GE-International Journal of Engineering Research
Vol. 4, Issue 1, Jan 2016 IF- 4.007 ISSN: (2321-1717)

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SOLID WASTE STABILISATION WITH PHOSPHOGYPSUM IN ADDITION TO FLYASH

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ABSTRACT

Since ancient times, a number of stabilization methods are used to improve the properties of the solid waste. Various studies were carried out on expansive grounds after stabilization with additives such as cement, lime, cement kiln dust, rice etc., which showed promising results. Now-a-days easily available industrial by-products are used for the enrichment of solid waste properties. In the present study, the effects of stabilizing agents such as Phosphogypsum (PG) and fly ash (FA) have been studied for improving strength in varying percentages. This article He describes a study to verify the improvements of land ownership with phosphor gypsum in various percentages(That is, 2, 4 and 6%) with the fixed quantity of fly ash (5%). The unconfined compression test (UCC) and the microstructure analysis the plot with different percentages of additives were determined separately after curing the samples for 3 days and 7 days. Strength of stabilized solid waste is increased with increased amount of stabilizer and care periods.

Keywords— Solid waste, Fly ash, Stabilization, Phosphogypsum

I. INTRODUCTION

Expansive solid wastes had been a difficult task for civil engineers in the design and construction of infrastructure projects. The big problems with the clay, including low and high strength compression, can cause serious damage to the civil engineering structures and can lead to very serious economic losses and environmental risks. Thus, these solid wastes must be treated before starting the operation of construction to get desired properties. This has led to the development of the solid waste stabilization techniques. Since the nature and properties of natural solid waste vary widely, a stabilization technique has adequate to be adopted for a particular situation after having considered the solid waste properties. The chemical technique is common ground, stabilization approach, producing a better solid waste quality with greater strength and durability than the mechanical and physical techniques. In many countries of the world, it is to stabilize solid waste especially if you have done the natural resources available locally / industry is available. The use of Phosphogypsum (PG) fly ash(FA) in solid waste stabilization can lead to the construction at low cost and Can provide a means of low environmental impact of their offer Distribution and technical characteristics of the land to improve.

Phosphogypsum is a by-product of the wet process Production of phosphoric acid (phosphates of ammonium
Fertilizer) per share of sulphuric acid on the rocks Phosphates. Ash is one of the residues Generated during the Combustion of Coal powder from the combustion chamber is transported by the exhaust gases. The fly ash is used principal elements, as a stabilizer considering its potentials as construction Pozzolan. In this work, the Study to investigate the force and the microstructure of the clay joined Tata with unconfined Compressive strength test and scanning electron microscope (SEM).

II. LITERATURE REVIEW

Solid wastes with remarkable plasticity can shrink and swell substantially varying conditions of humidity. These changes in volume may cause a reduction in the density and solid waste resistance, with a consequent increase in the potential of gravity. There is a considerable history of use of the solid waste stabilization additives to improve performance by controlling solid waste change the volume and the increase in strength. A number of They were established innovative techniques for the construction on this type of terrain. FA and lime are effective in stabilizing expansive grounds for the construction of road base, substrate and banks [1]. A combination of fly ash and rice husk ash (RHA) can stabilize the solid waste black cotton [2]. On the basis of the CBR and UCS tests, the optimum amount of FA and RHA were found to be respectively 12% and 9%. Studies on background solid waste treated with rice husk and lime showed an increase CBR strength and value with increased curing time [3]. The investigations were carried out on the microstructure and strength lime and cement stabilized clays which show that the development of resistance concerns the micro structural changes, increase in hardening time and the admixture content [4]. The micro structural changes in clay cement-stabilized can improve force which can be explained with reference to influential factors, namely, cement content, water content of clay, fly ash content and hardening time [5]. The compressive strength was not confined used as a practical indicator to investigate the force development.

III . OWNERSHIP ' OF THE MATERIALS AND METHODS

The solid waste samples used in this survey were collected in a depth of 60 centimetres below the level of the solid waste in an excavation open after removal of the top solid waste. The various laboratory tests made of virgin land for geotechnical characteristics in accordance with Bureau of Indian Standards (BIS) include: Sieve analysis, Atterberg limits, specific gravity, Proctor compaction, swelling index and free Unconfined Test of resistance to compression. The results obtained are reported in Table 1. Phosphogypsum (PG) and fly ash (FA) have been used as stabilizers to improve the properties of the solid waste. Based on limit, plasticity index and liquid limit retirement both land are classified as expansive solid wastes (IS: 1498-1970). The chemical substance the composition of solid waste samples, phosphogypsum and fly ash are shown in Table 2. To determine the effect of stabilizers solid waste samples, various percentages of PG (2, 4 and 6%) and fixed amount of FA (5 %) were mixed with the ground.

Table-1

GEOTECHNICALPROPERTIESOFVIRGINSOLID WASTESAMPLES

Property		Value	
		Solid waste -S1	Solid waste -S2
Specific Gravity		2.42	2.65
Grain size distribution	Sand,%	2.00	2
	Clay,%	28	32
	Silt,%	70	67
Liquid Limit,(%)		81.2	71
Plastic Limit,(%)		42	36
Plasticity Index, (%)		40.3	38
Solid waste classification		CH	CH
Shrinkage Limit,(%)		7.74	5.2
Free Swell Index,%		124	104
Maximum Dry Density,g/cc		1.4	1.52
Optimum moisture content,%		24.63	19.62
Unconfined compressive strength, kPa		72	114

Table-2

CHEMICALCOMPOSITIONOFSOLID WASTESAMPLES, PHOSPHOGYPSUM ANDFLYASH

Name of the chemical	Symbol	% by weight			
		Solid waste - S1	Solid waste - S2	PG	FA
Insolubleresidue	IR	82.94	63.30	4.92	39.30
Loss onignition	LOI	12	16.25	16.5	2.74
Sulphurtrioxide	SO_3	0.12	0.22	44.56	4.21
Silica	SiO_2	52.36	55.84	3.80	35.20
Calciumoxide	CaO	3.54	1.17	32.27	19.20
Magnesiumoxide	MgO	0.73	0.60	---	1.73
Alumina	Al_2O_3	13.79	15.77	---	27.40
Ferricoxide	Fe_2O_3	8.76	6.92	---	6.83

IV . SAMPLE PREPARATION AND TEST METHODS

For Unconfined compressive strength test, samples of 38in diameter and 76 mm height mm were prepared for compaction the samples at their optimal moisture content and maximum dry density to maintain the same dry density and water content using mold division. For virgin solid waste testing was performed immediately after sample preparation. For solid waste treated with phosphogypsum and fly ash samples prepared they were placed in polythene covering which have been treated with covering them with wet jute bags. Samples prepared for UCS test were cured for 3 and 7 days and at the end of each hardening period, the samples were tested until fracture. All samples were tested at a speed of axial deformation of 1.2 mm for minute second IS: 2720- (Part X).

V. DISCUSSION OF TEST RESULTS

To study the effect of fly ash and various percentages of phosphogypsum on land S1 and S2, tests were UCS performed on solid waste samples prepared in their MDD reached in the test of compaction, after the period of maturation of 3:07days. Stress - deformation behaviour of untreated and treated solid waste samples S1 and S2 for different periods of aging are presented in Fig.1 and 2 respectively.

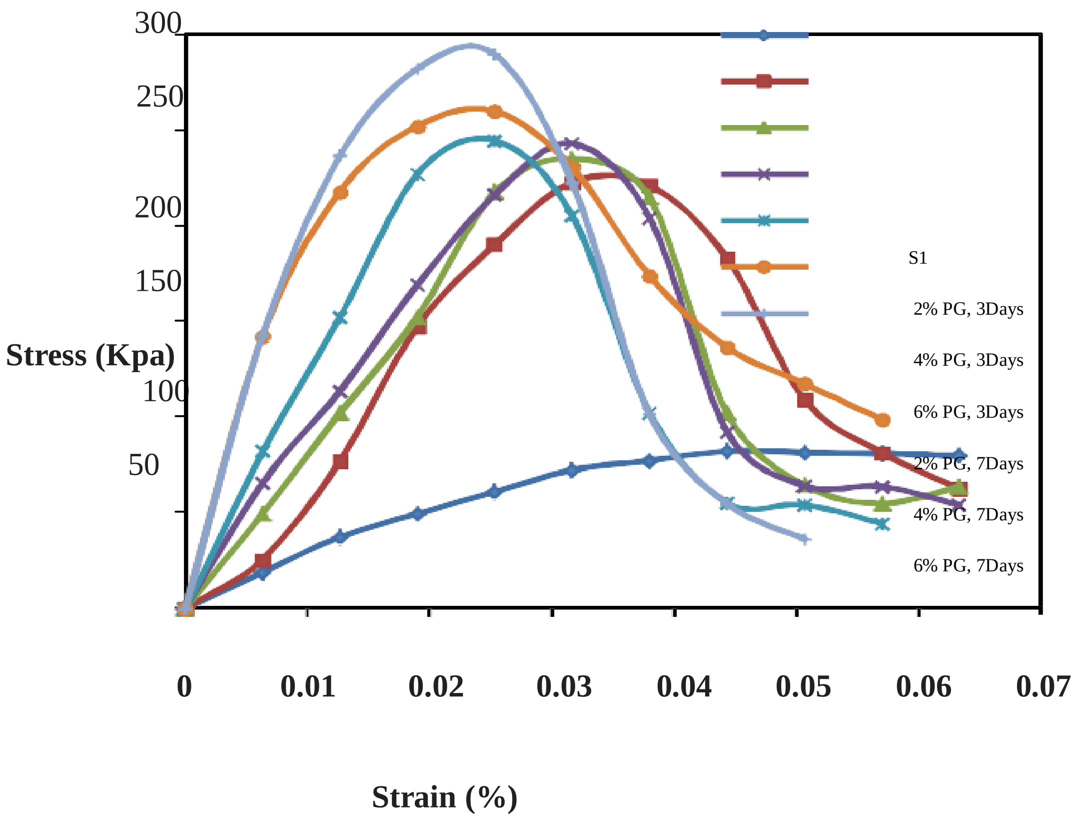


Fig. 1. Comparison of stress-strain behaviour of treated and untreated solid waste S1 with different percentages of stabilizer (Fly Ash: 5%+PG %).

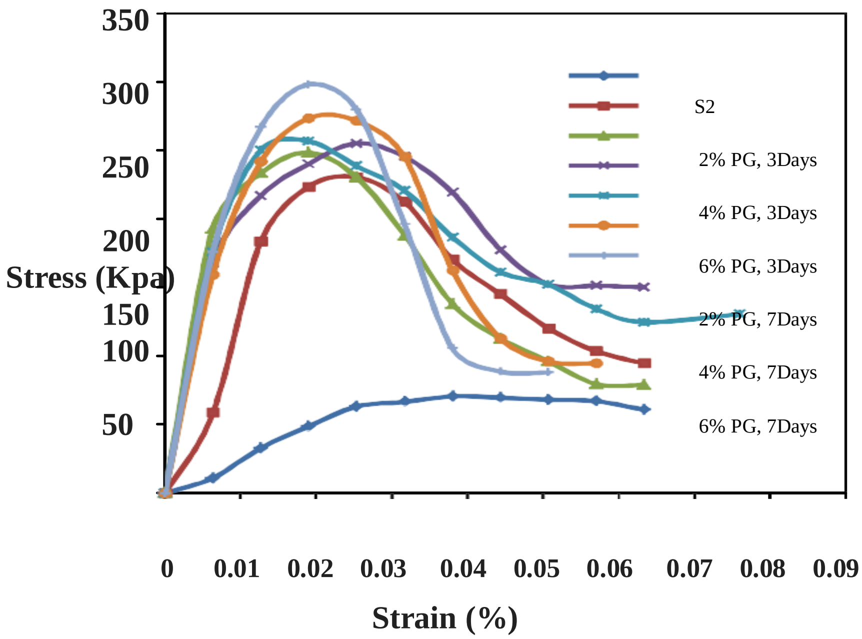


Fig. 2. Comparison of stress-strain behaviour of the solid waste treated and untreated S2with different percentages of stabilizer (fly ash : 5 % PG + %)From the test results it can be observed that there is a increased stress with the addition of fly ash and various percentages of phosphogypsum for both land and S2 . S1This trend was observed for both the curing period studied .From Fig .1, it can be observed that stress is increase rapidly and reached the peak at a particular strain for treated ground. For the solid waste is not treated , the peak voltage is reached at0.044 % deformation , while for the treated solid waste sample the peak stress was observed in less deformation of the 0.031 % and 0.025 % for periods of care of 3 and 7 days . The same behaviour was observed for S2 terrain that can be observed in Fig.2 .the increase value for UCS treated solid waste is compared ground untreated S1 and S2 and ' increase in the values of UCS various conditions studied are shown in table 3 - .

TABLE –3

COMPARISONBETWEENPEAKUCSOFTREATEDSOLID WASTEAND UNTREATEDSOLID WASTE

Solid waste + % PG+ %FA	UCS Value (kPa)			
	SampleS1		SampleS2	
	3days	7days	3days	7days
Solid waste + 0% PG+0%FA	75.41		112	
Solid waste + 2% PG+5%FA	204.9	224.9	240.6	268.1
Solid waste + 4% PG+5%FA	216.3	239.0	259.5	285.4
Solid waste + 6% PG+5%FA	223.5	266.5	266.5	292.1

The increase of the minimum UCS value was 1.72 times that of untreated solid waste to the stabilizer (FA: 5% + PG2%)Besides = 2%, seasoning period = 3 days in solid waste S1 but for the solid waste 2the increase is 2.25 times that of untreated solid waste. The UCS value increases linearly with increasing stabilizer content and was independent of the type of solid waste, S1 and S2 (Fig.3.)

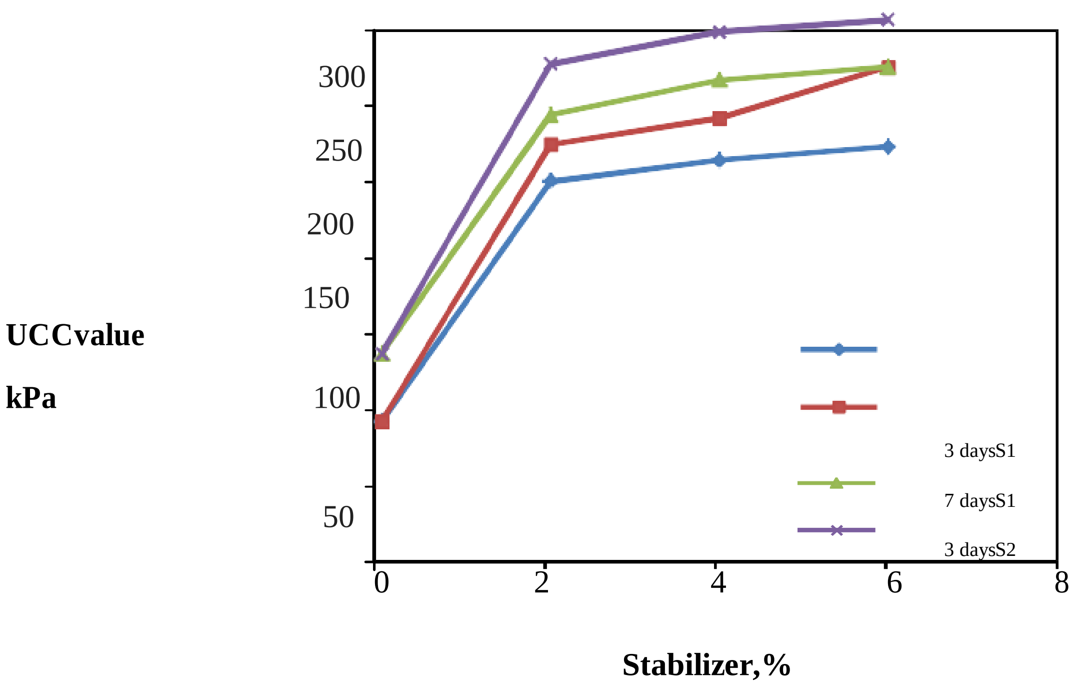
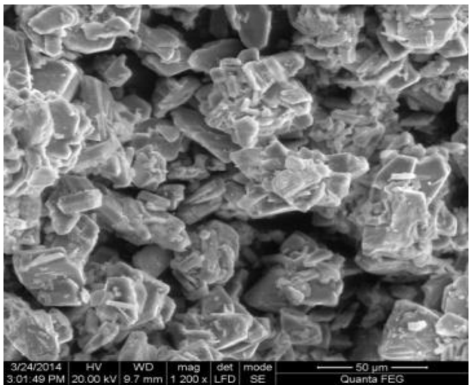


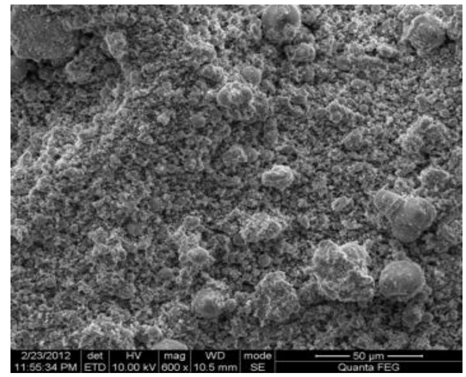
Fig. 3. Change in value UCS with the addition of a stabilizer on solid waste S1and S2 (FA: 5%)

VI. ANALYSIS MICROSTRUCTURAL

The technique scanning electron microscope was It employed using a microscope FEI Quanta 200 FEG qualitatively identify developments in micro structure matrix solid waste, fly ash, phosphogypsum and treated solid waste specimens. Fig. 4:05 shows micro structure stabilizers (eg. phosphogypsum and fly ash) and solid waste (Eg. Virgin solid waste and treated solid waste). (A) Phosphogypsum (b) fly ash

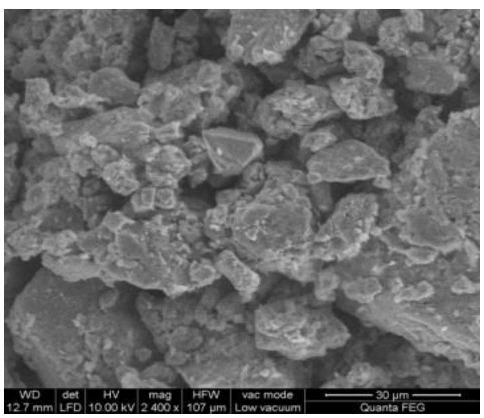
Fig. 4. SEM picture of stabilizers

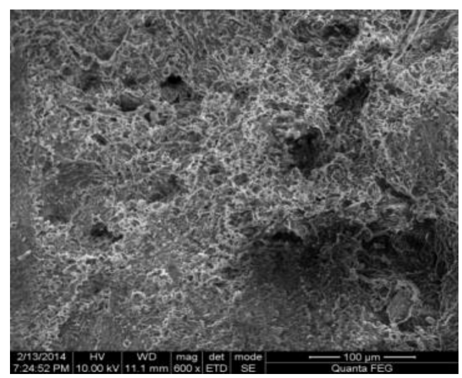




(a) Phosphogypsum (b) Fly ash

Fig. 4. SEM photos of stabilizers





(a) SEM photos of virgin solid wasteS2 (b) SEM photo of treated sampleS2

(6% PG & 5%FA)

Fig. 5. SEM photos of treated and untreated solid waste sampleS2

(A) SEM pictures of virgin land S2 (b) SEM picture of the treated sample S2 (6% 5% PG & FA)

Fig. 5. SEM picture of solid waste samples treated and untreated S2It can be observed from Fig. 4 and 5, the samples studied through SEM have very different micro structures. When fly ash and phosphogypsum are in contact with the water, pozzolanic reaction between fly ash and gypsum begins. Due to these pozzolanic reactions occurring during vulcanization period, the strength of solid waste treated with FA and PG is greatly improved.

VII. CONCLUSION

Based on experimental investigations conducted and the analysis of test results, the following conclusions are drawn. Strength of stabilized solid wastes increased with increasing amount of phosphogypsum in addition to the fly ash content of 5%.The aging of the mixture is a measure of how government the chemical reaction of stabilizers is depended on it. So you canconclude that the resistance increases with increase in the period of curing. Unconfined compressive strength of the treated solid wastes was superior to that of untreated solid wastes. The minimum increase is01.72 and 2.25 times for the solid waste S1 and S2 of adding 5% fly ash and 2 % phosphogypsum in a seasoning of 3 days. The addition of the combination of PG with FA stabilizer brands solid waste mixes durable, low cost and effective for solid waste stabilization.

Acknowledgement:

I am thankful to Analytical Research Laboratory which is MoEF, NABL, ISO Certified laboratory to provide all infrastructure and support.

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