# IMPACT OF MIXING RISE HUSK ON VARIOUS STRENGTH PARAMETERS OF PLAIN CONCRETE

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***Abstract:-*** ***Plain concrete is weak in tension and has numerous deficiencies and is also responsible for the overall strength of the structure. It has been observed that by replacing cement with small amount of Rise husk from 1% to 9% improves the compressive as well as tensile properties of the plain concrete. But the strength parameters decreases on further increasing the amount of rise husk. The specimen in compression as cube and cylinder has been tested for various mixing percentage of rise husk and well compared with plain concrete. The specimen in tension as flexural member is tested as beam in three point loading system and well compared with plain concrete specimens. The impact of mixing rise husk and replacing with the same amount of ordinary Portland cement in the mix proportion of M25 and M50 were studied after 7 and 28 days and compressive and flexural strength were concluded up to the 20% replacement of cement in hardened state.***

***Keywords:- Rise Husk, Concrete Mixes, Replacement, Rise Husk Aggregate(RHA)***

## 1. INTRODUCTION

Last few decades have witnessed the infrastructural development of the country plays vital role in the development of the country. As concrete is the main compound of construction for all type of structure. Plain concrete has numerous deficiencies hence overall strength and life of the structure can be enhance by enhancing the quality of the concrete. Generally the main ingredients of the concrete are the cement, sand, course aggregate, fine aggregate and water. It is very much evident that the quality of concrete is wholly dependent on the quality and mixing proportion of these compounds. In addition to that any other material which on mixing on concrete can change and improved the quality in terms of durability ,strength and resistant to various atmospheric action is always remain a matter of research in the field of structural engineering. The concrete is using in various types and in form like, Plain, Reinforced concrete, Pre-stressed concrete, Fibers concrete and in composite form for all type of structure around the world. The demand of the infrastructural development is increasing day by day due to growth in population. As in developing country like India the replacement of ordinary port land cement by pozzolana cement not only provide economic, efficient construction but also solve the problems of disposing the waste materials like rise husk. Rise husk Ash is agricultural by-product and a waste material which on mixing in plain concrete has shown effective and worthy outcome results in this research work. The most beneficial advantage of the pozzolana material in concrete is its inherent alkalinity which provides passive and safe mechanism and protect the steel reinforcement from corrosion. On mixing rise husk to the plain concrete reduces the production of heat in hydration process and saves the concrete from microcraks and enhance the overall ductility of the concrete. On the other hand using other ingredients to replace in concrete not only conserve the cement consumption but also eliminate he problems of consuming waste product.

## 2. BACKGROUND

Generally mineral admixtures are added to the concrete to enhance the workability requirement in fresh concrete and also improves the inherent properties of concrete to resist the various environment impact like sulfste attack, thermal cracking ,alkali-aggragate expension. The various compound are to be used as admixtures in making concrete like Fly ash, Silica fumes, Ground Granulated Blast Furnace Slag and Rise Husk Ash. Present paper describes the impact of rise husk in concrete as an ingredient. Burning of rise husk at various temperature produces numerous quality of ashes. The silica contents of the fly ash is minimized upto 90percent by processing it with chemicals in factories. This rish husk ash is used in the proposed work in various grades of concrete in different quantitites.

In 1972, Mehta et.al clarifies the pyro processing parameters and their influence on rise husk ash reactivity. They also describes the controlled burning of husks in incinerators and ingranding the ash with lime or blending with Portland cement. Ganeshan et.al concluded that 56 days using 7.5% , 10% and 12.5% cement replacement with Egyptian rise husk ash increased the compressive strength of concrete upto 20%,27% and 40% respectively.

Al-Khalaf and A.yousif (1984) also examined the use of Rise Husk Ash in concrete. The outcome of their reseach was that burning condition to convert rise husk into homogeneuous and well burnt ash is possible on temperature 5000 C for 2hrs continuous burning and use of such Rise Husk ash upto 40% in plain mortar can heigher level of volume change in charachterstic strength of the mortar. Aitcin(1995) found the use of RHA in high performance concrete enhance the compressive strength upto double to the basic compressive strength of plain concrete. Ismail and waliuddin (1996) also studied the Effect of RHA passing 200 and 325 micron sieves with 10-30% replacement of cement and tested the specimens in compressive and split tensile strength. Test results indicated that strength of HSC decreased when cement was partially replaced by RHA for maintaining same level of workability. Aitcin.(2003) studied on the durability characteristics of high performance concrete. He examined durability problems of ordinary concrete can be associated with the severity of the environment and the use of inappropriate high water/binder ratios. Basha and Muntohar (2003) stated that the plasticity of soil get reduced when rise husk ash and cement is added , as is the residual RHA provides a positive effect on the compressive strength at early ages, but the long term behavior of the concretes with RHA produced by controlled incineration was more significant.

M.A.Ahmadi et.al(2007) prosed that rice husk ash provides a positive effect on the mechanical properties at age after 60 days. Sumin Kim(2008) investigated the effect of combining rice husk itself with gypsum in the manufacture of drywall boards. Kim found that at rice husk levels up to 30%, the modulus of rupture and modulus of elasticity increased but decreased at levels over 40%. Internal bonding strength increased for rice husk ash levels upto 20%, but decreased at higher levels. Silva, Liborio and Helene (2008) identified Brazilian silica rice husk ash for the improvement of physical and chemical properties of concrete. In this study, the effects of silica extracted from rice husk ash as

partial replacement of cement in concrete with low water/binder are reported. Zemke and Emmet woods (2009) recommended to use rice husk ash substitution for Ordinary Portland Cement up to 30%. This will decrease the weight of the finished project, decrease the cost and dispose of rice husk ash waste product. Abu Bakar, Putrajaya and Abdulaziz(2010) concluded that Malaysian rice husk ash on using in concrete enhance the durability and corrosion resistance of Concrete. Sampaio et.al(2010) presented their study on Portuguese rice husk ash as a partial replacement at different percentages with 10%, 15% and 20% replacement of rise husk by weight of cement. . All results lead to the conclusion that Portuguese rice husk ash is highly recommended to enhance concrete performance Harunur R (2101) proposed Improvement on Mechanical Properties of Rice Husk Ash Concrete with Super plasticizer‖. By using superplastisizer concrete with 30% RHA attains strength of 30 N/mm2 at 28 days. DaoVan & PhamDuy(2011) presented several key properties of high strength concrete using RHA. RHAs obtained from two sources: India and Vietnam. India RHA was much better than that of the Vietnam RHA. Ramezanianpour & khani investigated ―The effect of rice husk ash on mechanical properties and durability of sustainable concretes‖. RHA replaced with cement by weight are 7%, 10% and 15%. we can replace 10% cement with the help of RHA without any ill effect.

Kartini showed that ―The RHA is a zemke & woods recommended to use rice husk ash substitution for Ordinary Portland Cement up to 30%. This will decrease the weight of the finished project, decrease the costHarunur & Keramat investigated the ―durability of cement mortar in presence of Rice Husk Ash (RHA)‖. The strength and durability of mortar with different replacement level (0%, 10%, 15%, 20%, 25% and 30%) of Ordinary Portland Cement (OPC) by RHA isisvetigated. Abhilash & Arbind evaluated one type of commercially available RHA as supplementary cementitious material for cement. There was a significant improvement in Compressive strength of the Concrete with RHA content of 10% for M30 and M60 at 7 days and 28 days i.e. 4.23% to 10.93%. It is concluded that pozzolanic material‖. The inclusion of Sp in RHA concrete while maintaining the w/b ratio increased the slump and improved the cohesiveness of the concrete.

Malleswara&Patnaikuni concluded that for M20 grade RHA concrete subjected to seawater exposure for 28 days and 90 days. The 7.5% replacement showed better compressive strengths. Maurice & Godwin proposed the patial replacement of cement with RHA and concluded that adding RHA to concrete resulted in increased water demand, increase in workability and enhanced strength compared to the control sample Shirule et.al investigated the for M20 grade of concrete the compressive strength of concrete cubes increased with addition of waste marble powder up to 10% by weight of cement. Marthong investigated the ―Effect of Rice Husk Ash (RHA) as Partial Replacement of Cement on Concrete Properties‖. Three grades of ordinary Portland cement (OPC) namely; 33, 43 and 53 are used. Percentage replacement of OPC with RHA was 0, 10, 20, 30 and 40% respectively.

Abdullahi et al investigated onthe compressive strength of some commercial sandcrete blocks in Minna, Nigeria was investigated. Rice Husk Ash (RHA) was prepared from burning firewood. Preliminary analysis of the Constituent materials of the ordinary Portland Cement (OPC) / Rice Husk Ash (RHA) hollow sandcrete blocks were conducted to confirm their suitability for block making. He conducted physical test of the freshly prepared mix. 150mm×450mm hollow sandcrete blocks were cast cured and crushed for 1, 3, 7, 14, 21, and 28 days at 0, 10, 20, 30, 40 and 50 percent replacement levels and dispose of the rice husk ash waste product.

Prasad et al (2006) investigated on Cement concrete which continues to be the pre- eminent construction materials for use in any type of civil engineering structure. Performance of these structures in terms of their strength and stability has withstood the test of time but the life span of the structures has become a matter of concern. . He concluded in his investigation the blended cements, particularly are better in Sodium Sulphate environment. The blended cement mixes show more deterioration in Magnesium Sulphate exposure in compared to plain cement mixes. The Magnesium Sulphate environment is more severe than Sodium Sulphate environment. The performance of low water/binder ratio mixes is inferior in Sulphate.

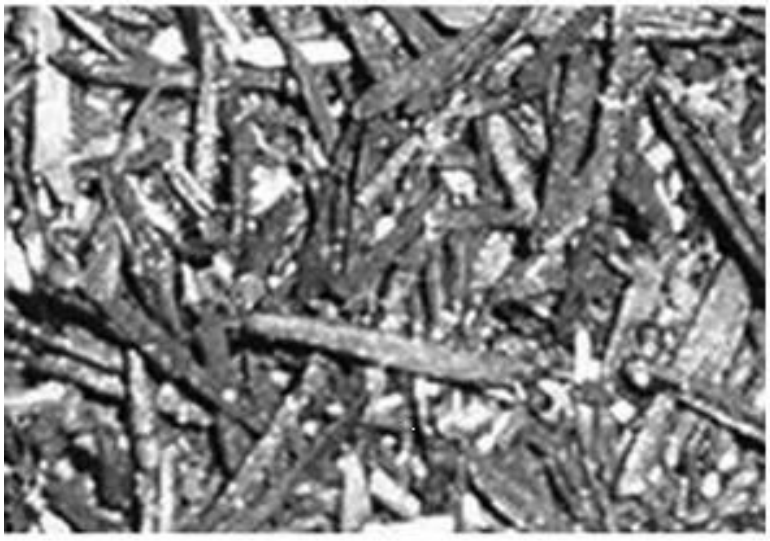


Figure1 Microscopy of RHA

## 3. EXPERIMENTAL OBSERVATIONS

To study the effect of Rise husk on concrete, specimens were casted in cubes 15×15×15cm3, Cylinder 15cm×30cm, Beam15cm ×15cm ×50cm size were tested. The experimental programmes consists material testing, mix proportion, casting and testing of specimens. Ordinary Portland cement grade53 as per IS12269,1999 were used for present study. Locally available fine aggregates which have specific gravity 2.65 and fineness modulus of 2.45 were used. The grading of 20 mm course aggregate were done as per IS 383,1970. The fineness modulus of course aggregate were 6.5 and specific gravity 2.7.

Rice Husk is collected from a Rise Mill, Allahabad(UP) having specific gravity 2.0.Various ingredients present in Rise Husk were Silicon Dioxide(SiO2) 85.01%, Aluminum Oxide(Al2O3) 0.18%, Carbon(C) 6%, Calcium Oxide(CaO)0.61%, Ferric Oxide(Fe2O3)0.2% and shape of the Rise Husk were irregular. Local tap water is used for both mixing of concrete and curing of concrete specimens.The properties of various concrete mixes were listed in tabular form for M25 and M50 grade of concrete for different rise husk mix from 4%,8%,12%,16%,20% replacement of cement.

Table 1: Mix Proportions for M25 grade concrete Mixture

| Mix Specimen | % of Rice Husk mixed | W/C ratio | Cement (Kg/m$^3$) | Rise Husk (Kg/m$^3$) | Sand (Kg/m$^3$) | Course Aggregate (Kg/m$^3$) | Water (lit/m$^3$) |
|---|---|---|---|---|---|---|---|
| PC | 0 | 0.44 | 420 | 0 | 622 | 1109 | 181 |
| RC1 | 4 | 0.44 | 403 | 17 | 605 | 1109 | 181 |
| RC2 | 8 | 0.44 | 386 | 34 | 588 | 1109 | 181 |
| RC3 | 12 | O.44 | 370 | 50 | 572 | 1109 | 181 |
| RC4 | 16 | 0.44 | 353 | 67 | 555 | 1109 | 181 |
| RC5 | 20 | 0.44 | 336 | 84 | 538 | 1109 | 181 |

**Table2: Mix Proportions for M50 grade concrete Mixture**

| Mix Specimen | % of Rice Husk mixed | W/C ratio | Cement (Kg/m$^3$) | Rise Husk (Kg/m$^3$) | Sand (Kg/m$^3$) | Course Aggregate (Kg/m$^3$) | Water (lit/m$^3$) |
|---|---|---|---|---|---|---|---|
| HC | 0 | 0.44 | 460 | 0 | 640 | 1121 | 169 |
| HC1 | 4 | 0.44 | 441.6 | 18.4 | 621.6 | 1121 | 169 |
| HC2 | 8 | 0.44 | 423.2 | 36.8 | 603.2 | 1121 | 169 |
| HC3 | 12 | O.44 | 404.8 | 55.2 | 584.8 | 1121 | 169 |
| HC4 | 16 | 0.44 | 386.4 | 73.6 | 566.4 | 1121 | 169 |
| HC5 | 20 | 0.44 | 368 | 92 | 548 | 1121 | 169 |

To find out the parametric effects of Cement and sand replacement by Rise Husk in concrete , the compressive strength of cubes , Flexural strength of beam at 7 and 28 days were tested as shown in figure., the compressive strength at 7-days are nearby 80% of 28 days strength.The flexural strength of beam for different percentage of cement replacement with rise husk was tested as shown in figure. Cement is replaced by rise husk up to 20%.The parametric effects of cement replacement at 7 and 28 days were tested. The increasing costs of construction or building materials are being used extensively to replace old conventional methods. The applicability of rise husk for development of light weight concrete is examined by these tests.

**Figure2: Compressive strength test**

**Figure3: Flexural Strength Test**

## 4. RESULTS AND DISCUSSIONS

All the samples like Plain Concrete and Cement replaced rise husk concrete specimens were tested in compression and tension both for M25 grade and M50 grade of concrete . The test results are computed in tabular as well as graphical form both from 7 days and 28 days of curing. It has been observed that the compressive as well as flexural strength of cement replaced rise husk concrete increases in compression from 4 to 12% of Rise husk sample and decrease in more than 12% of rise husk samples.

**Table3: Compressive Strength of M25 Grade concrete Mixes**

| Specimens | Rise Husk Contents(%) | Compressive Strength in MPa | |
|---|---|---|---|
| | | 7 Days | 28 Days |
| PC | 0 | 25 | 39 |
| RC1 | 4 | 27.5 | 42 |
| RC2 | 8 | 29 | 44.5 |
| RC3 | 12 | 31 | 46 |
| RC4 | 16 | 28 | 42 |
| RC5 | 20 | 24 | 37 |

**Table4: Compressive Strength of M50 Grade concrete Mixes**

| Specimens | Rise Husk Contents(%) | Compressive Strength in MPa | |
|---|---|---|---|
| | | 7 Days | 28 Days |
| HC | 0 | 45 | 58 |
| HC1 | 4 | 49 | 65 |
| HC2 | 8 | 53 | 67 |
| HC3 | 12 | 55 | 68 |
| HC4 | 16 | 51 | 65 |
| HC5 | 20 | 44 | 56 |

The variation in compressive strength after 7 and 28 days of curing is plotted in fig.4 and fig.5 for M25 and M50 grades of concrete cubes for different level of cement replacement by rise husk. These plots are more indicative for the variation in strength vs %of cement replacement by rise husk. It is clearly viewed that the linearity in plot after 28 days test are more indicative of variation rater than 7 days. Performance of these specimens in terms of their strength and stability has withstood the test of time but the life span of the structures has become a matter of concern. The patial replacement of cement with RHA and concluded that adding RHA to concrete resulted in increased water demand, increase in workability and enhanced strength compared to the control sample

**Figure4**

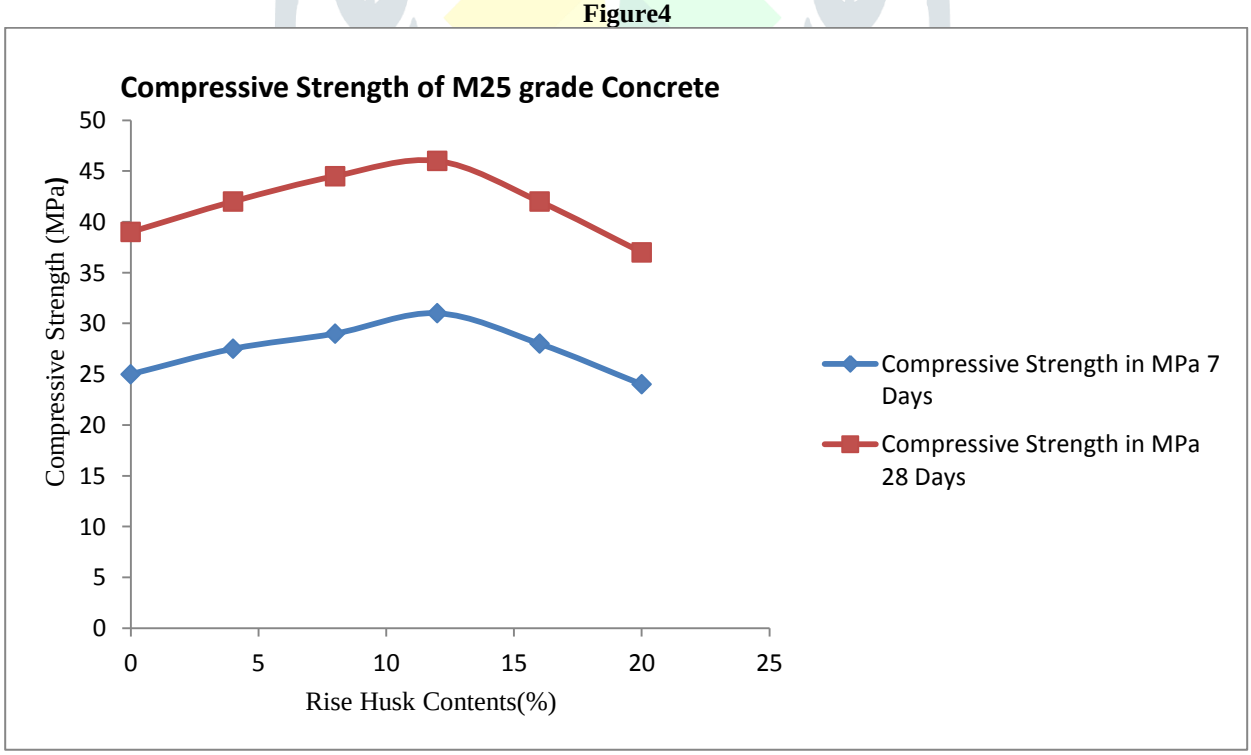
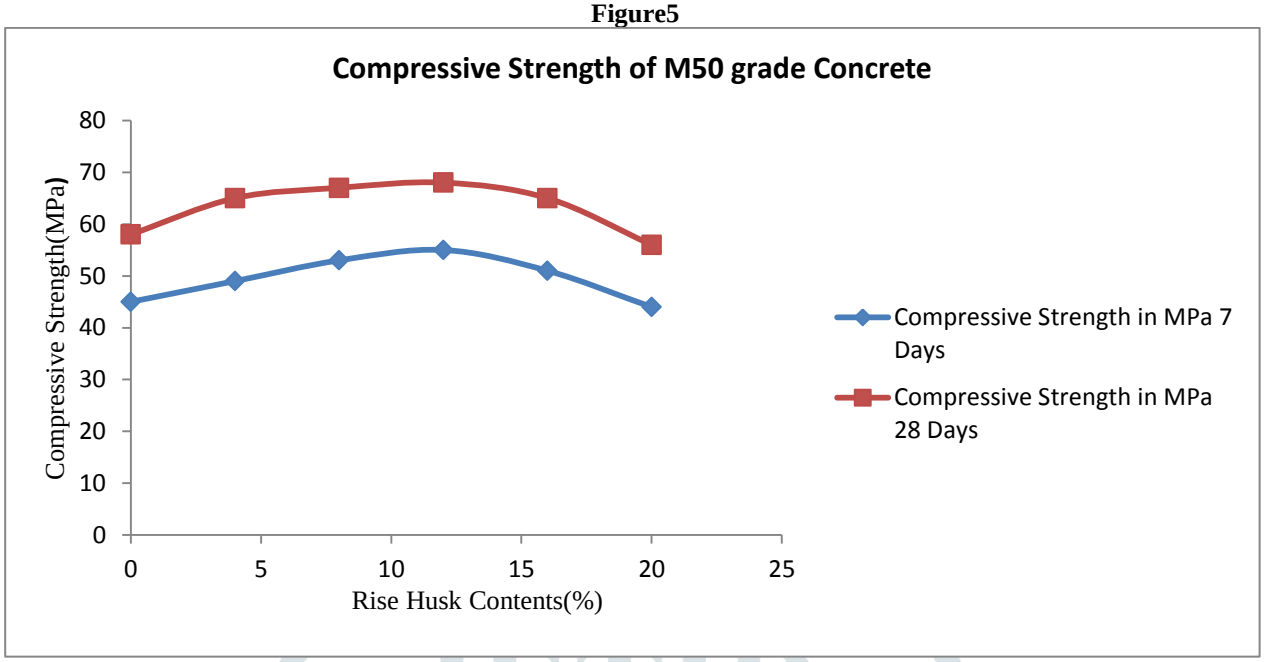


**Figure5**



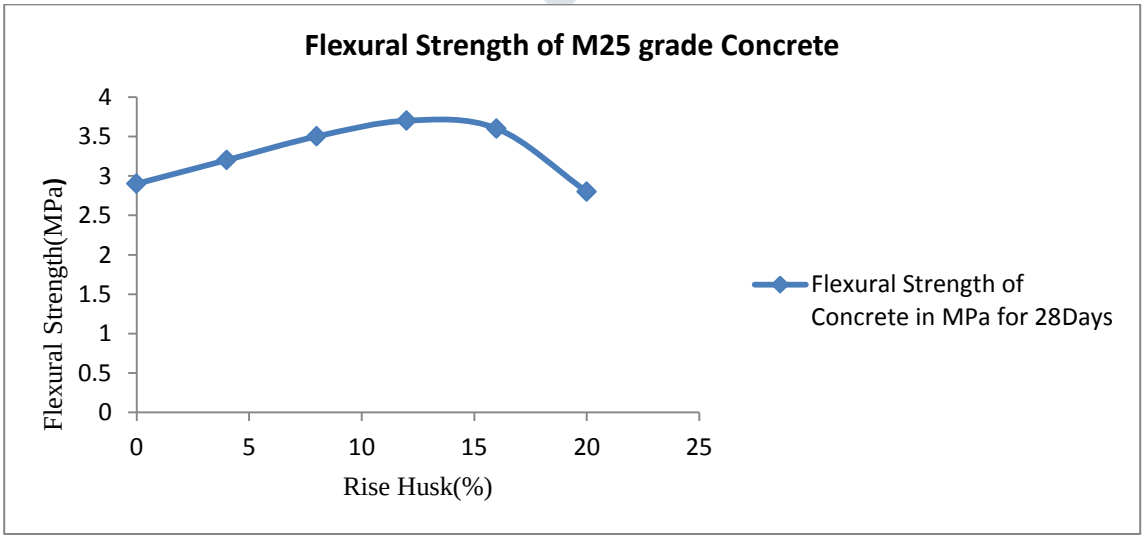

Rise husk is replaced by cement in M25 and M50 grade concrete and observed that the flexural strength was improved to the replacement of 16% in both cases. Both concrete mixes at 12% rice husk ash level showed 0.8% to 10% increase in flexural strength. Rice husk ash levels of 20% showed reduction in flexural strength in all ages as shown in Table5 and Table6

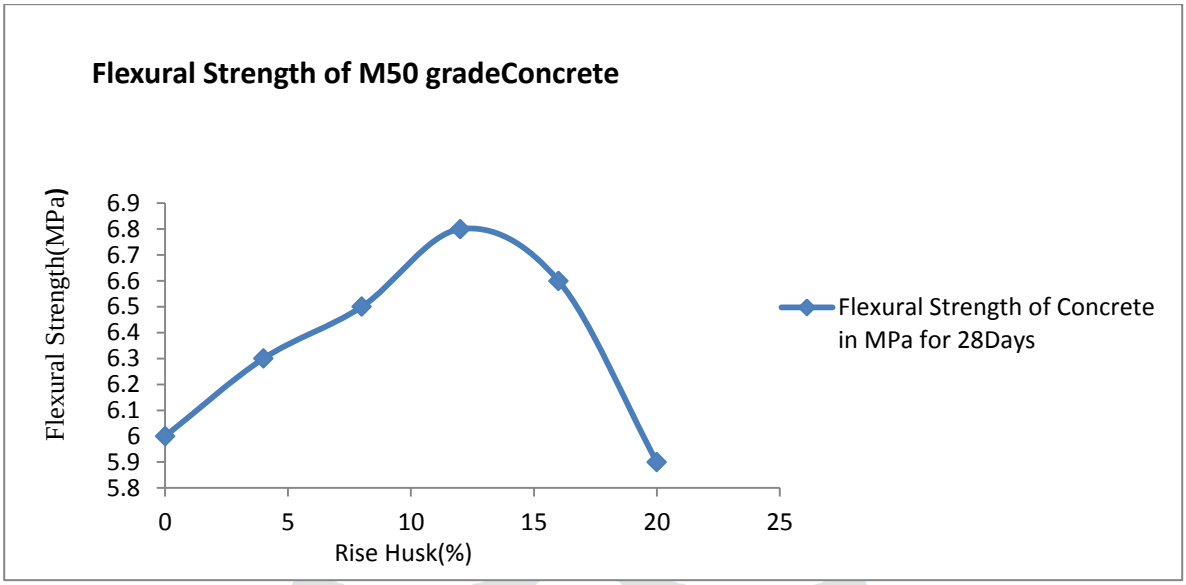
**Table5: Change in Flexural strength of M25 Grade of Concrete**

| Specimen | Rise Husk(%) | Flexural Strength of Concrete in MPa for 28Days |
|---|---|---|
| PC | 0 | 2.9 |
| RC1 | 4 | 3.2 |
| RC2 | 8 | 3.5 |
| RC3 | 12 | 3.7 |
| RC4 | 16 | 3.6 |
| RC5 | 20 | 2.8 |

**Table6: Change in Flexural strength of M50 Grade of Concrete**

| Specimen | Rise Husk(%) | Flexural Strength of Concrete in MPa for 28Days |
|---|---|---|
| HC | 0 | 6.0 |
| HC1 | 4 | 6.3 |
| HC2 | 8 | 6.5 |
| HC3 | 12 | 6.8 |
| HC4 | 16 | 6.6 |
| HC5 | 20 | 5.9 |






## CONCLUSIONS

On the basis of the study and test performed of rise husk replacement as cement and sand the following points were concluded

- The compressive strength of the concrete was increasing trend upto12% replacement sample for M25 and M50 grade of concrete after both 7 days and 28 days of curing.
- The increase trends in compressive strength was noticed as 4.5% to 9.2% for different grades at different ages.
- There improvement in Flexural strength of concrete was found significant with rice husk ash content of 12% for different grades namely M25 and M50 at the 28 days of curing.
- There graph of increase in Flexural strength was of the order of 1.75% to 9.8% for different grades and at the age of 28 days.
- As the concrete is a brittle material and cannot handle tensile stress as per IS:456-2000 proved to be right and that is why as the percentage of rice husk ash increased strength decreased. So it can be concluded that Split tensile strength test has a little importance for design aspects.

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