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AN EXPERIMENTAL INVESTIGATION ON STRUCTURAL BEHAVIOUR OF REINFORCED CONCRETE BEAMS WITH CRUSHEDPALM KERNEL SHELL

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Abstract:- *This project gives an account of the study conducted on the substitution of Palm Kernel Shell (PKS) for coarse aggregate in concrete works. It is aimed at determining the properties of PKS that makes it suitable as a replacement for natural aggregate in concrete works and the effects of mixing ratios on the strength characteristics of Palm Kernel Shell Concrete (PKSC). A number of tests were conducted on the PKS and concrete produced with palm PKS. Tests conducted on PKS were specific gravity and water absorption capacity. The results obtained gave the specific gravity and water absorption capacity of PKS as 1.37 and 10% respectively, thickness ranging from 1.0–3.0 mm, size ranging from 2–15 mm. While the tests conducted on PKSC include, density, compressive strength test, splitting tensile strength test and flexural strength, concrete mixes of 1: 2.48: 1.68 were used to produce cubes, cylinders and beams which were cured for 28 days before testing. Normal coarse aggregates was replaced in concrete in such gradation 0%,10%,20%,30% and %40%. The density of the PKSC is lower which characterize PKSC as a Light Weight Concrete (LWC). The compressive strength and split tensile strength test results showed that 30% of PKS replacement is optimum. The flexural strength of PKS reinforced concrete beam was closer to conventional reinforced concrete beams. 1% of hooked end steel fibre was added to 30% of PKS replacement concrete to improve the split tensile strength and flexural strength. The density test, compressive strength test, split tensile strength and flexural strength were conducted for PKSC with steel fibre. The test results show that steel fibre increases the compressive strength, split tensile strength and flexural strength of PKSC.*

1. INTRODUCTION

Concrete is an artificial stone-like material used for various structural purposes. It is made by mixing a binding material and various aggregates such fine aggregates and coarse aggregates, water and allowing the mixture to harden by hydration. Concrete has more advantages such economical, long life, low maintenance requirements etc.. But Concrete has a relatively low tensile strength, low ductility, low strength-to-weight ratio, and concrete is susceptible to cracking. The above characteristics are considered as disadvantages of concrete. The drawbacks of concrete are over come with use of some special material in the concrete like admixture, steel fibre and special type of aggregate.

There is a high demand for construction materials which are used to make concrete due to rapid decrease of natural materials such as coarse aggregates (CA) and fine aggregates (FA). Environmental problems arise due to the excessive usage of natural aggregates and thereby causing ecological imbalance. This leads to find and explore an alternative material that could be used as a replacement to the conventional aggregates to save the natural aggregates and to prevent the ecological imbalance. In concrete structures, the concrete imposes a huge amount of the total load of the structure which increases the total cost of construction. So the present scenario needs the importance of Light Weight Concrete (LWC) for the construction to reduce the self weight of the structures and to reduce the construction cost. LWC offers design flexibility and substantial cost savings by provide less dead load, low heat conductivity and lower foundations costs when applied to the high- rise buildings.

At the Same time the solid waste from agro industries creates the disposal problem. It affects the nature of environment. Palm Kernel Shell (PKS) is a Light Weight Aggregates (LWA) from the agricultural sector and is one of several types of waste resulting from the palm oil industry Palm Kernel Shell disposal creates the environment pollution.

PALM KERNEL SHELL

Palm Kernel Shell (PKS) is an agricultural solid waste originating from the palm oil industry. The requirement of vegetable oil is constantly increasing and more cultivation of palm oil is forecast in the near future. At the same time, the production of palm oil result in by products such as empty fruit bunches, palm kernel shells (PKS) or oil palm shells, fibres and palm oil mill effluent. The major problem of with solid wastes of palm oil mill is due to surplus, despite the use of palm pressed

fibres boiler feed. But Palm Kernel Shell is not suitable for boiler feed, because of it give block smoke and its high heating value.

LIGHT WEIGHT CONCRETE

One of the disadvantages of normal concrete is the self weight of concrete. Density of the normal concrete is in the order of 2400 to 2600 kg/ m^3. The heavy self weight of normal weight concrete will make it to some extent an uneconomical structural material. Attempts have been made to reduce the self weight of concrete at the same time there is no any strength reduction in concrete.

Methods of producing light weight concrete

- Light Weight Aggregate Concrete
- Aerated Concrete
- No –Fines Concrete

2. PROPERTIES OF MATERIALS

Discuss about the properties of the materials which are used for the experimental investigation of this project.

Materials Used

- Cement
- Fine aggregates
- Coarse aggregate
- Water
- Steel Fibres
- Palm Kernel Shell

Cement

Cement is a binding material, generally in powder form, that can be made into paste usually by addition of water. 53 grade Ordinary Portland Cement (OPC) (conforming to IS 8112) is used for this investigation. The specific gravity of OPC is 3.15. It should be free from lumps and may be greenish grey or brown or black colour.

Fine aggregates

The natural river sand is used as fine aggregates for casting the specimens. The fine aggregate is passing through 4.75 mm sieve and it has a specific gravity of 2.60.Coarse aggregate

The natural crushed stone is used as coarse aggregate for casting the specimens. The maximum size of coarse aggregate used for this investigation is 20 mm. The specific gravity of coarse aggregate is 2.67. The fine aggregates and the coarse aggregate shall comply with the requirements of IS 383.

Water

Water used for mixing and curing should be clean and free from injurious amounts of acids, oils, alkalis, salts, sugar, organic materials and other substances that may harmful to the concrete and steel.

Steel Fibres

Hooked end type steel fibres aspect ratio of 60 are used to enhance the flexural performance of the concrete. The steel fibres have tensile strength of 1100 Mpa as specified by the manufacturer.

Palm Kernel Shell

Palm kernel shells (PKS) are organic waste materials obtained from crude palm oil producing factories. PKS is used as Light Weight Aggregate (LWA) to produce Light Weight Aggregate Concrete (LWAC). The properties of PKS were found.

Table 2.1 Properties of Palm Kernel Shell

Size (mm)	2–15 mm
Thickness (mm)	1.0–3.0 mm
Specific Gravity	1.37
Water absorption capacity %	10

2. MIX PROPORTIONING

General

The concrete mix was done for M $_{20}$ grade as per IS 10262-2009. Proportion of concrete should be selected to make the most economical use of available materials to produce concrete of required quality. The mix ratio for casting the specimen used was 1:1.68:2.48 and water cement ratio is 0.45 In this concrete mix CA is replaced by PKS in proportion of 0%,10%,20%,30% and 40%. 1% of steel fibre was added to optimum PKS replacement concrete.

3. FUTURE WORK

- By the testing of materials crushed palm kernel shell has similar properties like coarse aggregate.
- In future, plan to do strength and durability properties of concrete and compare the results with conventional concrete.

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