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STRENGTH CHARACTERSTIC EFFECTS OF CONCRETE AS A PARTIAL REPLACEMENT OF COARSE AGGREGATE WITH COCONUT SHELLS AND CERAMIC WASTE

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Abstract: Now-a-days, the rising cost of building materials for construction purposes is a factor of great concern. The price of building materials is rising day by day as a result most of the researchers are paying much attention on the available materials which can reduce the construction cost of buildings as well as increase the strength properties of concrete by adding different materials Mainly gravel and sand are used in the preparation of conventional concrete. Concrete is a composite material which composed of aggregates, cement and water. The second largest material utilization in the world is concrete. The utilization of concrete is increasing at a higher rate due to development in infrastructure and construction activities all around the world. The possibility of a complete depletion of aggregate resources has rendered continued use of aggregates for construction unsustainable. In view of this challenge, researchers throughout the world have been investigating ways of replacing aggregates to make construction sustainable and less expensive. Research addressing environmental and sustainability issues in construction has generated lot of interest in the world. While wastes generated by industrial and agricultural processes have created disposal and management problems which pose serious challenges to efforts towards environmental conservation, their use contributes to resource conservation, environmental protection and the reduction of construction costs. While the use of an agricultural by-product i.e. coconut shell and industrial by product i.e. Ceramic waste as a partial replacement with coarse aggregates is expected to serve the purpose of developing housing developers in the field of building construction. The strength characteristic properties of concrete such as compressive strength, split tensile strength, flexural strength, impact resistance, bond strength using the mix made by replacing 5 %, 10%, 15% of coconut shell aggregates and 10%,20%,30%,40% and 50% Ceramic waste with coarse aggregates were reviewed in this paper.

Key Words: coarse aggregate , coconut shell, Ceramic waste **,**

1.INTRODUCTION

Concrete is the premier construction material around the world and is most widely used in all types of construction works, including infrastructure, low and high-rise buildings, and domestic developments. It is a man-made product, essentially consisting of a mixture of cement, aggregates, water and admixture(s). Inert granular materials such as sand, crushed stone or gravel form the major part of the aggregates. Traditionally aggregates

have been readily available at economic prices and of qualities to suit all purposes. But, the continued extensive extraction use of aggregates from natural resources has been questioned because of the depletion of quality primary aggregates and greater awareness of environmental protection. In light of this, the non-availability of natural resources to future generations has also been realized. Different alternative waste materials and industrial by products such as fly ash, bottom ash, recycled aggregates, foundry sand, china clay sand, crumb rubber, glass were replaced with natural aggregate and investigated properties of the concretes. Apart from above mentioned waste materials and industrial by products, few studies identified that coconut shells, the agricultural by product can also be used as aggregate in concrete. According to a report, coconut is grown in more than 86 countries worldwide, with a total production of 54 billion nuts per annum. India occupies the premier position in the world with an annual production of 13 billion nuts, followed by Indonesia and the Philippines. Limited research has been conducted on mechanical properties of concrete with coconut shells as aggregate replacement. However, further research is needed for better understanding of the behavior of coconut shells as aggregate in concrete. Thus, the aim of this work is to provide more data on the strengths of coconut shell concretes at different coconut shells (CS) replacements and study the transport properties of concrete with coconut shells as coarse aggregate replacement. Furthermore, in this study, the effect of fly ash as cement replacement and aggregate replacement on properties of the coconut shells replaced concrete was also investigated. The concrete obtained using coconut shell aggregates satisfies the minimum requirements of concrete. Concrete using coconut shell aggregates resulted in acceptable strength required for structural concrete. coconut shell may offer itself as a coarse aggregate as well as a potential construction material in the field of construction industries and this would solve the environmental problem of reducing the generation of solid wastes simultaneously. The coconut shell cement composite is compatible and no pre-treatment is required. coconut shell concrete has better workability because of the smooth surface on one side of the shells. The impact resistance of coconut shell concrete is high when compared with conventional concrete. Moisture retaining and water absorbing capacity of coconut shell are more compared to conventional aggregate. The amount of cement content may be more when coconut shell are used as an aggregate in the production of concrete compared to conventional aggregate concrete. The presence of sugar in the coconut shells as long as it is not in a free sugar form, will not affect the setting and strength of concrete.

Apart from the above mentioned waste materials, coconut shell and Ceramic waste can also be used as aggregates.

1.1 COCONUT SHELLS

Coconut shell is used as lightweight aggregate in concrete. The properties of coconut shell and coconut shell aggregate

concrete is examined and the use of coconut shell aggregate in construction is tested. Moisture content and water absorption were 4.20% and 24% respectively and these values are more compared to conventional aggregate. Coconut shell exhibits more resistance against crushing, impact and abrasion compared to conventional aggregate. Density of coconut shell is in the range of 550 - 650 kg /m^3 and these are within the specified limits for lightweight aggregate. There is no need to treat the coconut shell before use as an aggregate except for water absorption. The presence of sugar content in the coconut shell, as long as it is not in a free sugar form, does not affect the setting and strength of concrete. Hydration test on coconut shell fines with cement indicates that the inhibitory index for coconut shell fines with cement can be classified as low and no pre-treatment is required. Coconut shell-cement ratio has been optimized to satisfy the criteria of structural lightweight concrete. vii Long-term investigation up to 365 days on compressive strength of coconut shell aggregate concrete for three different curing conditions, namely, laboratory curing (full water immersion W1), simulation of the practical curing (Site curing W2), and air-dry (no curing W3) has been carried out. The increase in the pulse velocity and the compressive strength of coconut shell aggregate concrete is more in practical curing (W2) followed by full water curing (W1). Biological decay was not evident as the coconut shell aggregate concrete cubes gained strength even after 365 days. This continual increase in strength indicates that the coconut shell aggregate concrete does not deteriorate once coconut shell aggregates are encapsulated into the concrete matrix. In a short-term study, at 28 days, properties of coconut shell aggregate concrete namely flexural strength, splitting tensile strength, impact resistance and elastic modulus were determined and a comparison made with control concrete.

Fig 1: Coconut Shells

CONSTRUCTION WASTE IN INDIA:

In the present construction world, the solid waste is increasing day by day from the demolitions of constructions. There is a huge usage of ceramic tiles in the present constructions is going on and it is increasing in day by day construction field. Ceramic products are part of the essential construction materials used in most buildings. Some common manufactured ceramics include wall tiles, floor tiles, sanitary ware, household ceramics and technical ceramics. They are mostly produced using natural materials that contain high content of clay minerals. However,

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despite the ornamental benefits of ceramics, its wastes among others cause a lot of nuisance to the environment. And also in other side waste tile is also producing from demolished wastes from construction. Indian tiles production is 100 million ton per year in the ceramic industry, about 15%- 30% waste material generated from the total production. This waste is not recycled in any form at present, however the ceramic waste is durable, hard and highly resistant to biological, chemical and physical degradation forces so, we selected these waste tiles as a replacement material to the basic natural aggregate to reuse them and to decrease the solid waste produced from demolitions of construction. Waste tiles and granite 5 powder were collected from the surroundings. There are some researchers are also going on solid waste from construction to reuse them again in the construction to reduce the solid waste and to preserve the natural basic aggregates. These researches promotes to use the recycled aggregates in the concrete mix and they got good result when adding some extent percentages of recycled aggregates in place of natural coarse aggregate.

Fig 2: Ceramic Waste

3.EXPERIMENTAL INVESTIGATION

3.1 MATERIALS

In this investigation, the following materials were used:

Ordinary Portland Cement of 53 Grade cement conforming to IS: 169-1989

Fine aggregate and coarse aggregate conforming to IS: 2386-1963.

Water

Coconut Shells

Ceramic Waste

. TEST RESULTS AND DISUSSIONS

5.1 WORKABILITY

The concrete which exhibits very little internal friction b/w particle and particle which overcomes the frictional resistance offered by the formwork surface or reinforcement contained in the concrete.

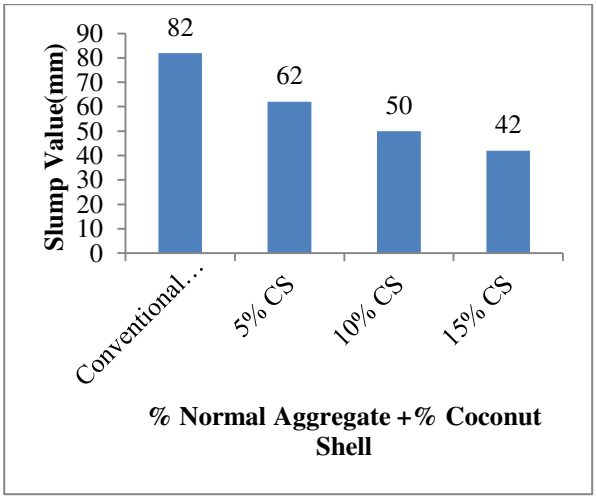

Figure 3: Test Results For Workability of coconut shell

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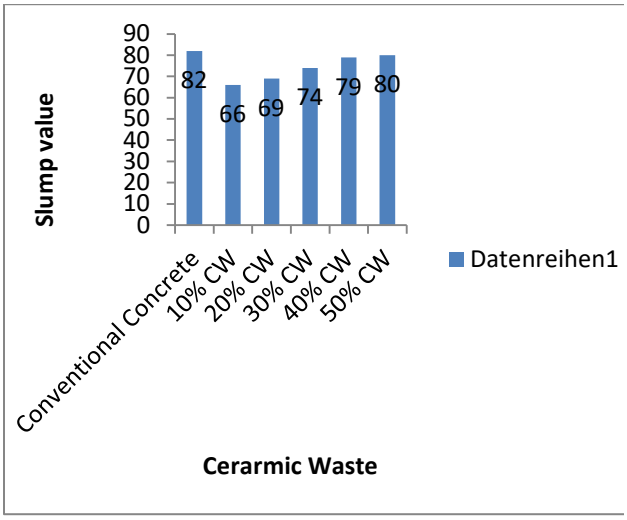

Figure 5.2: Test Results For Workability of Ceramic waste

COMPRESSIVE STRENGTH RESULTS

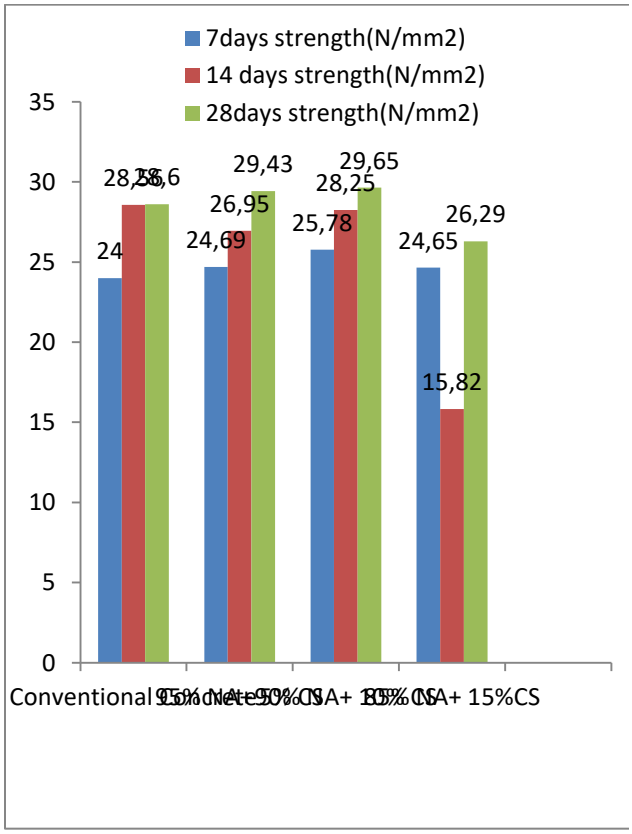

Figure 5.6: Compressive strength values of Coconut shells

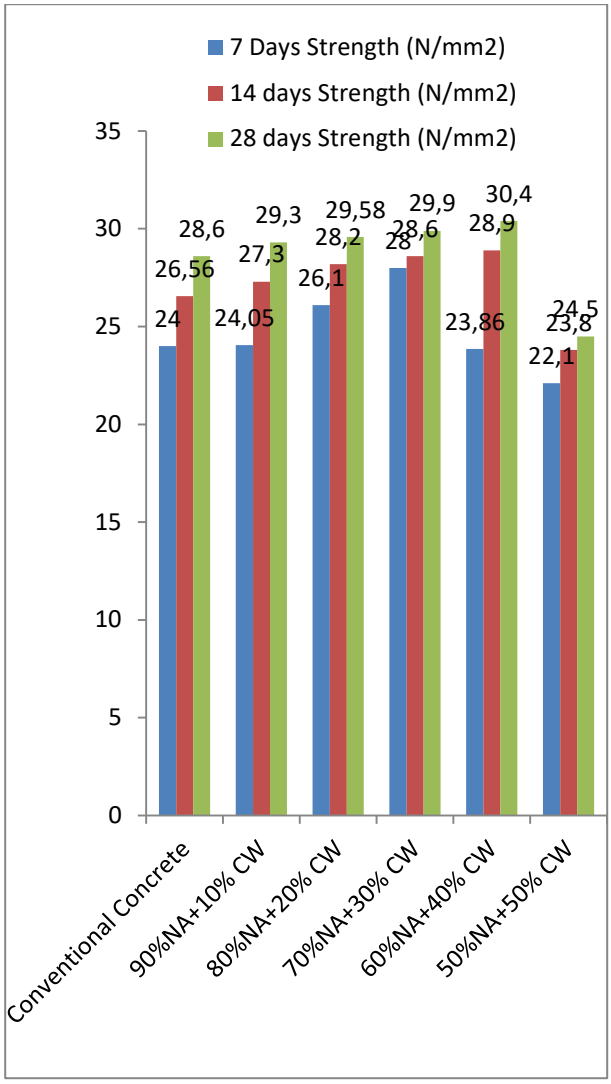

Figure 5.7: Compressive strength values of Ceramic Waste

Flexural Strength

Flexural strength is an indirect measure of the tensile strength of concrete. It is a measure of the maximum stress on the tension face of an unreinforced concrete beam or slab at the point of failure in bending. It is measured by loading 150 x 150-mm (or (100 x 100-mm) concrete beams with a span length at least three times the depth.

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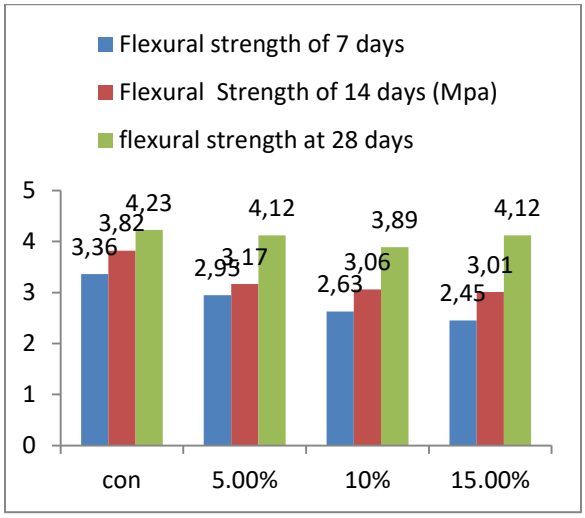

Figure 5.8: Flexural strength values of Coconut Shells

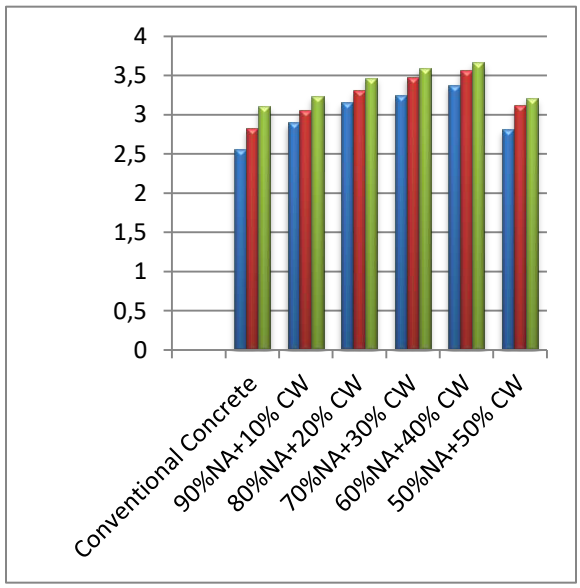

Figure 5.9: Flexural strength values of Ceramic waste

SPLIT TENSILE TEST One of the important properties of concrete is "tensile strength" as structural loads make concrete vulnerable to tensile cracking. Tensile strength of concrete is much lower than its compressive strength (that's why steel is used to carry the tension forces). It has been estimated that tensile strength of concrete equals roughly about 10% of compressive strength. To determine the tensile strength, indirect methods are applied due to the difficulty of the direct method. Noting that the values obtained of these methods are higher than those got from the uniaxial tensile test. These indirect techniques are: 1- split cylinder test and 2- flexural test. In this article, the Splitting Tensile Strength test is discussed.

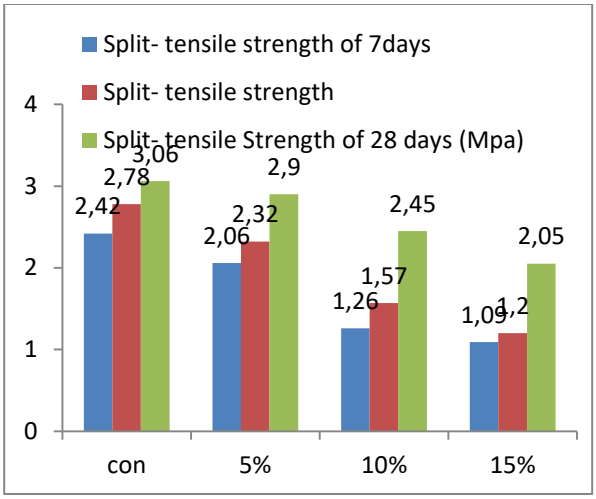

Figure 5.9: Flexural strength values of Ceramic waste

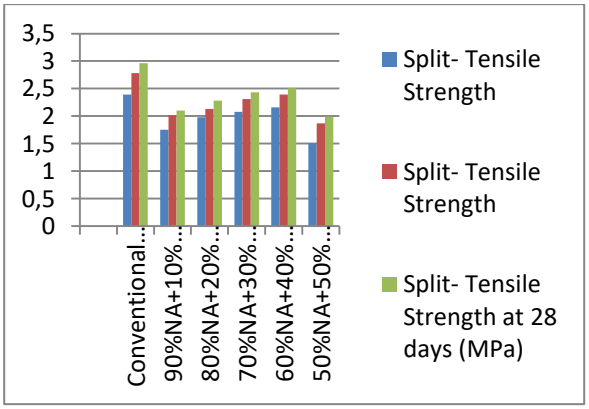

Figure 5.11: Split Tensile strength values of Ceramic waste

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CONCLUSION

From the results of the above stated research work conducted by various researchers, it is concluded that coconut shell can also be used in light weight concrete as coarse aggregates in preparation.

1.The workability of concrete increases with the increase in tile aggregate replacement. The workability is further increased with the addition of ceramic waste upto 40% which acts as admixture due to its chemical properties.

2.The properties of concrete increased linearly with the increase in ceramic aggregate up to 40% replacement later it is decreased linearly.

3. compressive strength, split tensile strength and flexural strength than the other mixes. But the mixes up to 50% of ceramic coarse aggregate can be used.

4.The usage of ceramic coarse aggregate has some effect on the properties of concrete in decrement manner.

5.The workability of concrete increases with the increase in tile aggregate replacement. The workability is further increased with the addition of Coconut Shells upto 10% which acts as admixture due to its chemical properties.

6.The properties of concrete increased linearly with the increase in coconut shell aggregate up to 10% replacement later it is decreased linearly. 7.compressive strength, split tensile strength and flexural strength than the other mixes. But the mixes up to 10% of Coconut shell coarse aggregate can be used.

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