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AN EXPERIMENTAL STUDY ON PARTIAL REPLACEMENT OF CEMENT WITH EGGSHELL POWDER AND AGGREGATES WITH COCONUT SHELLS

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Abstract:
In the construction, the cost of building materials are rising day by day, use of alternative material is a partial replace of coarse aggregate in solving part of natural aggregate and partial replacement of cement. The waste materials are used such as coconut shells, eggshells powder, cockle shell, periwinkle shell, foundry sand etc. So here in our project we will use coconut shells waste as replacement of coarse aggregate and eggshells powder as replacement of cement by different percentage for making concrete of different grade like M-20 with a ratio of proportion (1:1.5:3). Concrete made from coconut shells waste as coarse aggregate and eggshells powder as cement will be studied for compressive strength, tensile strength, and flexural strength, the percentage replacement will be 0%, 5%, 10%, 15% with natural coarse aggregate. The main ingredient in eggshells is calcium carbonate (the same brittle white stuff that chalk, limestone, cave stalactites, sea shells, coral, and pearls are made of). The shell itself is about 95% CaCo3 (which is also the mainingredient in sea shells). The remaining 5% includes Magnesium, Aluminium, Phosphorous, Sodium, Potassium, Zinc, Iron, Copper, Ironic acid and Silica acid. So replacement they both eggshells powder and coconut shells on a concrete. Then prepare cubes, cylinder and test the cubes by experimentally like compression test, finally slump test, tensile strength test, split tensile strength test and flexural strength test will be conducted to obtain the results.
The use of eggshells powder and coconut shells in concrete reduces the cost of raw materials with high strength durability and light weight of concrete.
A large number of trial mixes are required to select desired optimum replacement of aggregate by coconut shells and cement by eggshells powder waste material. So in our concept of the project is replacing the coconut shells and eggshells powder on concrete to achieve the required strength of concrete.

Keywords: EGG-SHEL, COCONUT SHELLS.

I. INTRODUCTION

Concrete is the most commonly used building material in the world. Its huge popularity is a consequence of several advantages, such as general availability, wide applicability and low cost. These advantages are also accompanied by a great environmental burden. The billions of tons of raw materials mined and processed each year leave a mark on the environment. Furthermore, during the production of Portland cement large quantities of CO2 are released into the atmosphere and enormous amount of energy are required. Portland cement is one of the most important ingredient of concrete. The environmental load of

concrete can be reduced by the partial replacement of Portland cement with other cement alternatives or additives. These cement replacing materials could be fillers or waste products. Among them, eggshell powder and coconut shell waste has been proposed to be a promising cement and aggregate replacement. Large amounts of coconut shell waste which are most important natural fillers are produced in tropical countries like Malaysia, Thailand and srilanka. As well as eggshell are generally available from the local areas such as hotels, restaurants .The traditional method of the disposal of the waste is by landfilling . Scarcity of land makes it necessary to find other possibilities to use this waste. Recycling of this eggshell and coconut shell waste is the best solution and will be beneficial for the environment and interesting for the government, since the environmental impact of new materials and the costs for disposing those waste products will be reduced.

II. LITERATURE

The primary purpose of the literature study was to provide general information about the materials used and about the parameters that influence the properties of the cement paste. This section also presents a summary of the research that has been done so far on cement replacements and aggregate replacements by eggshell and coconut shell waste

III. MATERIALS

CEMENT:

Ordinary Portland cement of 53 grade from a single batch was used for entire work and care has been taken it has to been stored in air tight containers to prevent it from being affected by the atmospheric and monsoon moisture and humidity. The cement produced was tested was physical requirements in accordance with IS: 4032-1977.

FIG:-3.1 **CEMENT**

Egg shell waste(cement replacement)

The eggshell wastelands in the poultry manufacturing have been highlighted because of its recovery potential. Eggshell waste is available in huge amounts from food processing, egg breaking and shading industries. The food indulgence industry is in need for investigations to find another methods for processing and using eggshell waste in an ecological friendly way. Eggshell consist of several growing layers of caco3 and it is a poultry waste to replace cement can have benefits like minimizing use of cement ,conserves natural lime and utilizing waste materials. Majority of eggshell wastes are deposited in landfill and it attracts vermin and causes human health and environmental problems.Eggshells procured from local nearby hotels and restaurants and packed in bags.then the collected eggshells werw washed in normal water and then dried in hot sunlight for a day to make grinding easy and also to avoid the paste formation while grinding. Blackened eggshells were removed separately and unwanted dust mixed in the sample collections are removed before bringing it to grinding. After collecting , drying and clearing,the samples were placed in a box for manual crushing upto some extent.Then samples were crushed by using some electronic equipment like mixer,grinder etc.

Figure:- 2.3 Egg shell

COCONUT SHELLS:

The budding if waste coconut shells are used as a alternative for coarse aggregate in concrete.after the coconut is tattered out,the shell is regularly discharged.the bulk density of coconut shell is about 500 - 600 kg/m^3,producing concrete of about less than 2000kg/m^3 in density,which makes that light weight.the coconut shell concrete straight forwardlt attains the strength around 17 N/mm^2.for the past 10 years light weight concrete getting a maximum hold in the construction industry.

Figure:- 2.3 Coconut shells

IV. Tests on fresh concrete

Slump Cone Test:-

Fig no:4.1 slump test

s.no	material	Slump(cm)
1	Concrete(0%)	26
2	Concrete(5%)	25
3	Concrete(10%)	30
4	Concrete(15%)	30

Compaction factor test:

Fig no 4.2 Compaction factor

s.no	materials	Compaction value
1	Concrete(0%)	0.84
2	Concrete(5%)	0.80
3	Concrete(10%)	0.75
4	Concrete(15%)	0.73

Vee-bee test

fig:-4.3 vee bee consistometer

s.no	Materials	Vee-bee time(sec)
1	Concrete(0%)	11.85
2	Concrete(5%)	16
3	Concrete(10%)	18
4	Concrete(15%)	20

V. Fabrication of Specimen

In this project total 16 specimens are prepared in a mould 150 x 150 x 150mm for compression test and 300 x 150mm diameter mould for tensile test & 150 x 150 x 700mm for flexural tests. The specimens are filled by concrete by 3 layers of moulds each layer tamped by 25 strokes using damping rod. After the specimens are stored in a room temperature for 24 hours.

Fig no 5.1

CURING:

Curing is probably the most important aspect of micro silica concrete as the material undergoes virtually zero bleeding. If the rate of evaporation from the surface is faster than the rate of migration of water from interior to the surface, plastic shrinkage takes place. In the absence of bleeding and slow movement of water from interior to the surface, early curing by way of membrane cuing is essential

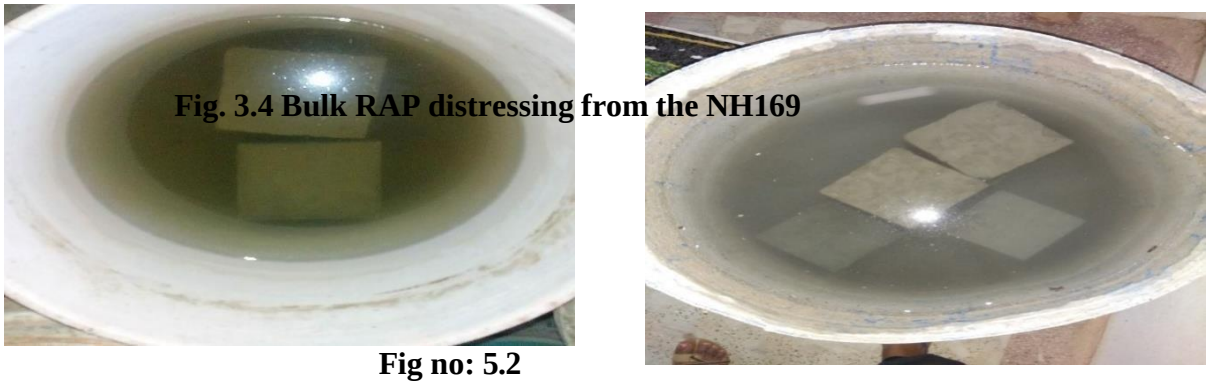
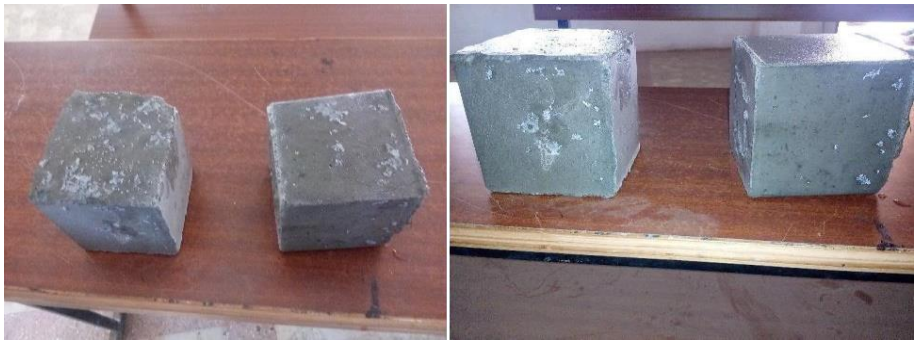


Fig. 3.4 Bulk RAP distressing from the NH169

Fig no: 5.2



Compressive Strength Test On Concrete Specimens:

In most structural applications, concrete is used primarily to resist compressive stresses. In most cases where the strength in tension or in shear is of primary importance, the compressive strength is frequently used as a measurement of this property

Fig no: 5.5

VI. Results:

Compression strength of concrete results

NO.OF DAYS	CONCRETE N/mm^2	REPLACED CONCRETE(5%) N/mm^2	REPLACED CONCRETE (10%) N/mm^2	REPLACED CONCRETE (15%) N/mm^2
3 DAYS	14.65	15.8	17.85	12.03
7DAYS	19.48	19.90	21.6	16.68
14 DAYS	27.71	28.73	24.47	21.24
28 DAYS	30.33	29.28	26.76	25.70

Split tensile strength:

Fig no :5.7 split tensile test machine

Split Tensile Strength Of Concrete Results:

NO.OF DAYS	CONCRETE N/mm^2	REPLACED CONCRETE(5%) N/mm^2	REPLACED CONCRETE (10%) N/mm^2	REPLACED CONCRETE (15%) N/mm^2
3 DAYS	13.6	14.2	15.8	13.0
7DAYS	14.4	16.8	16.9	15.4
14 DAYS	22.6	22.9	23.3	21.24
28 DAYS	28.2	29.4	29.7	25.70

V.CONCLUSIONS

i. The eggshells powder of 2.2 grams of calcium in the form of calcium carbonate and 95% dry eggshells is calcium carbonate of 5.5 grams.
ii. The specific gravity of the eggshells powder is 0.85 and the moisture content is 1.18 and surface area is 21.2
iii. sq.m per gram.
iv. Coconut shells exhibits more resistance aganist crushing,impact and abrasion.
v. By using coconut shells the aggregates provided volume at low cost comprising 66% to 78% of concrete.
vi. By increasing percentage of coconut shells reduces compressive strength of concrete.
vii. Using coconut shells on concrete is also termed as structural light weight concrete.
viii. The specific gravity of coconut shells is low as compared to coarse aggregates and water absorption is higher for coarse aggregates.
ix. The workability of concrete has decreased when compared with ordinary concrete.
x. The compressive strength of concrete is increased for 10% replacement where as the compressive strength of partially replaced concrete is increased at 3 and 7 and gradually decreased from 14 and 28 days.
xi. The replacement of cement with 15% the cubes act as a brittle material when compared to 5% and 10%.
xii. The partially replaced act as a admixture which can reduce the setting time.
xiii. The optimum compressive strength is obtained 12% greater than normal concrete.

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