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# Investigation on Strength Characteristics of Concrete by Partial Replacement of Cement with Fly Ash And Coarse Aggregate With Coconut Shell

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***Abstract***
*In today's world, the most emphasis is on green and sustainable development. Concrete is a construction material that is mostly used in the world. It is a composite material made out of the water, cement, fine aggregate and coarse aggregate. However, the manufacturing process of raw materials used in concrete such as cement and aggregates cause environmental influences (emission of greenhouse gases and dust) and significantly consumes energy and natural resources.*
*Aggregates account typically 70% to 80% of the concrete volume, while water and cement account 20% to 30%. These percentages affect the mechanical properties of concrete.so, replacing any material by industrial waste can positively impact the environment and reduce the intensive use of energy and natural resources (aggregate mining). There are plenty of industrial wastes that can be used in concrete as either replacement of cement or aggregate. Therefore, this project has focused on evaluating the opportunity to use these waste materials, which is the fly ash as a replacement of cement and coconut shell as a replacement of coarse aggregate.*
*Fly ash a waste generated by thermal power plants is as such a significant environmental concern. The physical and chemical properties of fly ash are similar to cement, which is permitted to be used in concrete. The use of fly ash in concrete formulations as a supplementary cementitious material was tested as an alternative to traditional concrete. The replace of cement with fly ash includes 0% (without fly ash),10%,20%,30% &40% by weight of cement.*
*The high demand for concrete in the construction using normal-weight aggregates such as gravel and granite drastically reduces the natural stone deposits. India is the third-largest producer of coconut products in the world. Coconut trees are widely cultivated in the southern states of India, especially in Kerala. Coconut shells as a substitute for coarse aggregates in concrete are gaining importance, especially in this region. Coconut shells replaced coarse aggregate in three different percentages such as 10%,20%,30%. Workability of concrete increases with the addition of fly ash at all mixes while decreased with addition of coconut shells. The best combination in strength criteria is found at 30% of fly ash and 20% of coconut shells as replacement of cement and coarse aggregate.*
***Keywords:*** *Fly ash, Coconut shell, sustainable concrete.*

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## I. INTRODUCTION

India is a one of the largest developing country in the world. In India, now a days the development will be a concept of smart material, smart way. Smart material is one which better results in less economy. Under the developing process they created a huge demand of constructed materials. Concrete is the vital civil engineering construction material. Its manufacturing involves utilization of ingredients, aggregates. water, and admixtures. Due to continuously increasing demands for the concrete and huge advances in coarse aggregate generally takes about 50% in self weight of concrete. The cost of construction materials is raised day by day due to the huge demand, scarcity, and high amount of energy required. To reduce the energy and utilization of natural resources, alternative materials in concrete is a global concern, sustainable and environmentally friendly construction material.

Fly ash is the finely divided mineral residue resulting from the combustion of ground or powdered coal in electric power generating thermal plant. According to Design and Control of concrete Mixture (2010), Fly ash is a natural pozzolan, which means that is a "siliceous or siliceous-and-aluminous material" which chemically reacts with calcium hydroxide (CH) to from composite having cementitious properties. The replace of cement with fly ash accordingly the range of 0%,10%,20%,30%,40% by weight of cement.

In developing countries, the huge waste of coconut shell is discharged, these wastes can be used in a good manner in construction industry by replacing the materials in concrete. The chemical composition of coconut shell is similar to the wood. It contains 33.61% cellulose,36.51% lignin,29.27% and ash at 0.61%. The

shells absorb less moisture due to its low cellulose content the report focusses on studying the effectiveness of coconut shell particles as a source of natural material for reinforcing epoxy resins towards their flexural properties. The hardness of the coconut shell is comparable to lower strength aluminum alloys, making it one of the hardest materials produced in nature. By replacing the material in concrete with coconut shell is contains a dual benefit of reduction in the appraisal value of construction material and also as a means of disposal of waste. The replace of coarse aggregate with coconut shell accordingly the range of 0%,10%,20%,30% and 40%.

## II. RESULT AND DISCUSSION

The results obtained are as discussed below

**Nominal Mix Proportion**

| Cement ($Kg/m^3$) | Fine aggregate ($Kg/m^3$) | Coarse aggregate ($Kg/m^3$) | Water |
|---|---|---|---|
| 389 | 661 | 1143 | 171 |

**COMPRESSIVE STRENGTH RESULTS:**

The experimental results obtained after the curing of 7 days and 28 days are shown in the table 4.1. Figures 4.1, represent the compressive strength for 7&28 days with Fly ash. Figures 4.3 represent the combined values of compressive strength for mixes with Fly ash and with 10%, 20% and 30% Coconut Shell.

**Table 2.1: Compressive strength of Fly ash**

| Mix | Fly ash | Compressive strength | |
|---|---|---|---|
| | | 7 days MPa | 28 days MPa |
| **1** | 0 | 29.02 | 38.94 |
| **2** | 10 | 25.67 | 39.42 |
| **3** | 20 | 26.42 | 40.42 |
| **4** | **30** | **30.74** | **41.94** |
| **5** | 40 | 26.32 | 36.46 |

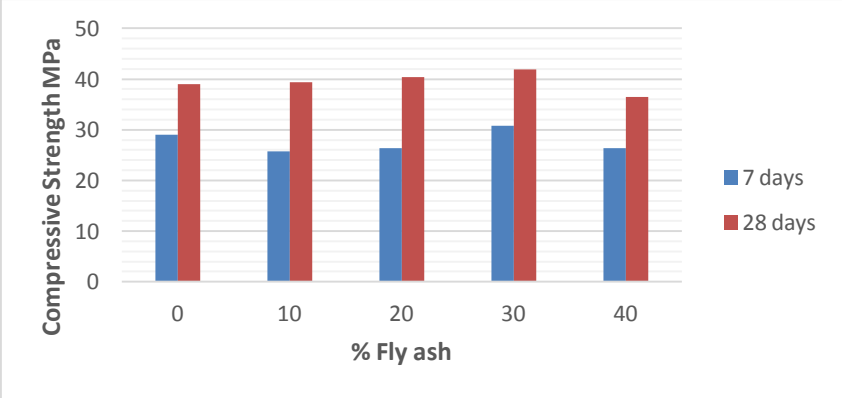


**Figure2.1: Compressive strength of Fly ash for 7 and 28 days**

**SPLIT TENSILE STRENGTH RESULTS:**

**Table 2.2: Split Tensile strength of Fly ash**

| Mix | Fly ash | Split tensile strength | |
|---|---|---|---|
| | | 7 days MPa | 28 days MPa |
| **1** | 0 | 2.83 | 3.81 |
| **2** | 10 | 2.54 | 3.61 |
| **3** | 20 | 2.67 | 3.76 |
| **4** | **30** | **2.88** | **3.87** |
| **5** | 40 | 2.51 | 3.46 |

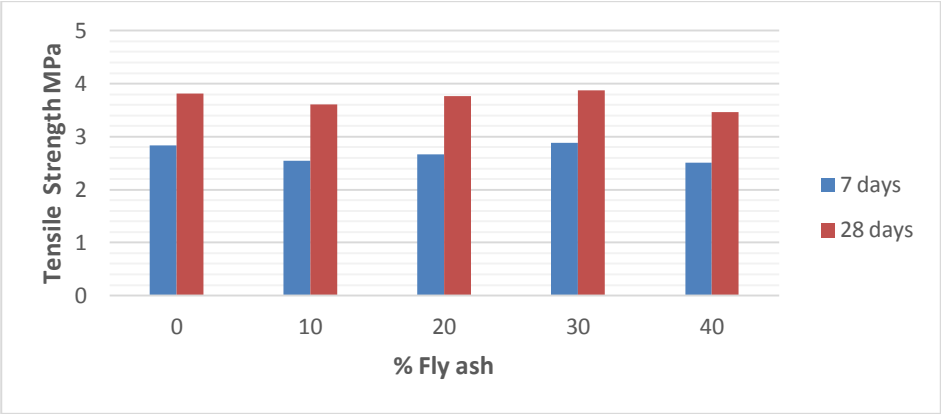


**Figure 2.2: Split Tensile strength of Fly ash for 7 and 28 days**

**Table 2..3: Compressive Strength For Optimum Fly ash& Coconut Shell**

| Mix | Fly ash | Coconut Shell | Compressive strength | |
|---|---|---|---|---|
| | | | 7 days MPa | 28 days MPa |
| **Mix 6** | 30 | 10 | 31.64 | 42.87 |
| Mix 7 | **30** | **20** | **33.89** | **44.63** |
| **Mix 8** | 30 | 30 | 26.83 | 40.92 |

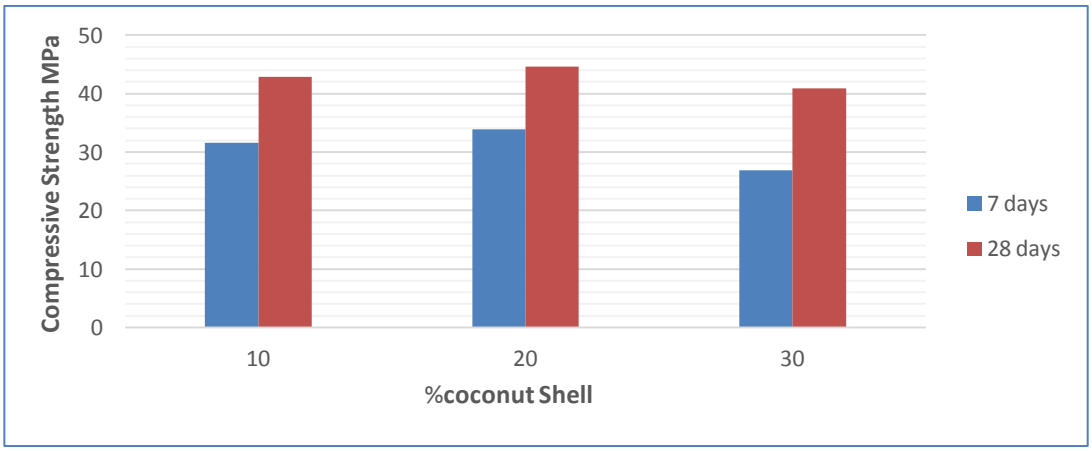


**Figure 2..3: Compressive strength of Fly ash and Coconut Shell for 7 and 28 days**

**Table 2..4: Split Tensile Strength For Optimum Fly ash& Coconut Shell**

| Mix | Fly ash | Coconut Shell | Split Tensile strength | |
|---|---|---|---|---|
| | | | 7 days MPa | 28 days MPa |
| **Mix 6** | **30** | **10** | **2.82** | **3.96** |
| **Mix 7** | **30** | **20** | **3.12** | **4.21** |
| **Mix 8** | **30** | **30** | **2.64** | **3.75** |

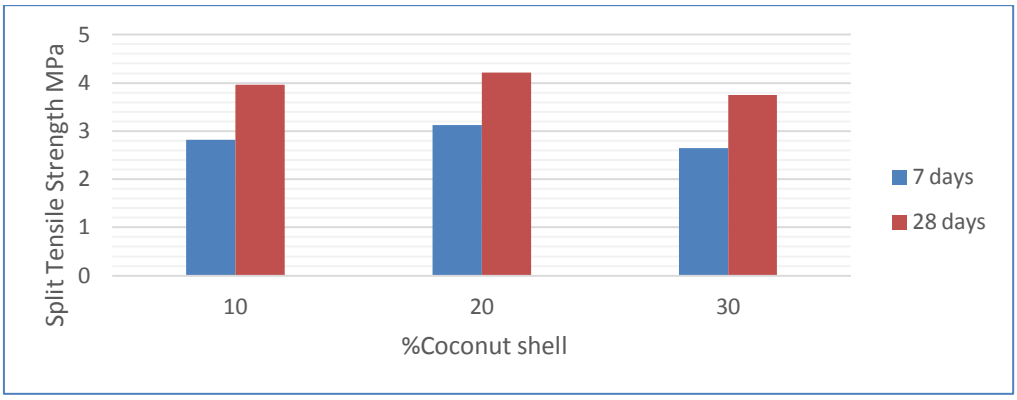


**Figure2..4: Split Tensile strength of Fly ash for 7 and 28 days**

## III. CONCLUSIONS

- Workability of concrete mixes are increased with the addition of mineral admixtures compared to conventional mix.
- Remarkable development in strength is observed in concrete mix with the use of Fly ash of 30% respectively as cement replacement.
- Increase in compressive strength of about 7.704% is observed in replacement of Fly ash concrete compared to conventional concrete,Where as in split tensile strength it was about 1.574%.
- Where as in addition of coconut shell as a replacement of Coarse aggregate, they showed promising results of the Compressive Strength is increased by 14.61% and Split tensile strength is increased 10.49%.

## REFERENCES

[1]. A Harison, V Srivastva, C.B. Gupta; Fly Ash as Supplementary Cementious Material in Portland Pozzolana Cement Concrete" International Journal of Engineering Trends and Technology (IJETT) – Volume 6 Number 3- Dec 2013,pp 113-117 Department of Civil Engineering, SHIATS, Allahabad- 211007, U.P 2013

[2]. S. Danshen—The Concrete of Fly Ash‖, Publishing House of Railway of China, Beijing, pp. 152(1989), M. Garg and M. Singh, ‖Phosphogypsum - Fly ash cementitious binder - Its hydration and strength development, Cement and Concrete Research, Volume 25, Issue 4, Pages 752-758(1995), ‖

[3]. E. A. Olanipekun, K. O. Olusola ,and O. Atia, "Comparative study between palm kernel shell and coconut shell as coarse aggregate", *Journal of Engineering and Applied Science*, Asian ReseaPublishing Network. Japan, 2005.

[4]. K. Gunasekaran, and P. S. Kumar, "Lightweight Concrete using Coconut Shells as Aggregate", Proceedings, International Conference on "Innovations in Building Materials, Structural Designs and Construction Practices (IBMSDCP-2008), 15-17 May 2008, pp.375-382.