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Substitution of Base Materials Rice Husk of Concrete

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Abstract— Concrete blocks containing rice husk ash should be promoted as a new construction material to replace the existing blocks in market. Properties of the material used must be better understood first to obtain the desired concrete block. Generally, this paper presents a study on the effect of Directly Burnt Rice Husk Ash on properties of concrete block. The compressive strength and water absorption were investigated. Preliminary analysis of the constituent materials of the ordinary Portland cement and Rice Husk Ash concrete blocks were conducted to confirm their suitability for block making. Physical test of the recently prepared mix was also carried out. 150mm x 150mm x 150mm concrete blocks were cast and compacted by a concrete testing machine for 7, 14, 28 days at 0, 5, 10, 15, 20, 25, and 30 percent replacement levels. In conclusion, the high performance of masonry blocks can be produced using rice husk ash (RHA) as cement replacement material.

Index Terms— Rise Husk, Waste Material, Concrete, Substitution.

I. INTRODUCTION

Concrete blocks containing rice husk ash should be promoted as a new construction material to replace the existing blocks in market. Properties of the material used must be better understood first to obtain the desired concrete block. Generally, this paper presents a study on the effect of Directly Burnt Rice Husk Ash (DBRHA) on properties of concrete block. The compressive strength and water absorption were investigated. Preliminary analysis of the constituent materials of the ordinary Portland cement and Rice Husk Ash concrete blocks were conducted to confirm their suitability for block making. Physical test of the recently prepared mix was also carried out. 150mm x 150mm x 150mm concrete blocks were cast and compacted by a concrete testing machine (CTM) for 7, 14, 28 days at 0, 5, 10, 15, 20, 25, and 30 percent replacement levels. In conclusion, the high performance of masonry blocks can be produced using rice husk ash (RHA) as cement replacement material. The compressive strength of the PPC and RHA concrete blocks increases with age at curing and decreases as the percentage of RHA content increases.

The study arrived at an optimum replacement level of 15%. As the growth in infrastructure is increasing so rapidly in India, the cost of construction and also the use of waste materials is a great need today so as to decrease the cost as well as for decreasing the impact on environment due to the construction works. India's Planning Commission has projected an investment of US$ 1 trillion for the infrastructure sector during the 12th Five-Year Plan (2012-17). India has focused heavily on the sector since the turn of the century, and the sector has contributed to the country's current reputation as one of the fastest growing economies in the world. In the same context the use of waste materials in place of the using rice husks ash in concrete and study of its compressive strength. The compressive strength of concrete block made with the use of this material is studied and compared with the results of conventional concrete.

II. ABOUT RICE HUSK DETAILS

Rice milling generates a byproduct know as husk . This surrounds the paddy grain. During milling of paddy about 78 % of weight is received as rice , broken[3] rice and bran .Rest 22 % of the weight of paddy is received as husk . This husk is used as fuel in the rice mills to generate steam for the parboiling process . This husk contains about 75 % organic volatile matter and the balance 25 % of the weight of this husk is converted into ash during the firing process , is known as rice husk ash (RHA). This RHA in turn contains around 85 % - 90 % amorphous silica. Collected rice husk from the local rice mill is shown in figure below ;

Figure 1: Rice Husk

So for every 1000 kgs of paddy milled , about 220 kgs (22 %) of husk is produced , and when this husk is burnt in the boilers , about 55 kgs (25 %) of RHA [3] is generated. Burnt rice husk called rice husk ash is shown in figure below

Figure 2: Rice Husk Ash

1. Direct Incinerion of RHA without Pre-Treatments

Rice husk is directly incinerated to produce silica of varying purity, with or without the use of pre-treatments. In an overall process, the temperature of incineration, holding time and pre-treatment techniques employed affect the character, especially the surface are and brightness (whiteness) of the silica produced. The transformation of raw husk to clear white or pale grey ash is directly dependent on the temperature of incineration. For instance a temperature of about 300-450o c only transforms fresh rice husk to carbonized husk, while a temperature of about 500-650oc produces white or grey ash depending on soaking time, which is the duration for which incinerationis allowed to proceed at the stated temperature range. As the incineration temperature increases, there appears to be some accompanying phase changes. It is noted however that rice husk silica produced between temperatures 500-650oc with incineration holding time of 2.5-6 hr is considered ideal for producing white amorphous silica while when crystallinity sets in when incineration temperature increases beyond 700oc. The quantity of the operational phase, whether cristobalite or tridymite is dependent on the applied temperature range and the impurity level in the rice husk. Also it was reported that the incineration temperature grossly affects the surface area and hence the reactivity of silica produced from direct incineration process.
Direct incineration of rice husk can be accomplished[5] in open air. So whether in static of flowing air, the incineration of the rice husk can be completely achieved with some varied effect on the properties of silica produced.

2. Concrete with Rice Husk

However the durability enhancement properties of RICE HUSK ASH when blended with cement makes it the most eco-friendly versatile supplementary cementing[1] material to concrete. The following properties of concrete are considerably altered when blended with RHA : :
1. Reduced heat of hydration – leading to minimal crack formation in higher grades of concrete.
2. Reduced permeability at higher dosages.
3. Increased chloride and sulphate resistance/mild acids.
Therefore RHA can be used as an effective and Green supplementary cementing material. RHA can be used for a wide variety of applications starting from a simple water proof coating to an admixture for cement to resist a wide variety of chemicals including mild acids like lactic acid (milk) alkalis, etc. in bathroom floors, swimming pools, Industrial factory floorings, foundation concreting when concrete is exposed to both chlorides and sulphate attack and as an effective repair mortar to resist chlorides.

III. MISCELLENIOUS APPLICATION

Rice husk ash has been effectively used as simple cementitious coatings for concrete [4] surfaces to act as a waterproofing barrier coupled with higher chemical resistance. Photograph shows a typical coating application of RHA in a [5]water-treatment plant. Field observations done by the author for concrete blended with RHA at 10% by weight has shown that RHA is intact on the concrete floor subjected to constant salt water usage – Even after more than 2 years of exposure. Neither [5] plastic shrinkage cracks nor long term drying shrinkage cracks were observed.

IV. CONCLUSION

RHA based concrete can be used in construction industry on low scale construction work by adding some percentage of rice husk in place of cement On the basis of our comparative analysis of test results of the basic properties of concrete with three different percentages of coarse recycled aggregate content (0%, 50% and 100%), the following conclusions are made. The way of preparing recycled aggregate for concrete mixtures influences the concrete workability: workability of concrete with natural and recycled aggregate is almost the same if ―water saturated—surface dry‖ recycled aggregate is used. Also, if dried recycled aggregate is used and additional water quantity is added during mixing, the same workability can be achieved after a prescribed time.

Additional water quantity depends on the time for which the same workability has to be achieved. It is determined as water quantity for which the recycled aggregate absorbs for the same period of time. Bulk density of fresh concrete is slightly decreased with increasing quantity of recycled aggregate. The type of coarse aggregate has no influence on the air content in concrete.

Concrete compressive strength mainly depends on the quality of recycled aggregate. If good quality aggregate (obtained by crushing higher strength class concrete as in this case) is used for the production of new concrete, the recycled aggregate has no influence on the compressive strength, regardless of the replacement ratio of natural coarse aggregate with recycled aggregate. The same conclusion is valid for concrete tensile strength (splitting and flexural).

Also, this type of concrete shouldn't be used for structures exposed to aggressive environment conditions without appropriate previous testing, as there are opposing conclusions about durability All the conclusions made in this work about the tested properties of fresh and hardened concrete and consequently.

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