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A STUDY ON USE OF FLY ASH AND RICE HUSK ASH IN REDUCTION OF PERMEABILITY OF ALLUVIAL SOIL OF THE RIVER KRISHNA

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***Abstract:** The stability of the hydraulic structure depends upon the soil properties on which it is constructed. All the hydraulic structures are constructed across the river or canals. The soil available at rivers or canal is mostly alluvial soil. In these structures, the failure is occurred due to piping or seepage. In this experimentation, an attempt is made to reduce the permeability of the alluvial soil of the river Krishna with the combination of fly ash and rice husk ash in proportions (2%, 4%, 6%, 8%, and 10% to 14%) with respect to the weight of the sample. The fineness modulus of the soil sample and filler material i.e., fly ash and rice husk ash, is obtained and the filler material is suitable for the soil sample for reduction of permeability. The permeability of the soil sample (alluvial soil) is checked by partially replacing the sample with a mixture of fly ash and rice husk ash in equal proportions. Laboratory tests were performed to determine the specific gravity, sieve analysis, and constant head permeability.*

***Keywords:** Rice husk ash, Fly ash, Mixture, Coefficient of Permeability, Grain size analysis.*

Study on:

1. ***Permeability characteristics of alluvial soil by partial replace with fly ash.***
2. ***Permeability characteristics of alluvial soil by partial replace with Rice husk ash.***

INTRODUCTION

Soil is considered by the engineer as a complex material and is formed by the disintegration of rocks due to physical, chemical and biological weathering. Soil particles consist of a mixture of mineral particles, organic matters, air, and liquids. Soils are different types based on the colour, profile, texture, composition and properties. Based on the properties of the soil it is classified as coarse gravel, fine gravel, sand silt and clay.

Soil is one amongst the main natural resources, like air and water. It is the top layer of the Earth's crust and may be a mixture of fine pulverised rocks, organic matter, liquids, myriad organisms and other minerals. It acts as an interface between layer, lithosphere, earth's atmosphere and biosphere. The proportion of the key ingredients determines the sort of soil. But, factors like vegetation, weather conditions, human activities for e.g. grazing, farming, gardening etc. also influence soil formation. In India, varied sorts of soils are found and their formations are influenced by bound factors like altitude, climate, disproportionate rainfall and many others. The type of soil differs in numerous areas of the country.

Alluvial Soil: Alluvial deposits are formed by the deposits of the sediments brought by rivers. Most of the rivers originate from the Himalaya and convey on high quantity of sediments with them. The soil is formed up of particles like silt, sand and clay. It has adequate quantity of orthophosphoric acid, potash and lime.

It is the most important form of soil found in the country as it covers about 40% of the total land. It is found within the northern plains starting from Punjab to West Bengal and Assam. It is also found within deltas of various rivers such as Krishna, Godavari, Kauveri and Mahanadi in peninsular India. Alluvial soil is very fertile and is light grey in colour. It is fine-grained fertile soil deposited in stream beds or by water flowing over flood plains.

Soil permeability is basically a measure of the ease with which water can flow through soil (Donald, 2001). Permeability depends on consistence – the higher the porosity the higher the permeability. It is one in all the foremost necessary geotechnical parameters that verify the behaviour of soil under load (Verruijt, 2010). Some soil types in the tropics (e.g. black cotton soil) absorb a large amount of water during the raining seasons and do not allow easy passage of such water – they are of low permeability (Alhassan, 2008).

MATERIAL AND METHODOLOGY

Soil sample (Alluvial soil): The soil, which is transported by water in rivers called alluvial soil. The soil sample is collected from the river the Krishna at Vijayawada. The soil sample, which is collected after the excavation of depth 0.5m from the ground surface, free from organic matter and paper and plastic.

Rice Husk Ash: Rice husk ash Rice milling generates a by-product known as husk. This surrounds the paddy grain throughout edge of paddy concerning 78% of weight is received as rice, broken rice and bran. Rest 22 % you look after the load of paddy is received as husk. This husk is employed as fuel within the rice mills to come up with steam for the

parboiling method. This husk contains concerning 75 % organic volatile matter and therefore the balance 25 % you look after the load of this husk is reborn into ash throughout the firing method, is known as Rice Husk Ash (RHA). This RHA, in turn, contains around 85 % -90 % amorphous silicon oxide. So for each 1000 kg of paddy polished, concerning 220 kg (22 %) of husk is produced, and when this husk is burnt in the boilers, about 55 kg (25 %) of RHA is created. India may be a major rice manufacturing country, and therefore the husk generated throughout edge is usually used as a fuel within the boilers for process paddy, manufacturing energy through dire combustion and/ or by gasification. An about 20 million tone of RHA is produced annually This RHA is a great environmental threat causing damage to the land and the surrounding area in which it is dumped. Lots of ways are being thought of for disposing of them by making commercial use of this RHA.

Fly Ash: Fly ash is finely divided waste by-product obtained from the combustion of pulverized coal in suspension fired furnaces of thermal power plants. It is collected by electrical or mechanical precipitators including cyclone precipitators or baghouses It is generally finer than cement and consists of mostly spherical glassy particles of complex chemical as well as mineralogical composition.

Collection of the alluvial soil sample from River Krishna. Determination the permeability of obtained soil. Modification of soil by mixing rice husk ash in the percentages of 2, 4, 6, 8, 10 % in the soil sample. Constant head permeability test will be conducted for the above modified soil. Percentage of reduction of permeability will be noted when compared to the above unmodified soil. Graph will be plotted between percentage of Rice husk and permeability. Above steps are repeated by changing the material from rice husk to fly ash. Reduction of permeability is noted for different percentages and try to establish optimum mixing percentage for both fly ash and rice husk. Then both materials mixed with some proportions and will repeat the above steps by Modifying soil by using the mixture of the above two materials try to Establishing the best possible mixture of above two materials for different conditions.

Results and Discussions

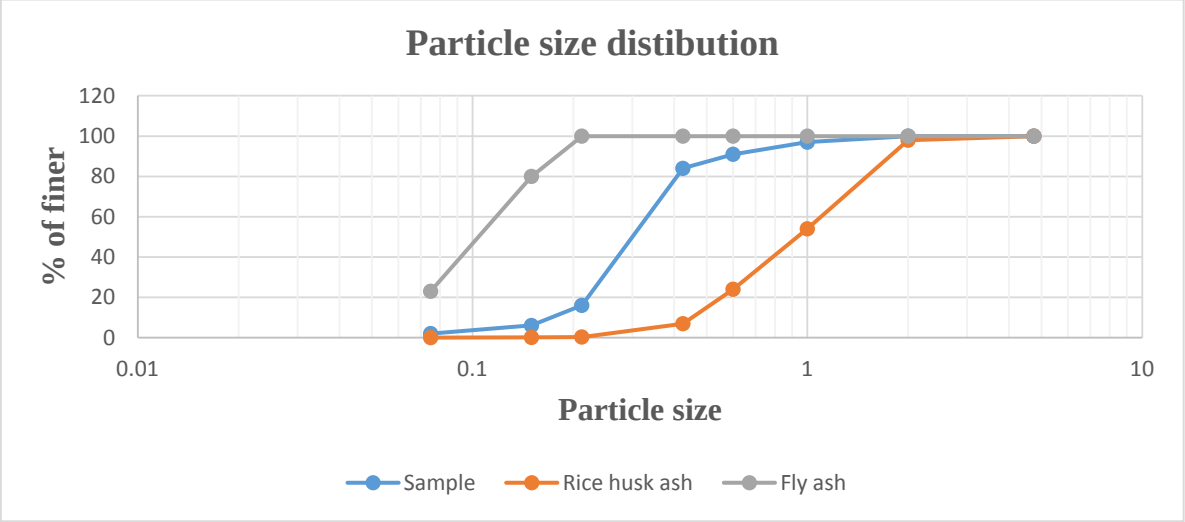

Figure 1: Showing the Grain size analysis of Soil, Fly ash and Rice

% of admixture		0	2	4	6	8	10	12	14	16	18	20
Fly ash	Coefficient of permeability 'K(cm s^{-1}) x 10^{-3}	5.438	4.055	3.055	1.959	1.431	1.113	0.546	0.2681	0.9443	0.5996	1.049
Rice husk ash		5.438	1.105	1.04	0.3014	0.081	0.0755	0.186	0.1542	–	–	–
Fly ash + Rice husk ash		5.44	3.246	1.634	0.3086	0.2987	0.093	0.023	0.046	–	–	–

Table 1: Showing the values of Coefficient of permeability of soil sample replacing with Fly ash and Rice husk ash

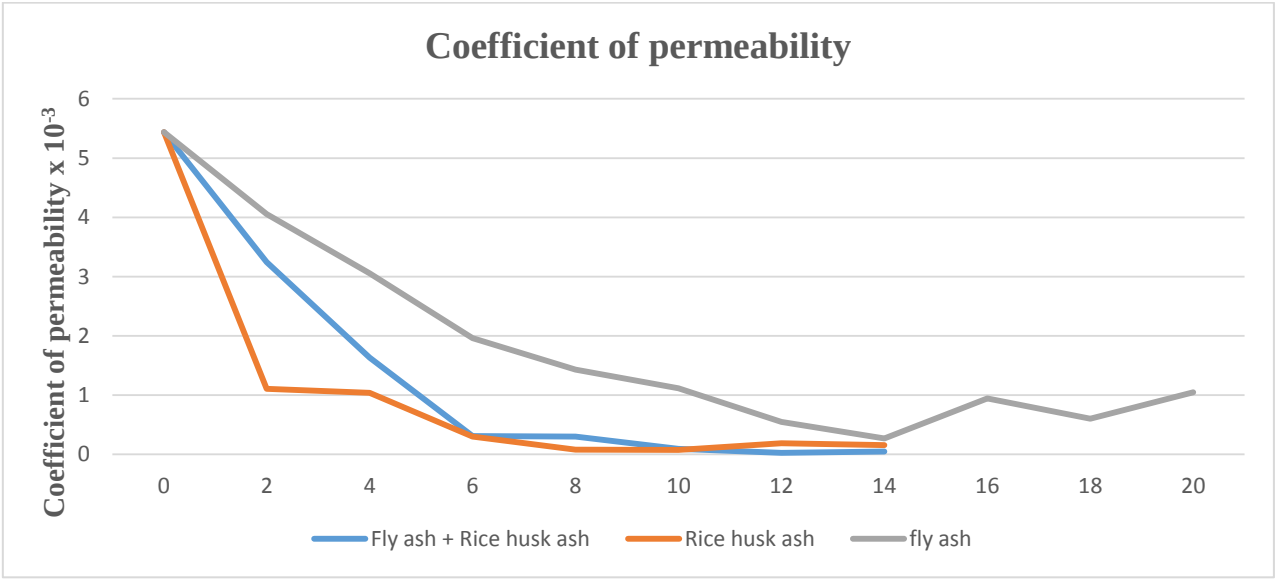

Figure 2: Showing the Reduction of Coefficient of permeability of soil sample

While doing the experiment constant head permeability, of soil sample with partial replacement of Fly ash up to certain percentage increase of fly ash content the coefficient of gradually decreasing, after adding it creates voids in the soil sample due to which permeability slightly increase. Then adding some fly ash content it fills voids which are created by previous percentage of fly ash. When replacing with Rice husk ash which absorbs moisture and creates a layer around its particle surface which leads to there is an obstruction to allow flow of water its voids cause permeability reduces. Up to 10% replacement of Rice husk ash permeability decreases then after increases. In equal mixture fly ash and Rice husk ash which fill voids in the soil and also absorb water which cause maximum reduction of permeability in alluvial soil. From the above study we concluded that Fly ash and Rice husk ash are used as an admixture in the reduction of permeability and stabilization of alluvial soil.

Conclusion

Based on the experiment conducted to determine the reduction soil permeability by partial replacement with Fly ash, rice husk ash and a mixture of fly ash and rice husk ash in equal proportions. The following can be deduced.

1. The rate of permeability of an alluvial soil decreases with increasing RHA up to 10% after that it is increased and decreased consecutively. The permeability can be reduced up to 95.07% with fly ash.
2. From the above results, the rate permeability of an alluvial soil decreases with increasing Fly ash up to 14% after that it is increased and decreased consecutively. The permeability can be reduced up to 98.62% with fly ash.
3. And also the rate permeability of an alluvial soil decreases with increasing mixture of fly ash and rice husk ash in equal proportions up to 12% after that it is increased and decreased consecutively. The permeability can be reduced up to 99.57% with fly ash.

The Fly ash and the RHA filled up the voids in soil sample and increased the bond among soil particles resulting in the reduction of the soil permeability. Therefore, Fly ash and RHA can be used as materials for soil grouting for under the foundation of the dam to minimize the piping failure and dam embankment and axis or places wherever porosity of water should be reduced for stability and property of structures.

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