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Experimental Study of Concrete Made By Partial Replacement of Coarse Aggregate with Composite Mix of Coconut Shell and Crumb Rubber

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Abstract: **-- In construction, Industry Rising Cost of Construction Material is the Great factor. The price of building material are rising day by day, therefore, there is the most priority of all human beings encourage or research on the sustainable material will help to use such waste material as a construction material with less cost and safety of the structure. The coarse aggregate is the main constituent of test results. The use of coconut shell can also help the prevention of the environment. The paper aims at analyzing the compressive strength of concrete (M20-1:1.5:3) produced using a coconut shell as a substitute for conventional coarse aggregate with 5%, 10%, 15 %, 20% partial replacement. Three sample cubes are prepared for M20 grade concrete mix for each case another aim of this paper is to spread awareness about use of coconut shell as construction material in civil engineering Concrete is most widely used building material in the world, as well as the largest user of natural resources with annual consumption of 12.6 billion tons. Basically, it consists of aggregates which are bonded together by cement and water. The major part of concrete beside the cement is the aggregate. Aggregate includes sand and crushed stone / Gravel. Use of these conventional materials in concrete is likely to deplete the resources unless there is a suitable substitute. Rubber which is generated in large quantities as waste does not have useful disposal till now. But rubber is found to possess properties that are required for viable replacement of fine aggregate in concrete. Hence we in this project have aimed to study the effectiveness of rubber as a substitute for fine aggregate and utilize the crumb rubber tires in concrete, to minimize global warming.**

Keywords: Crumb Rubber, Coconut Shell, Compressive Strength, Splitting Tensile Strength, Flexural Strength, Coarse Aggregate, Construction Material, Waste Utilization.

I. INTRODUCTION

Concrete is the vital civil engineering material. Its manufacturing involves utilization of ingredients like cement, sand, aggregates, water and required admixtures. Demand of construction material is increased due to infrastructural development across the world. Now time has come to think of some alternative materials for sustainable use in concrete mix. Day by day mount and type of waste materials has increased accordingly creating environmental issues. Coconut is grown in more than 93 countries. South East Asia is regarded as the origin of coconut. India is the third largest, having cultivation on an area of about 1.78 million hectares. Coconut shell is one of the waste material can also be used as an aggregate in concrete due to some reasons like large scale cultivation of coconut in coastal region of India including Kerala, Andhra Pradesh, Goa, Konkani, etc. due to tough made tissue, shell is not decomposed easily and remain as solid waste for years.

The use of rubber product is increasing every year in worldwide. India is also one the largest country in population exceeds 100cr. So the use of vehicles also increased, according to that the tyres for the vehicles also very much used and the amount of waste of tyre rubber is increasing. This creates a major problem for the earth and their livings. For this issue, the easiest and cheapest way of decomposing of the rubber is by burning it. This creates smoke pollution and other toxic emission and it create global warming. Currently 75-80% of scrap tyres are buried in landfills. Only 25% or fewer are utilized as a fuel substitute or as raw material for the manufacture of a number of miscellaneous rubber goods. Burying scrap tyres in landfills is not only wasteful, but also costly. Disposal of whole tyre has been banned in the majority of landfill operations because of the bulkiness of the fires and their tendency to float to the surface with time. Thus, tyres must be shredded before they are accepted in most landfills.So many recycling methods for the rubber tyre are carried according to the need. From this one of the processes is to

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making the tyre rubber in to crumb rubber. It is used in many works such as Road construction, Mould making etc
Ilker Bekir Topcu et al(1995) proposed the concrete was modified by mixing with crumb rubber in coarse aggregate in the ratio of 15%, 30% and 45%. In this study the changes of the properties of rubberized concrete were investigated according to the terms of both size and amount of rubber chips added. In this the physical and mechanical properties were determined according to that the stress strain diagram were developed from that the toughness value and the plastic and elastic energy capacities were determined. Fattuhi et al(1996) proposed that, the cement paste, mortar, and concrete (containing OPC or OPC and PFA) mixes were prepared using various proportions of either rubber crumb or low-grade rubber obtained from shredding scrap tyres. Properties examined for the 32 mixes prepared included density, compressive strength, impact and fire resistances, and nailability. Results showed that density and compressive strength of various mixes were reduced by the addition of rubber. (Rubber type had only marginal effect.) Density varied between about 1300 and 2300 kg/m3. Compressive strength reduced by 70% when the proportion of rubber to total solid content by mass of concrete reached about 13%.

II. INTENSION

To prove the coconut shell concretes which are lightweight and can be used as an economical civil engineering material?

III. RELATED WORK

3.1 Materials
Research material are cement, natural fine aggregate, coarse aggregate, water and coconut shell.

3.2 Coconut Shell
Coconut shell is obtained from temples etc. they were sun dried for minimum 1 month before using crushed manually. The particle size of the coconut shell range from 5mm to 20mm. Cement- Ordinary Portland cement of 53 grade conforming to Indian Standard IS 12269-1987 9 was used throughout the experimental program.

3.3 Coarse Aggregate
Crushed hard basalt chips of maximum size 20 mm were used in the concrete mixes. The bulk density of aggregate was 1545 kg/m3 and specific gravity was found to be 2.77

3.4 Water
Potable water conforming to IS 456-2000 11 was used for casting and curing

3.5 Testing Methodology:
Test is carried out for finding compressive strength by using following experimental procedure.

IV. EXPERIMENTAL INVESTIGATION

Materials
Cement
Ordinary Portland cement of Ultra-tech brand of 53 grade confirming to IS 12269-1987(9) was used in the present study. The properties of cement are
Initial setting time - 35min
Specific gravity - 3.148
Fineness modulus - 1.5%

Coarse Aggregate
Crushed aggregate confirming to IS: 383-1987 was used. Aggregate of size 12mm of specific gravity 2.63 and fineness modulus are
Specific gravity – 2.63
Fineness modulus – 6.75%
Water Absorption – 2.4%

Crumb Rubber:
The properties of crumb rubber are
Specific gravity -1.72
Fineness modulus- 4.48%
Water Absorption -2%

Coconut Shell:
The properties of Coconut Shell are
Specific Gravity-1.56
Fineness Modulus-6.48%
Water Absorption -23%

4.1 coconut shell after cutting

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4.2Crumb rubber after cutting

V. EXPERIMENTAL PROCEDURE

The specimen of standard cube of (150mmx150mmx150mm) and standard cylinders of (200mmx100mm) and prisms of (100mmx100mmx500mm) were used to determine the compressive strength, split tensile strength and flexural strength of concrete. Three specimens were tested for 7&28 days with proportion of crumb rubber replacement. Totally 30 cubes, 30 cylinders and 30 prisms were cast the strength parameters and 15 cubes for acid attack test. The constituents were weighed and the materials were mixed by hand mixing. The water cement ratio was 0.42.

Experiments Conducted:

The following experiments are conducted on the specimen cast

- Compression test
- Splitting tensile test
- Flexural test

Specimen Details:

From the study of the past literatures, the conventional concrete grade was chosen as M30 for replace the crumb rubber in the fine aggregate. Tests for physical properties of the materials have done and the mix ratio for the concrete was calculated by the materials properties as 1:1.82:3.07 and the water to cement ratio of 0.42% had been chosen.

Results and Discussion: The normal and crumb rubber concrete are tested for their performance by determining their compressive strength, splitting tensile strength and flexure strength development at different ages of 7th and 28th days. The results obtained are discussed in detail in the following sections

Compressive Strength:

The limit of compressive strength of the cement concrete depends on both, the strength of the matrix and the particle tensile strength of the aggregate. The strength of the concrete is usually related to the cement content and water to cement ratio. However, in this study the crumb rubber is partially replaced with fine aggregate and test the strength under compression

V. CONCLUSION

From this study the effective utilization of rubber tyre waste has been developed and it made to use in the concrete mixture as fine aggregate. At present the crumb rubber production in the south India is very less than north. So the material availability was less, because of less knowledge about that. Based on the test results the following conclusions were made. These can also include non-primary structural applications of medium to low strength requirements, benefiting from other features of this type of concrete .Overall cost of construction will reduced. The maximum compressive strength in control mix is 21.28 N/mm2 at 28 days, while the minimum strength at same days is 14.23 N/mm2. Thus compressive strength decreased as percentage of coconut shell is increased. Therefore coconut shell can be used where light weight concrete is required. Proper bonding between coconut shell and cement is not possible because of surface area of coconut shell aggregate. In future, we can increase strength of coconut shell concrete by adding admixtures

REFERENCE

[1] S Ghosal, SC Moulik, “Use of Coconut Shell as an Aggregate in Concrete: a Review,” International Journal of Scientific Engineering and Technology ISSN: 2277-1581 Volume No.4 Issue No.9, pp: 476-477

[2] Damre Shraddhal, Firake Hitali, Dode Pradeep and Shrikant Varpe, “Sustanable concrete by partially replacing coarse aggregate using coconut shell”, Journal of today’s Ideas ,Tomorrow Technology, vol 2 No. 1, June 2015, PP 1-14

[3] Vishwas P. Kulkarni, Sanjay kumar B. Gaikwad, “Comparative study on coconut shell aggregate with conventional concrete”, IJIET, Volume 2, Issue 12, June 2013, pp 67-70

[4] Tomas U. Ganiron Jr, “Sustainable Management of Waste Coconut Shells as Aggregates in Concrete Mixture”,

Journal of Engineering Science and Technology Review 6 (5) (2013) 7-14

[5] Amaranth Yerramala, Ramchandrudu C, " Propertise of concrete with coconut shell as Aggregate replacement", ISSN: 2278-7461, www.ijeijournal.com Volume 1, Issue 6 (October2012) PP: 21-31