PROPERTIES OF CONCRETE BLOCK CONTAINING RICE HUSK ASH,EGG SHELL,GGBS,LIME,COCONUT SHELL.

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ABSTRACT

Concrete blocks ***containing rice husk ash,egg shell,lime, coconut shell ash, GGBS*** *.should be promoted as a new construction material to replace the existing blocks in market.Properties of the material used must be better under understood first to obtain the desired concrete block. Generally, this paper presents a laboratory study the effect of gasses incinerating rice husk ash on properties of concrete block. The compressive strength, water absorption, moisture movement . 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. 150 concrete blocks were cast and compacted by a hammer for 7, 14, and 28 days at 0, 10, 15 and 20 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 OPC and RHA concrete blocks increases with age at curing and decreases as the percentage of RHA content increases.*

Keywords: concrete ,rise husk ash, coconut shell ,egg shell ,GGBS.

1. INTRODUCTION

Rice husk which is also known as rice hull is a by-product of rice milling product. Demand for rice has increased due to population growth that exceeds 1.2% annually in India . In paddy milling operation, approximately 78% by weight is received as rice and the rest, about 22% as husk. The disposal of large bulk of husk has gain serious concerns due to the importance to preserve the environment in the present days. Open-field burning or uncontrolled combustion contributes to enormous environmental threats which lower the air quality in the area involve . The un-burnt rice husk contained about 50% cellulose, 25-30% lignin and 15%-20% silica. Therefore, the presence of silica in this pozzolanic material makes possible the use of RHA to replace part of cement. In India , there is a lack of research conducted to improve the quality of concrete block available in the market. According to Gunduz the production of concrete block has to meet the international standard that stipulates specific properties of the products. Primarily, they give little attention to the importance of quality assurance in properties of block namely strength, durability, weather resistance, insulating properties and fire resistance. In order to fulfill the criteria, all the stated properties will be explained in detail in the incoming chapter. Another study towards upbringing the development of innovative blocks production should be reviewed. Recent study shows that the utilization of by-products such as fly ash ,GGBS, coconut shell, egg shell and other materials for example, sawdust and glass powder is frequently used in recent research instead of rice husk ash (RHA). It was found that RHA which is high in silica content can become potential cement replacement material. However, the objectives of this research are to study the effects of different replacement level of RHA on block unit properties and to determine the optimum RHA replacement level.

2. METHODS AND MATERIAL

2.1 PREPARTION OF RHA

In this study, rice husk had been used as a cement replacement material. Since this material is rich in silica, this leads to strength development due to pozzolanic reactions. Raw rice husks were obtained from a local paddy mill and then burnt at a temperature of 700ºC for six hours to obtain the ash via furnace gas. The chemical compositions and physical properties of the RHA are tabulated in Table 1.

table 1. Chemical and physical properties

Compound	Weight percentage
Chemical test Silicon oxide (SiO_2)	90.00
Aluminium oxide	00.39
Ferum oxide	0.37
Calcium oxide	0.46
Magnesium oxide	0.88
Potassium oxide	3.10
Na2O	0.07
Phosphorous oxide	1.60
MnO	0.039
Physical test	
Density	2.5
10%RHA	195
15%RHA	210
20%RHA	210

2.2 EGG SHELL ,GGBS ,COCONUT SHEL

Egg shell powders which are rich in calcium are thrown away as a waste. In the present study, these wastes are used as a partial replacement of cement

OXIDE ANALYSIS	PERCENTAGE (%)
SiO_2	0.09
Al_2O_3	0.03
Fe_2O_3	0.02
CaO	50.7
MgO	0.01
NiO	0.001
Na_2O	0.19
SO_3	0.57
Cl	0.219
Sro	0.13
P_2O_5	0.24

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Table 2. egg shell properties

Coconut shell

The possibility exists for the partial replacement of coarse aggregate with coconut shell to produce lightweight

Material	OPC	RHA20	RHA15	RHA10
Cement	96.04	78.80	81.60	86.4
RHA(rice husk ash)		15.4	9.8	5.5
Egg shell		6.7	4.4	2.1
Coconut shell		5.6	3.1	1.04
Ggbs		3.9	2.6	1
Water	70	70	70	70

concrete. Coconut shell exhibits more resistance against crushing, impact and abrasion, compared to crushed granite aggregate. Coconut shell can be grouped under lightweight aggregate. There is no need to treat the coconut shell before use as an aggregate except for water absorption. Coconut shell is compatible with the cement. The 28-day air-dry densities of coconut shell aggregate concrete are less than 2000 kg/m3 and these are 184 within the range of structural lightweight concrete.

GGBS

It is not only used in concrete and other applications include the in-situ stabilisation of soil. GGBS is used as a direct replacement for Portland cement, on a one-to-one basis by weight.

Lime

lime is added to the mix, the sand and the cement do not separate. The final mortar also is more waterproof. Shrinkage cracking often can be eliminated or minimized when hydrated lime is used. Replacing 10 to 15 percent of the total volume of cement with hydrated lime usually produces optimum results.

2.2 DESIGN MIX AND SAMPLE PRODUCTION

In this investigates, the percentage of cement, sand, and aggregate chipping is 12, 32, 44 and 12%, respectively. The compaction of samples was performed using a combination of wooden tamper and vibrating table. All samples were then covered with wet Hessian before being demoulded at the age of 24 hours. After being demoulded, all samples were subjected to curing by means of sprinkling with water twice a day until the age of seven days. Testing for compressive strength and water absorption were performed at the ages of 7, 14, and 28 days Constant w/c ratio is applied which is 0.70 in every mix. Mixing procedure for concrete block was similar to concrete mix adopted. At the laboratory stage, a KANGO hammer and a steel plate was used in order to compact each block. The finished block was then covered with polythene sheet for 24 hours before curing. The summary of the procedure can be seen in Figure 1. The mix proportions are shown

2.3 Compressive Strength Test

The compressive strength of the block samples was determined in accordance with the standard procedure for precast concrete blocks. Samples were immersed into water 24 hours before testing. The weights of the block samples were always taken before the compressive strength test was conducted. Ten sample blocks were crushed each at 7, 14, and 28 days after casting at different replacement levels using the compressive testing machine in the concrete laboratory of School of civil engineering, iimt college of polytechnic greater Noida

2.4 Water absorption

The 5-hour boiling test was adopted and applied in these investigations. Before the test was conducted, specimens were dried at least for 48 hours at 110°C. The specimens were placed into a water tank and heated up to one hour and continuously to be boiled for 5 hours, cooled to room temperature by natural loss of heat which was not less than 16 hours or not more than 19 hours. The specimens were removed and the surface was wiped with a damp cloth. Within two minutes after its removal from water and weighed.

3. RESULTS AND DISCUSSION

3.1 Standard Consistency and Setting Time

water content increases with the increase of cement replacement level. Water requirement needs increases in the mix is due to specific surface area is much higher than OPC. The increase of RHA content up to 15% also increases the initial setting time. 20% replacement of RHA indicates that there is decrease in initial setting time. Final setting time measured for cement up to 20% replacement level. It is recorded between the ranges of 120 to 210 minutes in final setting time for 0 to 20% replacement level. OPC with 0% RHA shows the lowest result for both initial and final setting time starts to give similar result at replacement level of 20% of RHA. Similar findings also obtained by Ganesan et al [7].

3.2 Analaysis of RHA

Properties of Concrete Block At later ages particularly at 60 days, there is a significant reduction in intensity peak of $Ca(OH)_2$ due to consumption of CH in cement containing RHA. Similar study conducted by Chindraprasirt et al using fly ash as a cement replacement material shows that intensity peaks of $Ca(OH)_2$ in the XRD patterns decreased when fly ash was incorporated into the blended cement. It was derived that $Ca(OH)_2$ consumption in a blended cement is related to the degree of pozzolanic reaction. Factors affecting the pozzolanic reactivity are the fineness and amorphous silica content in the RHA. It was determined that the properly burnt RHA can be used to produce good quality cement replacement material. It was also noticeable that $Ca(OH)_2$ decreased significantly with the increase of RHA content s also noticeable that $Ca(OH)_2$ decreased significantly with the increase of RHA content

3.3 Compressive Strength Test

Figure 5 illustrated the relationship between the compressive strength and the age of curing. The compressive strength of unit with different replacement level exceeds the specified minimum requirement compressive strength of 2.8 N/mm2 The similar graph trend exhibits in every block type shows the increment of strength. This could be attributed to the combined effects of lower cement content and slow pozzolanic reaction at early age [8]. The average data for strength against curing age is shown in Table 3. The similar graph trends are shown in every block types that strength increased with time. It can be seen that RHA15 reaches the optimum values of strength at 60 days. At 28 days, RHA15 which consist of 15% RHA replacement obtained the highest strength value followed by RHA20 and RHA10. Conversely, partial replacement of cement with RHA has a high potential to be commercialized in market based upon the result achieved.

3.4 water absorption

Water absorption for curing time between 7 and 28 days . The trend of OPC graph gives lowest result at 7 to 28 days as compared to block containing RHA. 10, 15 and 20% RHA block and continue to increase gradually with the increase of RHA content. It was found that at the age of 7 days, RHA20 shows the highest percentage of water absorption. Regarding to the result, RHA20 absorbs (14.42%) while RHA15 (13.89%), RHA10 gives (13.08%) and the lowest result goes to OPC (12.28%). High water absorption at the early age is due to adsorptive nature character and high fineness from micro porous particle in RHA. According to Ganesan et. Al increase of water absorption is due to the fact that RHA is finer than OPC and also hygroscopic in nature. A possible reason of the lower percentage of water absorption with the increase of curing time is the existence of pozzolanic material as cementreplacement in the block. The pore radius becomes finer from the formation of gel during hydration process. This is an agreement with the previous research finding reported by Kartini [9]. Block with no addition of RHA shows the highest water absorption percentage due to existence of connected pores in the block. This occurs when the water that in the void evaporated. For RHA block shows that addition of RHA leads to a reduction of permeable voids [7]. This leads to the increase of absorption in the unit masonry. 5-hours boiling test for concrete block leads to the weaker bond in concrete blocks and after the test the actual shape of the unit also change.

4. CONCLUSION

The followings are the findings for this research

1. It was observed the increase of replacement level of RHA significantly decreases the initial suction of rates. The possible reason arises for this fact is that the porous characteristic of the block resulted in capillary action from the aggregates. This is also probably because of the presence of RHA in the block that absorbed any available water for the hydration process to take place. Calcium silicates hydrate is a by-product from pozzolanic reaction which fills the pores and leads to higher strength development. In the case of water absorption, higher percentage gained at early age tends to decrease at later age except for controlled block. The existence of pozzolanic material in concrete block tends to finer the pore radius in accordance of C-S-H (gel) during the hydration process.

2. The high performance of concrete blocks can be produced using rice husk ash (RHA) as cement replacement material. It was found that optimum RHA replacement level is 15%. It shows the RHA replacement level exceeds 15% also indicates comparable results and reached minimum requirements 2.8 N/mm2 with no individual block result lower than 80% of that value. Nevertheless, the strength of the block was expected to increase in later ages. The strength gained contributes from the high silica content available in RHA. It was identified from XRF analysis that 90% of SiO2 is present in the ash. Burning temperature of 700ºC confirmed that the ash is in the form of amorphous form. c. There is influence of elastic modulus for concrete block when RHA was used as a partial cement replacement material from 0 to 20% to the cement. RHA20 block unit shows the lowest elastic modulus among the block i.e. RHA10, RHA15 and OPC.

3 . The compressive strength rice husk concrete block is slightlyless s compared to that of ordinary concrete block

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