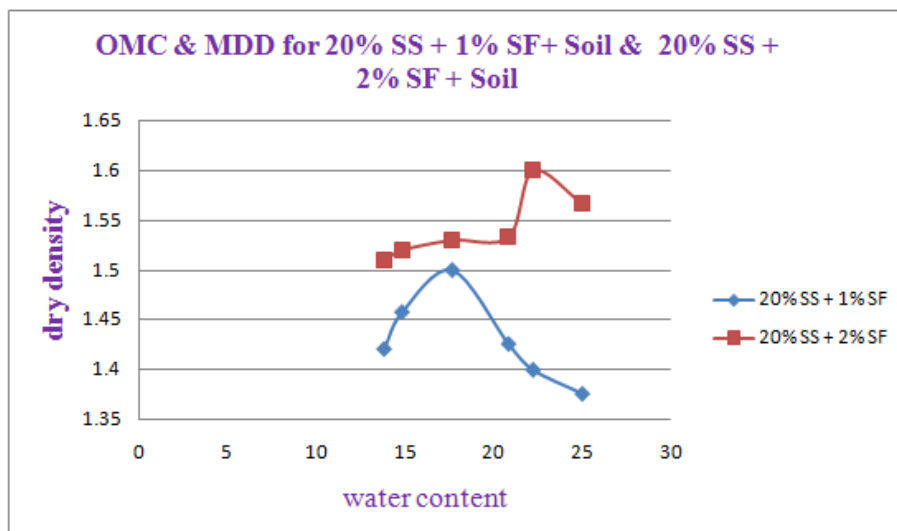


Fig. 3: indicating the results for Comparison of MDD for different % of Sulphur Sludge and Silica Fume.

From the above results and graph, the behavior of OMC and MDD for different proportion of soil sample can be observed due to the following reason.

Silica fume is generally used to alter the properties of the soil. When silica fume separately mixes with shedi soil with vary percentages, OMC increases linearly and MDD increases. When Sulphur Sludge mixes separately with shedi soil with vary percentages, it indicates that OMC increases but MDD decreases. By combing both Sulphur sludge and Silica fume and mixing with shedi soil with vary percentages, it indicates that both OMC and MDD both increases.

B. Unconfined Compressive Strength Test Results

Table – 4

Showing the results of unconfined compressive strength of Shedi Soil with different proportion of Sulphur Sludge and Silica Fume.

SL NO	Proportions	UCS for DIFFERENT CURING PERIODS (Kg/cm ²)			
		3	5	7	10
1	1% SF + Shedi Soil	1.059	1.12	1.18	1.25
2	2% SF + Shedi Soil	1.08	1.16	1.27	1.32
3	10% SS + Shedi Soil	1.22	1.26	1.35	1.42
4	15% SS + Shedi Soil	1.30	1.38	1.47	1.53
5	20% SS + Shedi Soil	1.52	1.63	1.76	1.88
6	10% SS+ 1% SF + Shedi Soil	1.45	1.56	1.72	1.85
7	10% SS + 2% SF + Shedi Soil	1.54	1.65	1.77	1.92
8	15% SS + 1% SF + Shedi Soil	1.70	1.83	1.95	2.02
9	15% SS + 2% SF + Shedi Soil	1.82	1.95	2.04	2.12
10	20% SS + 1% SF + Shedi Soil	1.97	2.08	2.16	2.24
11	20% SS + 2% SF + Shedi Soil	2.02	2.15	2.26	2.45

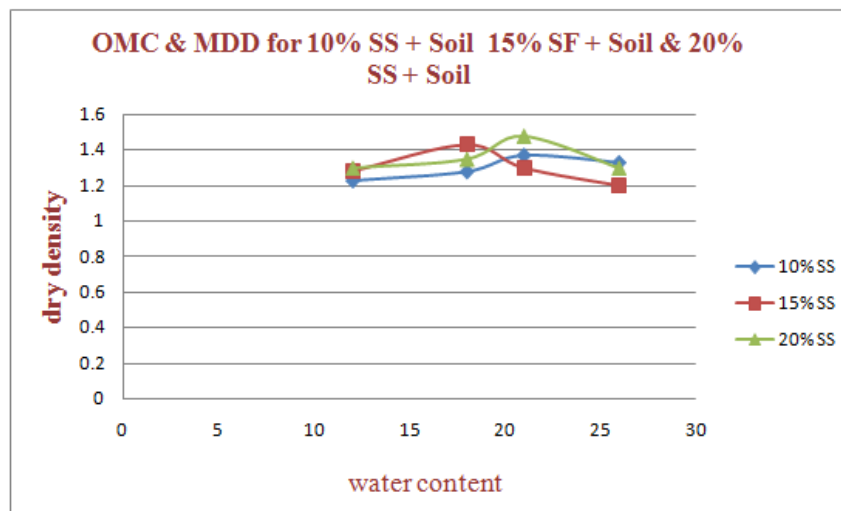


Fig. 4: indicating the results for Comparison of UCS for varying % of Sulphur Sludge and Silica Fume.

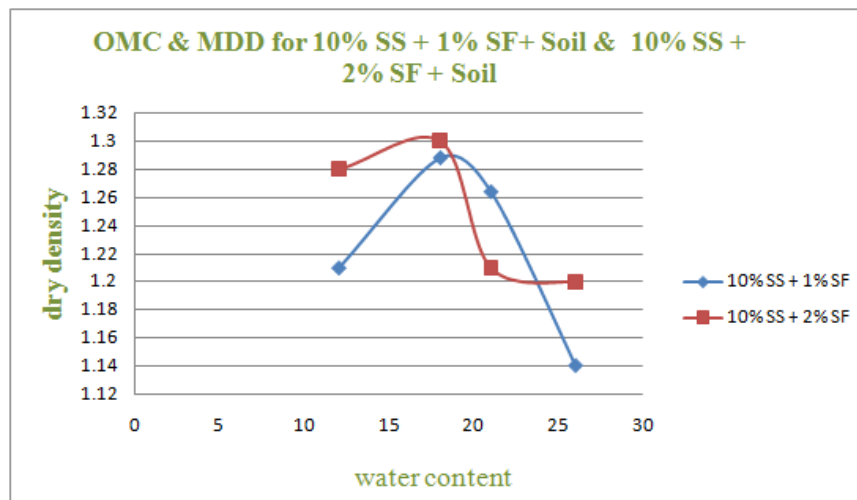


Fig. 5: indicating the results for Comparison of UCS for varying % of Sulphur Sludge and Silica Fume.

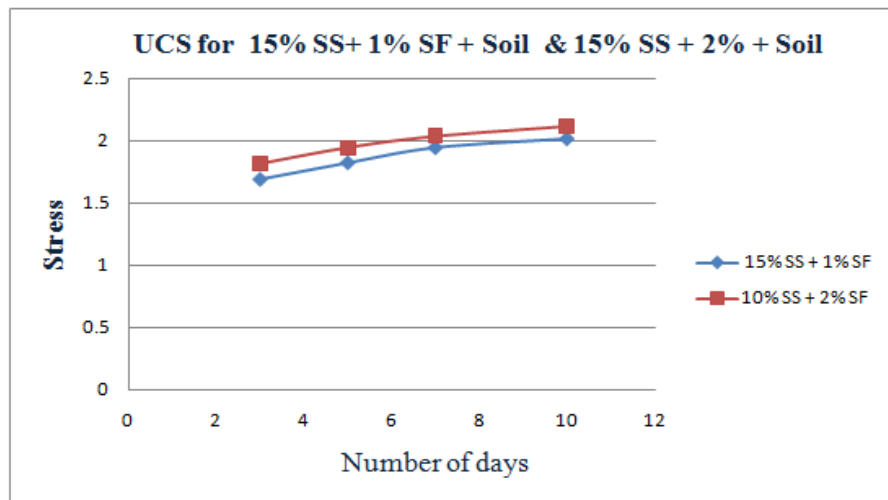


Fig. 6: indicating the results for Comparison of UCS for varying % of Sulphur Sludge and Silica Fume.

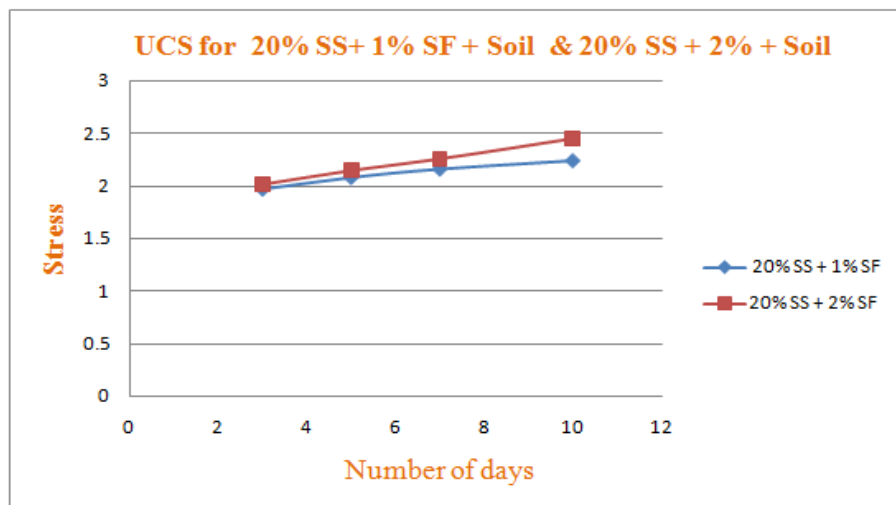


Fig. 7: indicating the results for Comparison of UCS for varying % of Sulphur Sludge and Silica Fume.

Graph shows the results comparing for unconfined compressive strength for maximum values of compressive strength obtain for different proportion of Sulphur sludge and Silica fume. From above results its shows that Shedi soil treated with 20% of Sulphur Sludge with 2% of Silica fume will give maximum value for compressive strength.

The above figures shows the unconfined compressive strength of treated Shedi soil with Sulphur sludge and Silica fume respectively with varying percentages and with Sulphur Sludge optimum value with varying Silica Fume percentage.

In this study Shedi soil has been stabilize with various percentages of Sulphur Sludge and Silica Fume, it has been kept for 3,5,7 & 10 days on a air tight desiccators. Results indicated that unconfined compressive strength is maximum for 20% Sulphur Sludge with 2% Silica Fume when added to shedi soil

IV. CONCLUSION

- Addition of Silica Fume and Sulphur Sludge to Shedi Soil (Separate & Combined) can decreases optimum Moisture Content and increases Maximum Dry Density to certain limit.
- Addition of Silica Fume and Sulphur Sludge to Shedi Soil (Separate & Combined) increases the strength for 20% of Sulphur Sludge and 2% Silica fume (Separate & Combined).
- This study concluded that weak Shedi soil can be strengthen by stabilizing the soil with stablizers Silica fume and Sulphur Sludge

Laboratory tests were conducted to study the effect Sulphur Sludge and Silica Fume on Shedi soil. The soil was tested, to know optimum moisture content, maximum dry density and unconfined compressive strength by treating with silica fume and sulphur sludge decreases optimum moisture content and increases maximum dry density (separate & combined). Unconfined compressive strength of different proportion of soil with curing period 3,5,7 & 10 days increases, with increase in the percentage of Silica Fume and Sulphur Sludge. Shedi Soil stabilized with 20% SS + 2% SF gives the maximum strength on the 10th day of curing

V. FUTURE SCOPE

Following are recommendation for future study

- 1) For high accuracy of results, work is carried out for big proportions of glass Silica Fume.
- 2) Stabilizing of shedi soil with combination of Sulphur Sludge and GGBS also be carried out for best results.
- 3) Treating Shedi soil with Silica Fume along with other chemicals (NAOH, NACL, NA₂SO₄).
- 4) UCS test should carry out for some higher days of curing for knowing strength behavior of soil.

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