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# EFFECT OF RICE HUSK ASH AND PLASTIC BITS ON CONCRETE STRENGTH

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***ABSTRACT***
***This paper reports the study of compressive strength and split tensile strength of concrete using Rice Husk Ash and P.V.C bits in different proportions. M-30 grade of concrete was taken for experimental study. RHA content was used from 5% to 15% at the interval of 5% by replacing portland pozzolana Cement (P.P.C) and plastic bits were used BY 2%, 3% and 4% by replacing the fine aggregate. Plastic bits were obtained from waste of pvc pipe screen factory. The compressive strength and split tensile strength of concrete was obtained at the age of 7 days and 28 days of curing period. The results show that concrete samples having RHA and plastic fibers showed slightly better strength as compared to control concrete mix.***

***Keyword: Rice husk ash (RHA), Plastic bits, Compressive strength, Split tensile strength***

## 1. Introduction

Concrete is the most versatile material which is used for various construction works such as house construction, bridge construction, roads and pavements. Simply, concrete is a mixture of cement paste and aggregates. Amongst the constituents of concrete, cement is the most expensive one. Concrete is the material of choice where strength, impermeability, durability, performance, fire resistance and abrasion resistance can be controlled by us. There are various industrial waste materials that are used to make a good quality of concrete. These materials are waste foundry sand, rice husk ash, blast furnace slag, iron slag and waste marble dust etc. Rice husk ash (RHA) is a waste material, is a by-product obtained from the burning of rice husk. It has high reactivity and pozzolonic property. Industrialization has resulted in large deposition of plastic waste. It is non-biodegradable material which is harmful to the environment. Plastic bits are used as fibers in concrete to enhance its strength and durability properties. Many researches were conducted to use industrial by-products and wastes such as rice husk ash and plastic waste in concrete. Disposal of these industrial by-product or waste from industrial unit in open land surface become a major challenge for environment and health. Use of these waste material in concrete is a novel cause as well as to decrease the depletion of natural resources from earth.

## 2: LITERATURE REVIEW

Bhogayata at el. investigated the concrete properties inclusion with plastic waste and fly ash. Tests were performed with different curing conditions to check the effect of chemical surrounding on compressive strength of concrete. Minimum results were obtained at 30 % fly ash and 1.5% of plastic fiber by volume. [1]. Chirag G. and Jain A. conducted the tests on concrete incorporating with fly ash. They investigated that how fly ash used in concrete, contributes the reduction of greenhouse gases. Their research showed that 0.9 tons of CO2 is produced per ton of cement production [2]. Deotate at el. investigated the effect of partial replacement of cement by fly ash and rice husk ash with using steel fiber in concrete. Various strength and durability properties were investigated. Results showed that there is an improvement in concrete properties with inclusion of waste materials in concrete [3]. Shubha khatri examined the M20 concrete design mix incorporating with admixture and rice hush ash at the age of 7 and 28 days. Cement was replaced with 5% and 15% RHA. Test results showed that concrete strength had been improved by addition of waste material [4]. K. Ramadevi and R. Manju examined the properties of concrete with replacement of fine aggregate with plastic bottle fiber. The range of plastic waste in concrete mix was between of 1 % to 6%. Finding reveled that there was an enhancement in compressive strength and tensile strength of concrete [5]

## 3: EXPERIMENTAL PROGRAM

### 3.1 Cement

**PPC** (fly ash based) cement was used. It was tested as per Indian standard specification (IS-1489 part 1:1991) [6]. Specific gravity and standard consistency of cement was 3.05 and 33%. Soundness (Le chatellier expansion) of cement was 1.4. Rice husk ash was obtained from Mandigobindgarh, Punjab. Chemical properties of RHA are shown in Table no 1.

Table 1: Chemical Properties of RHA

| Constituents | % By Weight |
|---|---|
| Silica ($SiO_2$) | 82.8 |
| Iron Oxide ($Fe_2O_3$) | 0.70 |
| Alumina ($Al_2O_3$) | 0.41 |
| Calcium Oxide (CaO) | 0.62 |
| Magnesium oxide (MgO) | 0.51 |
| Sodium Oxide ($Na_2O_3$) | 0.20 |
| Potassium Oxide ($K_2O$) | 1.15 |

### 3.2 Aggregate

Natural coarse sand having 4.75 mm maximum size particle was used. It was tested as per Indian standard (IS- 383-1970) [7] and satisfied its requirement. Locally available Crushed coarse aggregate having maximum size 12.5mm was used. Physical properties of fine aggregate and coarse aggregate are given in Table 2. P.V.C bits were used as plastic fiber. Plastic was obtained from waste end product of plastic pipe industry from Mandi-gobindgarh, punjab

Table 2: Physical Properties of Aggregate

| Properties | Natural Sand | Coarse Aggregate | Plastic waste |
|---|---|---|---|
| Specific Gravity | 2.58 | 2.75 | 0.89 |
| Fineness Modules | 2.60 | 6.24 | 2.5 |
| Water absorption (%) | 1.12 | 1.2 | ------ |
| Moisture content (%) | 0.16 | Nil | ------- |
| Material finer than 75 µ (%) | 0.4 | ------ | ------- |

### 3.3 Superplasticizer

To maintain the flow workability of the concrete, superplasticizera-polycarboxylic ether based was used in form of slump having density 1080g/l at 30°C. PH value of superplasticizer was approximately 5.

### 3.4 Concrete Mix

A control concrete mixture (CM-1) was designed as per (IS: 10262-1982) [8] to have 28 day compressive strength of 30 MPa (Target strength 38 MPa). Three more concrete mixes (CM-2, CM-3, and CM-4) were made by replacement of fine aggregate with plastic bits and cement with RHA. Replacement percentage was 5%, 10%, 15%. Control concrete mix was made by cement (390 $Kg/m^3$), fine aggregate (569 $Kg/m^3$ and coarse aggregate 12.5mm size (1165 $Kg/m^3$) with water cement ration 0.5. 0.59 $L/m^3$ super-plasticizer was used to maintain the slump of mix.

### 3.5 Casting of specimen

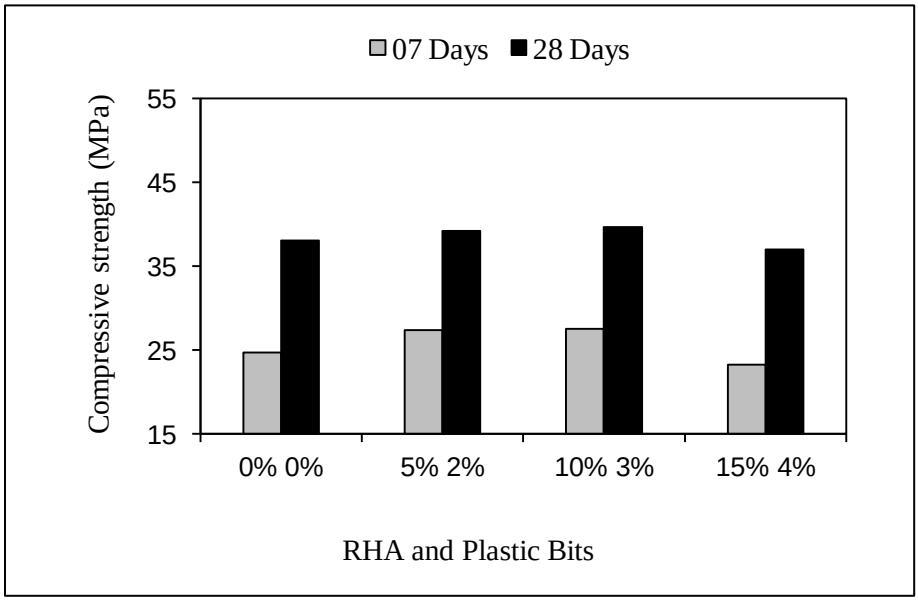
Compression test was performed on 150 mm cubes and 150 x 300 mm cylinders were cast to conduct the splitting tensile strength test at the age of 7 and 28 days. After casting the test specimens, all specimens were covered with plastic sheet to reduce the moisture loss and cured for 24 h in air. All test sample specimens were taken out from the mould and placed in water tank for curing.

## 4. RESULTS AND DISCUSSION

### 4.1 Compressive Strength

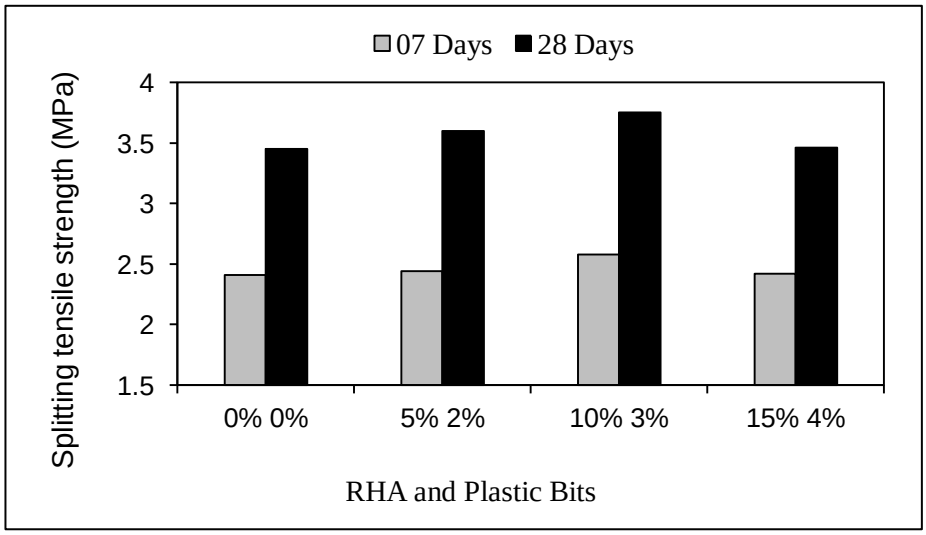
Compressive strength of concrete mixes CM-1, CM-2, CM-3 and CM-4 (M30 grade concrete) with and without RHA and plastic bits was determined at the age of 7and 28 days shown in Figure 1. It was observed that concrete mixes made with 10% RHA and 3% plastic bits exhibited higher compressive strength than control mix (CM-1). Target compressive strength of CM-1 was 38.1 MPa at the age of 28 days. From these results, it was found that 28-day compressive strength increased by 2.8% and

3.41% for mixes CM-2 and CM-3 respectively than the strength (38.1 MPa) of control mix CM-1 (0% 0% RHA and plastic bits). But concrete mix CM-4 showed negative result (37 MPa) when compare to control mix.




### 4.2 Splitting Tensile Strength

Splitting tensile strength of concrete mixes CM-1, CM-2, CM- and CM-4 determined at the age of 07 and 28 days (figure 2). It was observed that concrete mixes made with 10 RHS and 3% plastic bits exhibited higher splitting tensile strength than control concrete mix (CM-1). The same trend was observed in compressive strength of the concrete mixes. Splitting tensile strength of control mix was 3.45 MPa at the age of 28 days. From these results, it was seen that 28-day splitting tensile strength 3.6, 3.75 and 3.46MPa for mixes of CM-2, CM-3 and CM-4 respectively than the strength (3.45 MPa) of control mix CM-1. At the age of 7 days, concrete mixes with and without waste materials exhibited the same trend which was observed at 28 days of testing.




## 5. CONCLUSIONS.

i. Replacement of fine aggregate with plastic bits and cement with rice husk ash enhanced the strength properties at all ages
ii. Maximum increase in compressive strength and splitting tensile strength of concrete was observed with addition of 10% RHA and 3% of plastic bits at both 7 days and 28 days.
iii. Inclusion of RHA (15%) and plastic bits (4%) decreased the compression strength and splitting tensile strength of concrete, because of increase of volume of plastic bits.

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