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A Review Paper on Expansive soil stabilization By Using Bagasseash and Risehuskash

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ABSTRACT

Soil stabilization means alteration of the soils properties to meet the specified engineering requirements. Methods for the stabilization are compaction, soil reinforcement and use of admixtures. Compactions are done with help of rollers, rammers and vibrators. Earth reinforcement techniques are commonly used with mild steel rods, geo synthetics etc. Admixtures like lime, cement were used traditionally for stabilization purposes as a stabilizer for altering the properties of soils. From the recent studies it is observed that, waste materials such as Bagasse ash, rice husk ash and pond ash are used for this intended purpose with or without lime or cement. Disposal of these waste materials is essential as these are causing hazardous effects on the environment. With the same intention literature review is undertaken on utilization of solid waste materials for the stabilization of soils and their performance is discussed. Wastes are versatile material with attractive characteristics and advantages. Huge amount of waste are easily available in all over the India. Wastes have various engineering properties that can help in improving the properties of the soil e.g. Compaction characteristic, unconfined compressive strength and California bearing ratio.

Keywords:Bagasse ash, Pond ash, Rice husk ash, Expansive Soiland Soil stabilization.

I.INTRODUCTION

Soil is highly heterogeneous, complex and unpredictable material which has been subjected to vagaries of nature, without any control. The properties of soil change not only from one place to other but also at the place with depth and with a change in the environmental, loading and drainage conditions. The properties of a soil depend not only on its type but also on the conditions under which it exists. In comparison to other construction materials such as concrete or steel, it is not economically feasible to transport the soils from one place to other, because a huge quantity of soil is involved and it is not opened to inspect at greater depth for foundations of different structures. Sometimes, Civil Engineers or Geotechnical engineers are forced to construct a structure on the site selected for reasons other than soil conditions. Therefore, it is more and more important for the engineer to know the degree to which the engineering properties of the soil may improve or other choices that can be thought of for the construction of the intended structure at the specified site. If unsuitable soil conditions are encountered at the site of a proposed structure, unsuitable soil can be bypassed by means of deep foundation

extended to a suitable bearing material, poor material can be removed and replaced by a suitable material or soil in-place can be treated by using any suitable ground improvement methods to improve its engineering properties. Thus, to solve out at the selected site it is necessitate having proper knowledge about their properties which are affected. In India, the modern era of soil stabilization begun in early 1970 with a universal shortfall of petroleum and aggregates; it became necessary- for the technologists to look at means to improve soil other than replacing the poor soil at the construction site. Soil stabilization was used, but due to the use of obsolete methods and also due to the absence of proper technique, soil stabilization lost favour. In recent times, with the growth in the demand for infrastructure, sensitive materials and fuel, soil stabilization has begun to call for a fresh form. Site feasibility studies for geotechnical projects are of far most beneficial before a task can bring off. Site survey usually takes place before the design process commences in order to infer the characteristics of subsoil upon which the project can be built. The following geotechnical design criteria have to be considered during the site selection.

i) Type and importance of the structure.

ii) Design load and Type of foundation to be utilized.

iii) Load Carrying capacity of the subsoil.

In the above criteria, the third criteria played a major role in decision making on site selection. In one case the bearing capability of the soil is poor, the following are options:

i) Change the design to suit site condition.

ii) Remove and replace the in-situ soil.

iii) Abandon the site.

iv) Soil improvement

Abandoned sites due to undesirable bearing capacities of soil dramatically increased, and the result of this was the scarcity of land and increased need for natural resources affected areas include those which were susceptible to liquefaction and landslide those crossed with soft mud, contaminated soil and organic stains. In most of the geotechnical projects, it is not possible to obtain a construction site that will meet the design requirements without ground modification. The current exercise is to modify the engineering properties of the native problematic soils to meet the planned requirement. Nowadays, soils such as, soft clays, contaminated soil and organic soils can be modify to the civil engineering requirements are focuses on soil stabilization methods which is one of the various methods of soil improvement.

Waste term includes all those solid, semi-solid and liquid materials that are discarded by the community. Improper management of solid wastes causes adverse effects on the ecology which may lead to cause possible outbreak of diseases and epidemics. Solid wastes are broadly classified in to three group's namely Industrial waste, Agricultural waste, and Municipal waste apart from other categories of wastes. This paper discussed on rice husk ash waste from paddy grain, Bagasse ash waste from sugar cane, pond ash from thermal station use in geotechnical works. Rice and sugar are the primary source of food for billion peoples across the world. India is the one of the largest producer of rice and sugar cane in world. One ton of rice paddy produces 220 kg rice husk

and one ton of sugar cane produces 260 kg bagasse ash. Numerous problems arises from rice husk and bagasse ash disposal such as, methane generation due to fermentation of RHA and SCBA with microorganisms, being light and fine particles causing breathing problems, bad effect on the health are reported such as acute and chronic effect affecting eyes, skin and upper respiratory tract and allegoric response such as nasal catarrh, asthma and limitation of RHA and SCBA because of low nutritious value, it required long periods for decompose and are not appropriate for composting of manure. Thus, proper and safe disposal of this waste is again a big problem. Different ways are available in for enhancing the engineering performances of soils by using waste is soil stabilization. One of the alternative ways of disposing of waste is to use them for geotechnical applications, due to following advantages:

(1) It will help in not only saving huge spaces occupied by waste, but the environmental health hazards will also be reduced.

(2) The consumption of natural soil will be reduced, there by rendering cost saving benefits.

(3) The various soil properties such as bearing capacity, shear strength, drainage etc. can be improved by waste.

This may found to be economical treatment methods for soils and solution will definitely found beneficial for the developing countries like India where economy is the prime concern for adopting any new method or technique.

About 20% of the soil found in India is expansive in nature. In rainy season black cotton soil absorbs water heavily which results into swelling and softening of soil. In addition to this it also loses its strength and becomes easily compressible. Black cotton soil has tendency to heave during wet condition. In summer season due to reduction in water content it shrinks and produces cracks. Thus as a result of this roads on black cotton soil suffer from early failures in structure and pavement.

In India, the modern era of soil stabilization began in early 1970's, with a general shortage of petroleum and aggregates, it became necessary for the engineers to look at means to improve soil other than replacing the poor soil at the building site. Stabilization is the process of improving the engineering properties of soil and making it more stable. Now a day there is problem to utilization of industrial waste because thousands of tones wastes are generated from industry. The usage of industrial waste in stabilization of soil becomes economical and it is easily available. There is a need to focus on improving properties of black cotton soils using cost effective materials like treating with industrial wastes those having cementitious properties. In this study, industrial wastes like rice husk ash (RHA), Pond Ash(PA) and Bagasse ash (BA) are used to improve geotechnical properties of a soil.

II.STUDIES ON STABILIZATION OF SOIL USING WASTE MATERIALS

A. Mandeep Singh and Anupam Mittal, (March 2014); "A Review on the Soil Stabilization with Waste Materials". Soil stabilization means alteration of the soils properties to meet the specified engineering requirements. Methods for the stabilization are compaction and use of admixtures. Lime and Cement was

commonly used as stabilizer for altering the properties of soils. Earth reinforcement techniques with commonly used with mild steel rods, geo synthetics etc. From the recent studies it is observed that, solid waste materials such as rice husk ash and waste tyres are used for this intended purpose with or without lime or cement. Disposal of these waste materials is essential as these are causing hazardous effects on the environment. With the same intention literature review is undertaken on utilization of solid waste materials for the stabilization of soils and their performance is discussed.

B. IJTARME(2014),"Study on heave characteristics of black cotton soils using copper slag with cement as admixture." Black cotton soil is one of the significant nearby soil deposits in India, spreading over a field of about 3.0 lakh sq.km. Black cotton soils are enormously far from being obviously true, as they swell on ingestion of water and therapist on vanishing thereof, as an after-effect of this substitute swell and shrinkage; distress is made to the bases of structures laid on such grounds. Coppers slag which is created amid hydrometallurgical generation of copper from copper minerals, contains materials like iron, aluminium oxide, calcium oxide, silica, and so on. For each metric ton of metal creation, around 2.2 tons of slags are produced. Dumping and transfer of such unfathomable measures of slag causes ecological and space problems. Therefore, we apply the modern waste - Copper Slag to decrease the swelling of far reaching grounds. The present paper clarifies about the works being done utilizing copper slag as a padding material. Advancements of strong bonds in a concrete balanced out copper slag pad, when settled with bond, are required to resulting capture hurl. The results of the study show a novel answer for the issue hurl of expansive soil.

C. Prakash Chavan1 and Dr.M.S.Nagakumar,(2014); "Studies On Soil Stabilization By Using Bagasse Ash". Soil is the foundation material which supports loads from the overlying structure. Soil is the most widely used material in a highway system, either in its natural form or in a processed form. The construction cost can be considerably decreased by selecting local materials including local soils for the construction of the lower layers of the pavement such as the sub-base course. The formation of undulations, corrugations, up heaving and rutting are generally attributed to the poor sub grade conditions. In this paper the soil sampling was done on Kavadimatti village Bagalkote district as per IRC recommendations. This soil was classified as CH as per Indian Standard Classification System (ISCS). Different dosages of blast furnace slag i.e. 3%, 6%, 9% and 12% were used to stabilize the expansive soil. The performance of Bagasse Ash stabilized soil was evaluated using physical and strength performance tests namely; plasticity index, specific gravity, compaction, California bearing ratio (CBR) and Unconfined compressive strength Test (UCS). These tests were conducted in order to evaluate the improvement in strength characteristics of the subgrade soil. Hence use of such advanced materials in road construction can prove efficient in increasing the strength of soil and in turn reduce the project cost. From the results, it was observed that the basic tests carried out proved significant after the addition of Bagasse Ash. Furthermore California bearing ratio (CBR) value improved from 1.16% to 6.8 %. And the unconfined compressive strength of specimens increased from 93KN/m^2 to 429 KN/m^2.

D. D. N. Vijaya Kumar; (2014), "Evaluation of wear properties of industrial waste (Slag) reinforced polypropylene composites." A decent arrangement of waste is delivered by commercial ventures and they are stacked up on soil which makes state and natural issues. Government approaches and controls constrain us to search for decisions. In this manner, scientists are endeavoring to use these squanders as in composites. Slag is a mechanical waste fortified in polypropylene composites. The stick-on plate wear testing machine has been used to look at the grinding and wear behavior of the polymer composites. The wear adversity and coefficient of disintegration are plotted against the ordinary loads and sliding rates. It is noted from the graphical representation of the outcome that with the expansion in burden weight reduction declines and increment in sliding speed weight reduction likewise increments.

E. VaishaliSahu (Dec-2013), "Sustainable reuse of stabilized and fiber reinforced fly ash-lime sludge (FALS) as pavement sub-base material." In the road construction sector, the world is confronting a noteworthy issue of shortage of traditional building materials. Then again, in that appreciation are numerous twist offs from different fabricates, which are lying as waste. In the present study, a composite material made up of fly fiery remains and lime slime (FALS) was attempted as sub-base material in the clearing. Adjustment of FALS with industrially accessible lime and gypsum was done and promote the impact of adding polypropylene strands to balanced out FALS was examined. A progression of unconfined pressure tests was done on examples of fiber-strengthened fly fiery debris lime muck composite (FRFALS) to evaluate the impact of fiber consideration on the sturdiness and flexibility attributes of the composite. The result of fiber support on the shear strength parameters and California Bearing Ratio (CBR attachment (c) and inside rubbing point (ϕ) is additionally discussed. Taking into account the outcomes, it has been contemplated out that the expansion of low measures of polypropylene fiber (0.1 %) expands the solidness and malleability of the FRFALS for the distinctive curing time frame. The CBR estimation of FALS expanded by 54% with fiber expansion and the shear parameters c and ϕ likewise increments. Henceforth the FALS composite is appropriate in sub-base layers of adaptable asphalt, in the event that it is strengthened with polypropylene fiber.

F. Sanjay J. Shah; (Nov-2002), "Stabilization of fuel oil contaminated soil - a case study" Fuel oil pollution brings unfriendly effect on essential geophysical properties of establishment soil. The present study relates to one such case, from the petrochemical complex close Vadodara City in Gujarat State, India. In this study, fuel oil pollution brought on injurious impacts to the fundamental geotechnical properties of the CL sort of soils. Oil tainted soil when warmed with various adjustment specialists like lime, fly slag and concrete either freely or as an admixture demonstrated a change in the geotechnical properties. This change can be credited to scattering of oil, cation trade, agglomeration, and pozzollanic activities of added substances to be specific lime, fly powder and concrete. Best results were watched when soil was treated with a blend of 10% lime, 5% concrete and5% fly slag. During the time spent adjustment fuel oil may have shaped a steady complex with metals. Increment in the quality of the soil can be ascribed to transformation of mixes like CSH, CSH-1, that coat and scaffold soil grains.

III.WASTE MATERIALS AND THEIR COMPOSITION

Following are somewastematerialscommonlyusedforstabilisingsoil.

Bagasse ash:

Bagaseashisthefibrousmatterthatremainsaftersugarcaneiscrushedtoextracttheirjuice.Itisdrypulpyresidueleftafterth eextraction of juicefromsugarcane. Bagasseisutilized as a biofuel and in the manufacture of pulp and buildingmaterials. Foreach 10 tonnes of sugarcanecrushed, a sugarfactory produces nearly 3 tonnes of wetbagasse. Sincebagasseis a by-product of thecanesugarindustry, thequantity of production in each country is in line withthequantity of sugarcane produced. Thehighmoisturecontent of bagasse, typically 40 to 50%, isdetrimentaltoits use as a fuel. In general, bagasseisstored prior tofurtherprocessing. Forelectricityproduction, itisstoredundermoistconditions, and themildexothermicreactionthatresultsfromthedegradation of residual sugarsdriesthebagasse pile slightly.

Rice husk ash:

Rice husk is the shell produced during de-husking of paddy. Rice husk being agricultural waste dumped near the mills or burnt in open fields. Rice hulls (or rice husks) are the hard protecting coverings of grains of rice. In addition to protecting rice during the growing season, rice hulls can be put to use as building material, fertilizer, insulation material, or fuel. Rice hulls are the coatings of seeds, or grains, of rice. The husk protects the seed during the growing season, since it is formed from hard materials, including opalinesilica and lignin. The hull is mostly indigestible to humans. Winnowing, used to separate the rice from hulls, is to put the whole rice into a pan and throw it into the air while the wind blows. The light hulls are blown away while the heavy rice falls back into the pan. Rice pounderis a simple machine developed to remove hulls. During the milling processes, the hulls are removed from the raw grain to reveal whole brown rice, which may then sometimes be milled further to remove the bran layer, resulting in white rice.

Pond Ash:

The residue part after combustion of coal in power thermal plant is ash. The fine particle (fly ash) and coarser particle (bottom ash) are mixed in slurry form and deposited in the pond, which are known as pond ash. Due to the production of large amount of pond ash, it needs to be suitably disposed of by creating an engineered ash pond to take care of environmental condition.In the power plant, the 'fine' ash fraction which is carried upwards with the flue gases and captured before reaching the atmosphere by highly efficient electro static precipitators is known as Pulverized Fuel Ash (PFA) or 'fly ash'. It is composed mainly of extremely fine, glassy spheres and looks similar to cement. The 'coarse' ash fraction falls into the grates below the boilers, where it is mixed with water and pumped to lagoons. This material is known as Furnace Bottom Ash (FBA) or Pond ash which has a gritty, sand-like texture.

There are four basic types of coal-fired boilers: pulverized coal (PC), stoker-fired or traveling grate, cyclone, and fluidized-bed combustion (FBC) boilers. The PC boiler is the most widely used, especially for large electric generating units. The other boilers are more common at industrial or cogeneration facilities.

Table 1: Comparative chemical properties of RHA, SCBA and cement Chemical properties

Sr. No.	Constituent	RHA (%)	SCBA (%)	PondAsh(%)
1	Silica as SiO2	90.70	62.43	55
2	Alumina as Al2O3	0.40	4.38	26
3	Iron as Fe2O3	0.40	6.98	7
4	Calcium as CaO	0.40	11.8	9
5	Potassium as K2O	2.20	3.53	0.4-0.75
6	Magnesium as MgO	0.50	2.51	0.1-1.8
7	Sodium as Na2O	0.10	0.10	-----
8	LOI	------	4.73	2.0

IV. RESULTS AND DISCUSSION

As per our discussion in literature reviews waste are suitable for replacing conventions material in geotechnical area. Waste materials are very versatile in nature therefore they can be used as soil stabilisation or soil improvement.

V.CONCLUSIONS

Following observations have been pulled out from the broad overview of the literature presented above:

(i) Various waste materials, for example, SCBA, rice husk (RHA), Pond ash, so forth had been utilized by the various researches as soil stabilizers or soil improvement however their still some area had been need to be work out by the researches as soil stabilizers or for the improvement of engineering properties the soil.

(ii) The wastes like fly ash, baggash and rise husk ash are easily available in many parts of India and also having low cost comparatively to other conventional material.

(iii) Very finely ground glass has been shown to be excellent filler and may have sufficient pozzolonic properties to serve as binder, the effect of ASR appear to be reduced with finer glass particles, with replacement level.

(iv) By using waste in geotechnical field we have not only protect the environment but also to achieve the sustainable development of country.The utilization industrial wastes are economical for local area and it is environmental friendly.

(v) Bagasse ash & RHA has been shown to be excellent filler and may have sufficient pozzolonic properties to serve as binder. Therefore responsible for improving permeability of soil.

(vi) By adding the waste in expansive soil like black cotton soil we can control the swelling nature of soil on a large scale.

(vii) By using waste in geotechnical field we have not only protect the environment but also to achieve the sustainable development of country.

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