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Investigations on Properties of Concrete by Partial Replacement of Sand and Cement with Copper Slag and Rice Ask Ash

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ABSTRACT

- The Natural resources are getting exhausted rapidly so construction technology is moving toward the utilization of alternative materials industrial waste / by product such as copper slag and agriculture waste such as rice ask ash.
- In this study use of copper slag in partial replacement of sand and cement from 0% to 20% and 0% to 20% Rice Husk ash by weight using design mix by satisfying different quality parameters has been done.
- M30 grade were prepared and the different strength parameters i.e. compressive strength, tensile& flexure strength.
- Partial substitution of Copper waste in concrete with shows good resistance to sulphate attack.
- Cost of Concrete production reduces when Copper Slag is used as a fine aggregate in concrete as replacement.

INTRODUCTION

- The value of concrete in present society cannot be underestimated. We can see concrete structures everywhere, such as buildings, roads, bridges, and dams.
- The concrete having cement, sand and coarse aggregates mix in an appropriate percentage in addition to water is called cement concrete.
- Concrete is one of the oldest and most common construction materials in the world, mainly due to its low cost, availability, its long durability and ability to sustain extreme weather environment.
- The worldwide production of concrete is 10 times that of steel by tonnage. on the other hand, other construction materials such as steel and polymers are more expensive and less common than concrete materials.

LITERATURE SURVEY

1. Sukhoon Pyo, Sherif El-Tawil, Antoine E. Naaman, "Direct tensile behavior of ultra high performance fiber reinforced concrete (UHP- FRC) at high strain rates", Elsevier 2016.

Conducted analysis using a recently developed impact testing system that uses suddenly released strain energy to generate an impact pulse. Three fiber types were considered, a twisted fiber and two other types of straight fibers. Specimen impact response was evaluated in terms of first cracking strength, post-cracking strength, energy absorption capacity and strain capacity. The test results indicate that specimens with twisted fibers generally exhibit somewhat better mechanical properties than specimens with straight fibers for the range of strain rates considered. All Ultra-High Performance Fiber Reinforced Concrete (UHP-FRC) series tested showed exceptional rate sensitivities in energy absorption capacity, generally becoming much more energy dissipative under increasing strain rates. This characteristic highlights the potential of Ultra-High Performance Fiber Reinforced Concrete (UHP-FRC) as promising cement based material for impact- and blast-resistant applications.

2. Yuh-Shiou Tai, Sherif El-Tawil, Ta-Hsiang Chung, "Performance of deformed steel fibers embedded in ultra-high performance concrete subjected to various pullout

rates", Elsevier 2016

Investigated the mechanical behavior of high performance steel fibers embedded in Ultra-high performance concrete (UHPC) at various pullout speeds the test variables were steel fiber type, matrix constituents, and pullout rates. In particular, five types of high strength steel fiber were used and five pullout rates from quasi-static to impact rates were applied. In addition, the effect of reduced amount of glass powder, as key matrix constituent, on pullout behavior was explored. Experimental results show that the pullout response of all of the fiber types exhibit progressively increasing rate sensitivity as the pullout speed increases and becomes significant during impact loading. It is most pominent in the smooth and twisted fibers and least in the hooked fibers. Additionally, scanning electron microscope studies are presented and used to explain the mechanism of rate enhancement from a microscopic perspective.

3. Anju Ramesan, Shemy S. Babu, Aswathy Lal, "Performance of light weight concrete with plastic aggregate", International Journal of Engineering Research and Applications, Vol. 5, Issue 8, August 2015, pp.105-110. Studied about suitability of performance of light weight concrete with plastic aggregate. the suitability of recycled plastics (high density polyethylene) as coarse aggregate in concrete by conducting various tests like workability by slump test, compressive strength of cube and cylinder, splitting tensile strength test of cylinder, flexural strength of R.C.C as well as P.C.C Beams, to determine the property and behavior in concrete. Effect of replacement of coarse aggregate with various percentages of plastic aggregate on behavior of concrete was experimentally investigated and the optimum replacement of coarse aggregate was found out. The results showed that the addition of plastic aggregate to the concrete mixture improved the properties of the resultant mix.

4. Sahil Verma, Sahil Arora, "Replacement of Natural Sand in Concrete by Polyethylene Bottles" International Research Journal of Engineering and Technology (IRJET), Volume: 02 Issue: 01, Apr-2015.

Investigated about the use the waste plastic crushed bottles of appropriate size in concrete with partial replacement of fine aggregates and it has the potential of disposing of large quantities of the catastrophic waste in a beneficial way. The environmental effects can be substantially reduced by proper encapsulation of these waste plastic bottles. The study also gives the comparison of compressive strength of normal conventional concrete with the concrete made from the partial substitution of aggregates with Polyethylene Terephthalate bottles. Hence concrete with waste Polyethylene Terephthalate (PET) fiber can be used as an effective plastic waste management practice in future.

5. Binaya Patnaik, Seshadri Sekhar.T, Srinivasa Rao, "Strength and Durability Properties Of Copper Slag Admixed Concrete" International Journal of Research in Engineering and Technology, e- ISSN: 2319-1163, p-ISSN: 2321-7308, Volume 4, Issue 1, Feb 2015

Sudied about the strength and durability properties of concrete having copper slag as a partial replacement of sand (fine aggregate) and results have been presented in this paper. Two different kinds of Concrete Grade (M20 & M30) were used with different proportions of copper slag replacement i.e 0 to 50% in the concrete. Strength & Durability properties such as compressive strength, Split Tensile Strength, flexural strength, acid resistivity and sulphate resistivity were evaluated for both mixes of concrete. Test results explains that the strength properties of concrete has better having copper slag as a partial substitute of Sand (up to 40%) in concrete but in terms of stability the concrete found to be low resistant to acid attack and better resistance against sulphate attack.

6. Binaya Patnaik, Seshadri Sekhar.T, Srinivasa Rao, "Strength and Durability Properties of Copper SlagAdmixed Concrete" International Journal of Research in Engineering and Technology, e- ISSN: 2319-1163, p-ISSN: 2321-7308, Volume 4, Issue 1, Feb 2015. Studied about the alternate of river sand by sand is possible in concrete mix. For M 20 and M 25 grade concrete, the optimum sand exchange proportion is generally 20-25%. Moreover, generally the sand can be replaced till 30-40% by sand in material. The exchanging of sand by foundry sand in concrete increases the compressive force, split tensile force, flexure power and modulus of flexibility. Usually the experimental analysis is carried out for concrete grade. Further investigation should be find out regarding M 35 and M 40 grade concrete, which could be useful for multi-storey buildings, construction of bridges, expressways, etc. where strength requirement is high.

Problem identification

- Natural resources are decreasing in all over the world and increasing wastes from industries generated simultaneously.
- The eco-Friendly and reliable development for construction consists the use of non-conventional and different waste materials and recycling of waste material for reducing emissions in environments and decreasing the use of natural resources.

Objectives

The objectives of the research are outlined below:

- To investigate the effect of Copper Slag waste materials in M-30 grade of concrete on its strength.
- To study the properties of fresh concrete and harden concrete prepared by replacement of copper slag and rice ask ash.
- To produce lighter weight polymer concrete for its multidimensional use.

METHODOLOGY

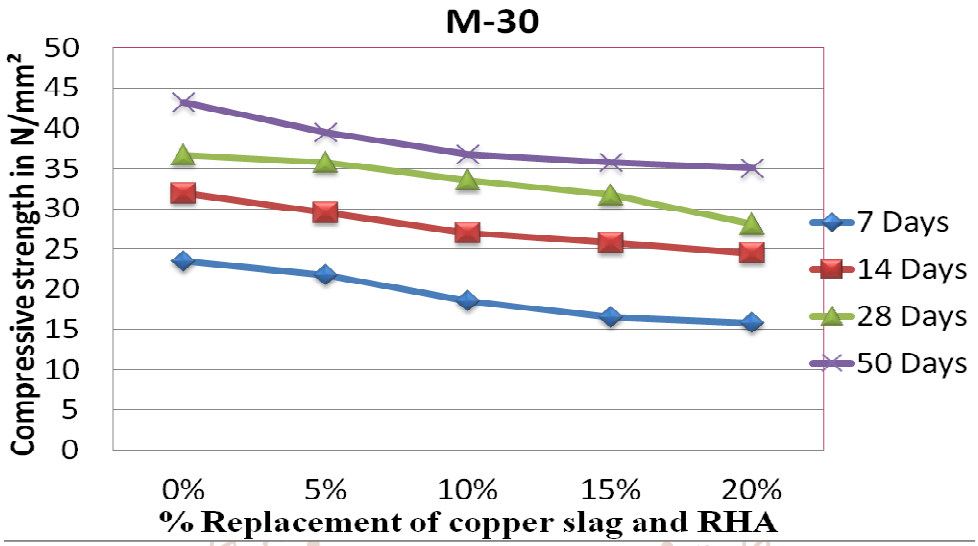
Proportioning of a concrete mix means determining the relative amounts of materials (cement, aggregates, and water) required for batches of concrete of required strength. It can also be defined as the process of selecting suitable ingredients of concrete and determining their relative quantities with the object of producing, strength, workability and durability.

EXPERIMENTAL RESULTS

COMPRESSIVE STRENGTH TEST

Compressive Strength (N/mm²) Grade:M-30				
Copper slag+ 20% RHA	7 Days	14 Days	28 Days	50 Days
0%	19.94	27.42	32.43	42.17
5%	21.75	29.5	35.75	39.5
10%	18.50	27	33.5	36.75
15%	16.54	25.75	31.75	35.75
20%	15.75	24.5	28.05	34.99

The result of the compressive strength with partial replacement of copper slag and RHA for 7, 14,28 and 50 days are shown for M-30 concrete and their graphical representation in the Figure.



Graph Shows Compressive Strength of M30 Mix cubes with Copper slag & RHA at different curing stages

CONCLUSION

- The utilization of copper slag in concrete provides additional environmental as well as technical benefits for all related industries. Partial replacement of copper slag in fine aggregate reduces the cost of making concrete.
- Replacement of copper slag with sand increases the self weight of concrete specimens to the maximum of 15-18%.
- A Copper slag is a type of waste used as a substitute to natural sand in concrete.
- From this investigation, the copper slag particles are waste of low cost material which would help to resolve solid waste disposal problem and protect environment from pollution.
- Cost of Concrete production reduces when Copper Slag is used as a fine aggregate and cement with RHA in concrete.

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