A STUDY ON SOIL STABILIZING ADMIXURES:REVIEW

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ABSTRACT-*This paper consists of literature survey on stabilization of soil using lime, cement, Fly ash and Rice Husk Ash. India is a place of geographical diversity having different soil in different areas. So to improve those areas having poor bearing capacity stabilization technique is used. Both mechanical and chemical stabilization methods are used for the improvement of soil strength. In mechanical method, some machines are used for digging the soil and some other type of soil mixed with poor soil in required quantity. After properly mixing of the soil, spread it by machine and compacted with machine up to required strength. In chemical methods soil mixed with chemical compounds like lime, cement, fly ash and Rice Husk Ash. Though cement is capable of stabilizing a wide range of soil types, it is most effective in sandy soil, sand with silt soil, and clay soil having plasticity range low to medium. Lime is primarily use for clay soil having high plasticity.*

Key Words: RICE HUSK ASH, FLYASH,LIME, STABILIZATION

1.INTRODUCTION

SOIL STABILIZATION:

Soil stabilization is the alteration of one or more soil properties to create an improved soil material possessing the desired engineering properties.

Advantages of Soil Stabilization

- Improves soil strength
- Helps to reduce soil volume change due to temperature or moisture
- Improves soil workability
- Reduce dust in work environment
- Improves durability

Soil available in nature is very useful for both agriculture and engineering purpose. For engineering point of view, soil plays different roles in the construction of building, highway, railway, airport, harbor, etc. as foundation material. According to the type of soil, strength differs, in case soil having the low strength for the particular structure at the site it is required to improve the strength of soil by using stabilization technique. Before doing soil stabilization identify the goals of soil stabilization, select the appropriate type and amount of stabilizers. Evaluate the material properties and field performance to ensure the designed goals of soil stabilization to be achieved. Goals of soil stabilization consist of dry up the construction site and provide a working platform, reduce plasticity index (PI) of soil, improve soil density, reduce shrink or swell characteristics of the soil, improve strength and stability of soil, reduce moisture susceptibility and utilize local materials. Many clayey soils have a potential to shrink and swell with the variation in moisture content. The resulting volume changes in the soil can be unfavorable to any structures built on such soil . A number of stabilization methods have been used to control this shrink/swell behavior and thus prevent the potential damage.

Soil stabilization is an economical and environmental friendly process for altering both chemical and mechanical behavior of soil via pozzolanic reaction . For many years, researchers in this domain have concentrated their efforts on soil stabilization through the utilization of a range of additives including cement, lime, industrial waste products, fly ash, Rice Husk Ash. Chemical stabilization of the soil using lime, cement, fly ash, Rice Husk Ash and their combinations is very common nowadays. Among them lime is the most widely used admixture as they form cementing products which bonds the clay particles thereby reducing the plasticity, shrinkage, swelling and improve the strength characteristics .Main objective of this research study was to compare different stabilizing agents like Lime, cement, Fly ash and Cement in pavement construction.

2. LITERATURE REVIEW

Pandianet.al. (2002). Studied the effect of two types of fly ashes Raichur fly ash (Class F) and Fly ash by itself has little cementations value but in the presence of moisture it reacts chemically and forms cementations compounds and attributes to the improvement of strength and compressibility characteristics of soils. It has a long history of use as an engineering material and has been successfully employed in geotechnical applications.

Phanikumar and Sharma (2004): A similar study was carried out by Phanikumar and Sharmaand the effect of fly ash on engineering properties of expansive soil through an experimental programme. The effect on parameters like free swell index (FSI), swell potential, swelling pressure, plasticity, compaction, strength and hydraulic conductivity of expansive soil was studied. The ash blended expansive soil with fly ash contents of 0, 5, 10, 15 and 20% on a dry weight basis and they inferred that increase in fly ash content reduces plasticity characteristics and the FSI was reduced by about 50% by the addition of 20% fly ash. The hydraulic conductivity of expansive soils mixed with fly ash decreases with an increase in fly ash content, due to the increase in maximum dry unit weight with an increase in fly ash content.

Bhuvaneshwari et al., (2005) studied the effect of fly ash on soil. Authors increase the fly ash content from 0 to 50%. The soil has Liquid Limit 30%, Plastic Limit 18%, Plasticity Index 12%, Dry Density 18.04 KN/m3 and Unconfined compressive strength 2697KN/m2. The Dry Density was continuously decreases and15.13KN/m3 at 50% of fly ash. Unconfined compressive strength is also decreases and becomes 1176KN/m2 for 50% of fly ash.

Brooks (2009) stabilized expansive soil of CH type. Author uses Fly ash and Rice Husk ash (RHA) to stabilize the soil. O.M.C and M.D.D of untreated soil is 20% and 15.5 kN/m3 respectively. In stress strain graph of unconfined compressive strength.

it is clearly shown that failure stress and strain increased by 106% and 50% respectively when the fly ash content was increased from 0 to 25%. When the RHA content was increased from 0 to 12%, unconfined compressive stress increased by 97% while CBA improved by 47%. Author concluded that 12% of RHA and 25% of fly ash is used for strengthening the expansive sub grade soil. Based on laboratory test 15% of fly ash was mixed with RHA to form a swell reduction layer.

Muntoharet.al (2013) Conducted laboratory tests to evaluate the engineering properties of silty soil stabilized with lime, waste plastic fibers and rice husk ash. They have conducted CBR, UCS shear strength test to find out the strength of stabilized soil. From the test results, they have concluded that the proposed methodology is very effective for improving the engineering properties the clayey soil.

Ms. Aparna Roy has presented a study which gives details about soil which is stabilized with different percentages of Rice Husk Ash and a small amount of cement. The results obtained show that the increase in RHA content increases the Optimum Moisture Content but decreases the Maximum Dry Density. Also, the CBR value and Unconfined Compressive Strength of soil are considerably improved with the Rice Husk Ash content.

Jan and Walker (1963) and Wang et al. (1963)stated that the reduction in soil plasticity is maintained in the second stage (because of cementitious formation). Bell (1996) investigated the effects of lime addition on the engineering properties of clay minerals. Three clay mineral deposits, namely, montmorillonite, kaolinite and quartz, were considered in this study. He found that after lime treatment, the liquid limit of montmorillonite decreased, whereas those of kaolinite and quartz increased. Parsons et al. (2001) used five types of soils to evaluate the mixing procedure of soil modification using lime. In their study, the soil was mixed with 2.5 and 5.0% lime and the results showed that the liquid limit decreased with increasing lime content, together with the decrease in plastic limit and plasticity index.

3. MATERIALS AND METHODS

SOIL

In this report different types of soils are taken to improve their Plasticity and strength characteristics . There are three basic types of soil naturally occurring in this area: sand, silt and clay. Clay soils are generally classified as "expansive. “ This means that a given amount of clay will tend to expand (increase in volume) as it absorbs water and it will shrink (lessen in volume) as water is drawn away. The effects can be dramatic if expansive soils supporting structures are allowed to become too wet or too dry.

RICE HUSK ASH

Rice husk ash is especially produced from rice milling after milling the paddy 78% of the total weight is received as rice, broken rice and bran, while the remaining 22% is received as husk. This husk is employed as fuel for rice miller and thus rice husk ash is produced. The rice husk ash contains about 85% to 90% silica, this is often why rice husk ash is that the best replacement of silica, also approximately 108tons of rice husk ash is produced annually this is often very dangerous to the environment because it tends to occupy space within the landfills and may cause damage to the paddy lands if not managed properly, this is often one more reason of using rice husk ash in soil stabilization

CEMENT

A cement may be a binder, a substance that sets and hardens and may bind other materials together. The word "cement" traces to the Romans, who used the term opus caementicium to explain masonry resembling modern concrete that was made up of gravel with calcium oxide as binder. The volcanic ash and pulverized brick supplements that were added to the calcium oxide , to get a hydraulic binder.

LIME

Lime provides an economical way of soil stabilization. Lime modification describes an increase in strength brought bycation exchange capacity rather than cementing effect brought by pozzolanic reaction. In soil modification, as clay particles flocculates, transforms natural plate like clays particles into needle like interlocking metal line structures. Claysoils turn drier and less susceptible to water content changes. Lime stabilization may refer to pozzolanic reaction in which pozzolana materials reacts with lime in presence of water to produce cementitious compounds. The effect can be brought by either quicklime, CaO or hydrated lime, Ca $(OH)_2$. Slurry lime also can be used in dry soils conditions where water may be required to achieve effective compaction. Quicklime is the most commonly used lime;

FLYASH

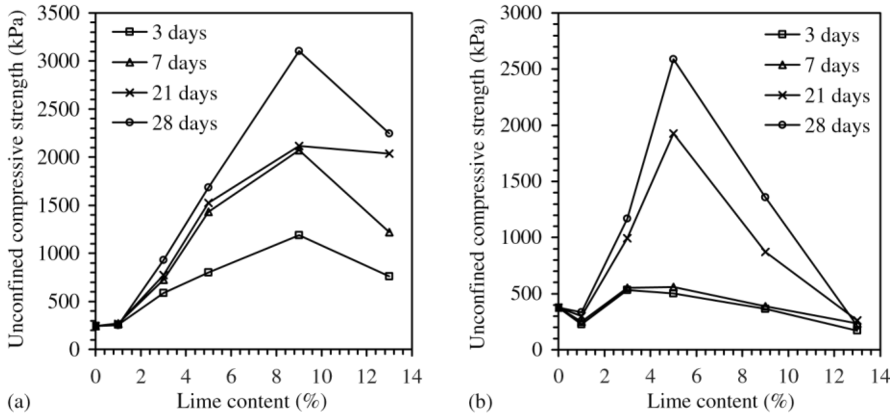
Fly ash is a byproduct of coal fired electric power generation facilities; it has little cementitious properties compared to lime and cement. Most of the fly ashes belong to secondary binders; these binders cannot produce the desired effect on their own. However, in the presence of a small amount of activator, it can react chemically to form cementitious compound that contributes to improved strength of soft soil. Fly ashes are readily available, cheaper and environmental friendly. There are two main classes of fly ashes; class C and class F .Class C fly ashes are produced from burning sub bituminous coal; it has high cementing properties because of high content of free CaO. Class F fly ashes are produced by burning anthracite and bituminous coal; it has low self-cementing properties due to limited amount of free CaO available for flocculation of clay minerals and thus require addition of activators such as lime or cement. The reduction of swell potential achieved in fly ashes treated soil relates to mechanical bonding rather than ionic exchange with clay minerals.

METHODS

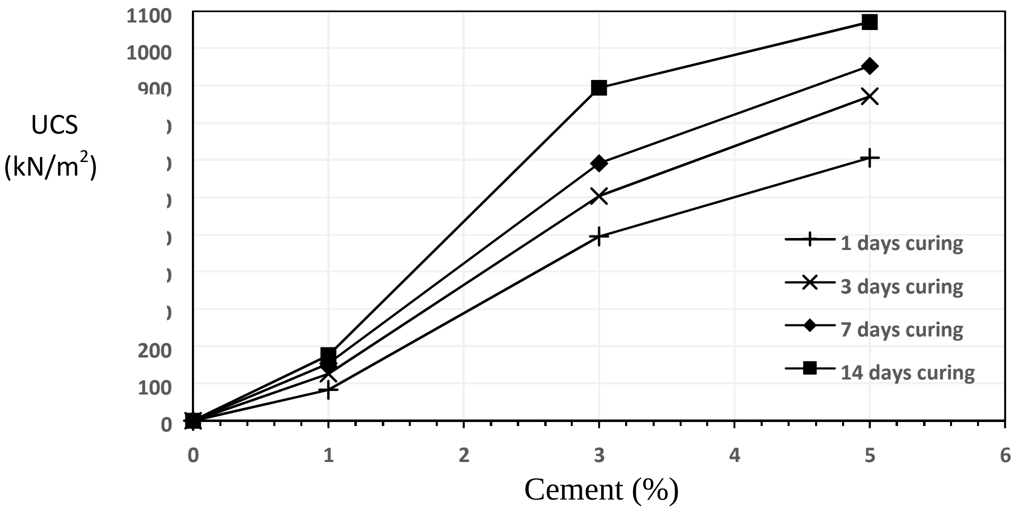
The laboratory tests that are carried out on the natural soil include particle size distribution, compaction, Atterberg limits, and unconfined compressive strength. The specimens required unconfined compressive strength tests will be prepared at the maximum dry densities and optimum moisture contents. The soil should be free from organic matter, pebbles and large stones. The dried and pulverized soil passing through I.S. 4.75 mm is taken for the test.

4. DISCUSSION

- With addition of lime in different percentages like 2%,4%,6%,8%,10%,12% to the expansive soil and residual soil, the unconfined compression strength is calculated[12] . The results are as follows



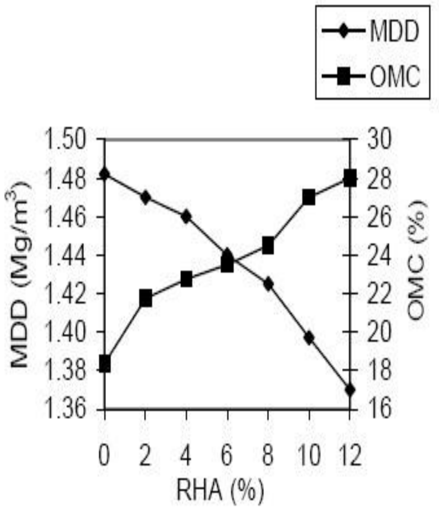
- With addition of cement in different percentages like 1%,2%,3%,4% to the soil and cured 14 days to compare UCS value in different days, the unconfined compression strength is calculated[11].

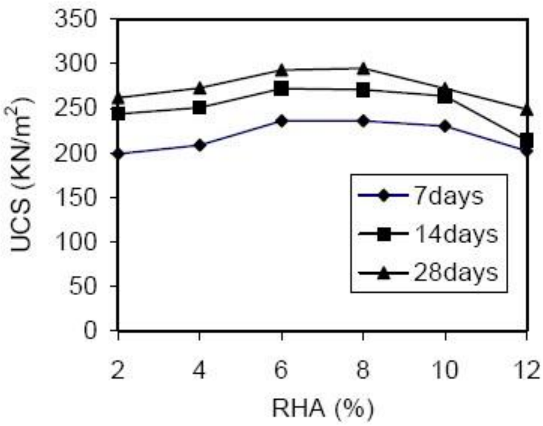


- With addition of fly ash in different percentages like 0%,5%10%,15%,20%, to the soil, the Atterberg limits, Standard compaction test, Unconfined compression strength are calculated[1]. The results are as follows

S.NO	Flyash Added(%)	Liquid Limit(%)	Plastic Limit(%)	MDD (g/cc)	Average OMC(%)	Specific Gravity	Unconfined Compressive Test(kg/cm^2)
1.	0	21.42%	20.65%	1.81	7%	2.73%	0.395
2.	5	15.38%	17.29%	1.73	7%	2.47%	0.418
3.	10	21.8%	12.46%	1.63	7%	2.03%	0.452
4.	15	24.3%	11.32%	1.59	7%	2.21%	0.905
5.	20	31.2%	11.20%	1.60	7%	2.21%	0.498

- With addition of Rice Husk Ash in different percentages like 0%,2%,4%,6%,8%to the soil and cured 14 days to compare UCS value in different days .the Standard compaction test ,unconfined compression strength are calculated[10]. The results are as follows





5.CONCLUSION

- From the above graphs and values of lime ,the UCS value of expansive soil with lime increases with increase in curing time and again decrease at some percentage of lime .The optimum percentage is 9% .
- From the above graphs and values of cement from previous report, the UCS value of soil with cement increases with increase in curing time and going on increase with cement%.
- From the graph and values of fly ash ,the value of UCS increases with increasing percentage of fly ash and at certain point it will decrease The optimum percentage obtained is 15%.The value of MDD and specific gravity is going down with increasing percentage of fly ash.
- From the above graphs and values of RHA ,the value of MDD increases and OMC decreases. The value of UCS increases with increasing curing time and decrease at some percentage of RHA. The optimum percentage obtained is 10%.
- By using RHA and fly ash as Stabilizing agents ,the cost of Stabilization will be decreased.
- Environmental pollution due to these fly ash and RHA can be minimized.

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