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Utilization of Rice Husk Ash and Glass Fibre for Eco-Friendly Concrete

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Abstract

Waste which is increasing day by day becomes eyesore and in turn pollutes the environment, especially in villages on the top of mountains, where no garbage collection system exists. The production of cement depletes natural resources, consumes high energy and emits huge amount of greenhouse gases. It accounts for 7% of the global carbon dioxide emission, as the production of one ton of ordinary Portland cement releases approximately one ton of carbon dioxide. Due to severe environment pollution and health hazards associated with the cement and construction industries, they are strict scrutiny from the government and environmentalists. Rice husk is an agricultural waste, whose natural degradation is restricted due to irregular abrasive surface and high siliceous composition, it is not appropriate to be used as a feed for animals due to the low nutritional values. If dumped as landfill, they can take a lot of area and become a major challenge to the environment. The use of RHA and glass fibre is found durable, environment friendly and economically viable. Studies suggest there is scope of usage of RHA and glass fibre in cementitious material. RHA is having good strength and high silica content while glass has similar chemical composition as that of sand, glass also has high tensile strength and good fire resistant property the addition of these materials will definitely provide us great concrete

Keywords— Concrete block, Eco-friendly, Glass Fibre, Rice husk ash, Waste.

I. INTRODUCTION

Construction sector is one of the most booming sector in the whole world at a current period of time. As there is increase in the number of population, modernization, urbanization, change in lifestyle the construction of buildings, public infrastructures, institutions, roads and highways have increased tremendously. In the construction industry, concrete is most commonly used material. The current concrete construction practice is unsustainable because, not only it is consuming enormous quantities of stone, sand, and water, but also two billion tons a year of Portland cement, which is not an environment friendly material from the standpoint of energy consumption and release of green-house gases leading to global warming. The most difficult problem is dealing with waste disposal. Since global warming has emerged as the most serious environmental issue of our time and waste disposal has become a great threat to the environment and human beings as well there is need to come up with some new environment friendly concrete. Economical solution is utilization of waste materials as partial replacement of cement and aggregates in the concrete.

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We have used rice husk ash as the partial replacement of cement and glass power as the partial replacement of the aggregates for making environment friendly concrete or green concrete.

A. Rice husk ash

Rice Husk Ash is an agro based waste product. Disposal of rice husk is a very difficult task Rice husk has high silica contents which means that it decomposes slowly when brought back to the field. Rice husk has low bulk density brackets or pellets. Thus it requires large volumes for storage and transport, which makes transport over long distances un-economical. Rice husk ash has a high average calorific value of and therefore it is a good renewable energy source .Because of the high silica contents rice husk is very abrasive and wears conveying elements very quickly. Rice husk is burned to produce gas for cooking purpose. The ash which is left over after burning rice husk can be used as partial replacement of cement. Use of RHA with cement improves workability and stability, reduces heat evolution, thermal cracking and plastic shrinkage.

B. Glass fibre

Glass fiber provides abrasive characteristics that can be used as a substitute for silica sand. The amount of waste glass has gradually increased over recent years where most of the waste glass ends up in landfill while only fraction can be recycled. Since glass is non-biodegradable, landfill is not an environmentally friendly option. Recent studies have shown that waste glass can be effectively used in concrete either as aggregate or as cement. Glass has similar physical and chemical composition as that of sand therefore glass can be used as a partial replacement of sand in concrete.

II. METHODOLOGY

1. Collection of rice husk ash and glass fiber
2. Determining optimum proportion of waste materials for concrete
3. Mix design of concrete blocks
4. Casting of concrete blocks and curing
5. Finding strength and water absorption for 7th and 28th days respectively
6. Comparisons of the block samples prepared

A. Mixing Process

The concrete mixer was cleaned thoroughly so no left over concrete can be mixed which can alter the result. Cement, rice husk ash, fine aggregates, coarse aggregates were dry mixed inside the concrete mixer. Glass fibre was added afterwards and was dry mixed along with other materials. Later water was added gradually to the mix. The mixing was carried on till the concrete was mixed forming a homogeneous mixture.

B. Compressive Test Procedure

1. The compression test was performed for blocks with curing period of 7 days and 28 days.
2. The wheel on the compression machine was rotated in anti-clockwise direction to loosen the horizontal bearing plates.
3. The blocks were placed in the centroid of the bearing surface been aligned with the center of thrust of the bearing blocks.
4. The wheel was not rotated in clockwise direction to clamp the block between the plates.

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5. Load was applied on the block until the specimen failed.
6. The value was noted down from the meter on the machine which showed the load at which the specimen failed.
7. The compressive strength value of a specimen was taken as the maximum load in New tones divided by the gross cross sectional area of the unit in square millimeters
8. The test was performed for 3 specimens of each three proportions and their average value was calculated.

C. Water Absorption Test Procedure

1. The casting blocks were kept for drying for period of 24 hours.
2. After the specimen were dried they were weighed on the weighing balance and the value was noted down(A)
3. The blocks were immersed in the water tank for curing period of 7 and 28 days respectively.
4. The blocks were removed from tank after the curing periods and it was allowed to dry in the sun for 10 minutes.
5. After 10 minutes the blocks were weighed again and the value was noted down for 7 and 28 days respectively (B).
6. The difference between the B-A gives the water absorption value of the blocks and (A-B)/B * 100 Gives the percentage of water absorbed.

D. Mix Proportion of Pavement Block Material

In order to find the concrete block that they possess high compressive strength with various mix proportions are made and they are tested using compressive testing machine. The mix proportion were in the ratio of (Proportion 1-(5% RHA: 1% GF), Proportion 2- (5.5% RHA: 1.5% GF).

Fig. 1 Mixer

Fig. 2 Mould

Fig. 3 Slump Cone

Fig. 4 Compressive Testing Machine

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III. RESULTS AND DISCUSSIONS

The cubes were tested for compressive strength and water absorption of all the proportions. The result obtains are as discussed below in the Table I.

TABLE I
COMPRESSIVE STRENGTH

Proportion	Compressive strength
Block (5%: 1%)	53.77N/mm^2
Block (5.5% : 1.5%)	48.44 N/mm^2

It can be seen that the less amount of glass fibre and rice husk gives better results in compressive strength. The optimum amount from these two proportions can be said that is the proportion which has 5% of Rice Husk Ash and 1% of Glass fibre.

TABLE II
WATER ABSORBTION

Proportion	Water Absorption
Block (5%: 1%)	2.33%
Block (5.5% : 1.5%)	1.99%

IV. CONCLUSIONS

1. The present work explores the suitability of using Rice husk ash and glass fiber as a replacement of cement and sand partially.
2. To check the efficiency of sample in terms of water absorption, a water absorption study was conducted.
3. From the experimental investigation it was found that optimum replacement of Rice Husk ash in cement was 5 % and glass fiber in sand was 1 %.
4. The usage of Rice husk ash in concrete as a placement for cement and glass fiber for replacement of sand can decrease the emission of green-house gases to a larger extent which automatically increases the possibility for gaining more number of carbon credits and also decreasing over use of river sand and will help in economic construction practice.

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