INTRODUCTION

Worldwide annually 20% of the 649.7 million tons of rice produces Rice husk as residual waste. Rice husk ash (RHA) is obtained by the combustion of the rice husk. Traditionally, rice husk has been considered as a non usable material so it was dumped and although some has been using as a low grade fuel. The partially burnt rice husk from the milling plant used as a fuel also creates pollution and step was taken to overcome this issue by utilizing this material as a supplementary cementitious material. The chemical composition of rice husk is varied from one place to another due to the differences in the type of paddy, climate and geographical conditions. Rice husks contain organic and inorganic substances.

RHA produced after burning of Rice husk which has high pozzolanic property. Chemical compositions of are affected due to burning process and temperature. Silica content increases in the ash at the higher burning temperature. Rice husk ash is one of the excellent pozzolanic materials that can be blended with Portland cement for the production of concrete and at the same time it is a over whelming product. Addition of rice husk ash in cement improves early strength of the concrete and also forms a calcium silicate hydrate (CSH) gel around the cement particles; it results in formation of highly dense and less porous concrete against cracking.

The introduction of basalt Fibre and rice husk ash into blended concrete as a new constituent helps to increase the strength of the concrete. Many important characteristics of concrete are influenced by the ratio of water to cementitious materials used in the mixture. By reducing the amount of water, the cement paste will have high density, which results in increase the cement paste quality and due to this increase in paste quality will yield higher compressive and flexural strength, lower permeability.

RHA AS CEMENTITIOUS MATERIAL

During burning process, chemical compositions of RHA are affected. Silica content in the ash increases with higher the burning temperature. Increase in temperature increases fineness of the rice husk ash. The main physical properties of RHA are its fineness that influences the activity in gaining strength. RHA required having equal or finer than OPC for its good cementing efficiency. RHA produced by burning rice husk between 600 and 700°C temperatures for 2 hour duration, while it result in 90-95% SiO₂, 1-3% K₂O and < 5% unburnt carbon. Under controlled burning condition in industrial furnace, RHA contains silica in amorphous and highly cellular form, with 50-1000 m²/g surface area. So use of RHA with cement, results in increases in workability, decreases in heat evolution, thermal cracking and plastic shrinkage. By addition of RHA to cement, the concrete increases in strength, durability, modifies the pore-structure and by pozzolonic reaction it blocks the large voids in the hydrated cement paste. RHA minimizes alkali-aggregate reaction, expansion, refines pore structure and diffusion of alkali ions to the surface of aggregate by micro porous structure.

MANUFACTURE OF RHA

Rice husk was burnt under uncontrolled combustion process for duration of two days. The burning temperatures for rice husk ash are kept as 800 degree. The ash so obtained was ground in a ball mill by box-behken methodology and its appearance was grey from the chemical composition table it is clear that the principal material contained in RHA is SiO₂ and it contains 7.27% loss on ignition which is an indication of its carbon content. The RHA also contains high K₂O content which is due to fertilizers. The increase in temperature also increases the sand and silica content in the ash and also decreases the loss on ignition. For normal RHA and and silica content is about 82.89% and loss on Ignition is 7.27%, for 150oC RHA the sand and silica content is 84.51% and loss on ignition is 6.11%, for 250degree RHA the sand and silica content is 88.32% and loss on ignition is 4.27% and for 800degree the sand and silica content is 90.48% and loss on ignition is 0.69%.

MATERIALS USED

Cement OPC of 53 Grade locally available is used in this investigation. The Cement is tested for various properties as per the IS: 4031–1988 and found to be confirming to various specifications of IS: 12269–1987 having specific gravity 3.12.

Water

Tests were performed for split tensile strength for all replacement levels. The basalt fibers were added by 0.5% by volume of cementitious material.

ABSTRACT

Due to increasing quantities of waste materials and industrial by-products, solid waste management is the prime concern in the world. One such industrial by-product is Rice Husk Ash (RHA). RHA is a major by-product of rice mills and used as a land filling material for many years. Fiber Reinforced Concrete (FRC) is another technology which yields similar properties as that of conventional concrete. Many journals showed that use of basalt fibers in lower strength concretes increases their Split tensile strength. The development of HSC has brought about the essential need for additives, both chemical admixtures and mineral admixtures, to improve the performance of concrete. The experimental investigation has been performed to evaluate the strength properties of M40 grade of concrete mixes, in which cement was replaced with RHA at four different percentages namely 0%, 10%, 20% and 30%. The basalt fibers were added by 0.5% by volume of cementitious material. Tests were performed for split tensile strength for all replacement levels. Test results show that there is an increase in split tensile strength. Hence, Rice Husk Ash can be safely used in concrete to increase the strength of concrete.

KEY WORDS: High Strength Concrete, Rice Husk Ash, Basalt Fiber, Split Tensile Strength.
Ordinary water available in the laboratory was used for the experimental investigations and curing purposes. Water is a vital role in concrete as it actively participates in the chemical reactions with cement to form the hydration product, calcium-silicate-hydrate (C-S-H) gel. The strength of the cement concrete depends on the binding action of the hydrated cement paste gel. The quantity of water added should be the minimum requirement for chemical reaction of un-hydrated cement.

2.3 Fine aggregate
Fine aggregate locally available clean, well graded, Natural River sand conforming IS: 383 – 1970 was used as the fine aggregate. The specific gravity of the sand is found to be 2.65.

2.4 Coarse aggregate
Coarse Aggregate crushed angular aggregate of size 20 mm nominal size from the local source with specific gravity of 2.78 was used as coarse aggregate. The water absorption value is about 2.5%.

2.5 Rice husk ash (RHA)
It is a material consisting of silica and alumina. Hence it can be used in the concrete to partially replace cement. The rice husk ash samples are obtained from the rice mills present in and around Erode District. The specific gravity of RHA is 2.14 and its normal consistency is 30%.

2.6 Basalt fiber
Basalt fibers have the most preferable parameter as its price and performance is better when compared with glass & carbon fibers. Basalt rock is a volcanic rock and can be divided into small particles then formed into continuing or chopped fibers. It has a higher working temperature and has a good resistance to chemical attack, impact load, and fire with less poisonous fumes. The production of basalt fibers is similar to the production of glass fibers.

3 RESULTS

3.1 Split tensile strength
The cylinders of size 200 mm x 100 mm were employed for testing the Split tensile strength of concrete. The specimens after 24 hours and were immersed in a curing tank with water. The details of the test specimens cast are designated in Table 2. The cubes were tested in a Testing Machine with references of IS: 516 – 1959 at an age of 7 days and 28 days. The test results of the Split tensile strength are illustrated graphically in Fig.2.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Description</th>
<th>Specimen identification</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Conventional</td>
<td>A</td>
</tr>
<tr>
<td>2</td>
<td>0.5% B</td>
<td>B</td>
</tr>
<tr>
<td>3</td>
<td>0.5% B + 5% RHA</td>
<td>C</td>
</tr>
<tr>
<td>4</td>
<td>0.5% B + 10% RHA</td>
<td>D</td>
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<tr>
<td>5</td>
<td>0.5% B + 15% RHA</td>
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<td>6</td>
<td>0.5% B + 20% RHA</td>
<td>F</td>
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<tr>
<td>7</td>
<td>0.5% B + 25% RHA</td>
<td>G</td>
</tr>
<tr>
<td>8</td>
<td>0.5% B + 30% RHA</td>
<td>H</td>
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</tbody>
</table>

* B – Basalt fiber

4 CONCLUSIONS
During this experimental study of Rice Husk ash concrete, indicated that a combination of OPC and RHA can be effectively used to optimize the behavior of concrete. A description is given of an optimum combination of cement and RHA in concrete. Based on the investigations conducted,

The addition of RHA in concrete proves to give the desired strength in concrete.

1. The replacement of 10% of RHA gives increased tensile strength when compared to conventional concrete.
2. RHA thus proves to be an effective pozzolonic cementitious material and provides optimum results at 10% replacement with cement.

REFERENCES
5. IS: 516-1959, ‘Code of Practice- Methods of Test for Strength of Concrete.