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EXPERIMENTAL ANALYSIS ON CONCRETE AS PARTIAL REPLACEMENT OF EGGSHELL & CAL-SIL POWER

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Abstract:

Aim of this project is to prevent the improper disposal of the Eggshell waste, a remain from eggshells domestic waste such as poultries ,restaurant, bakeries, homes and fast food joints, by using it as an additive material in conventional concrete with grade M20 since it is normally used in construction sites..This project concentrates on mix design, material testing of ingredients of concrete such as cement, fine aggregate, coarse aggregate and eggshell powder and eggshell ash and cal-sil powder. Concrete cubes and cylinders with various trail percentages of eggshell powder, eggshell ash, cal-sil powder are casted.Cal-sil powder is the new methodology that the producing calcium silicate from wastes, Calcium silicate gives the good bonding between the aggregate and cement paste, so it is produced by the mixture of glass powder & egg shell ash.All the results obtainedare compared with the conventional ones and the results are consolidated.

Keywords: Eggshell, cal-sil powder, Calcium silicate.

Introduction

Throughout the world, concrete is being widely used for the construction of most of the buildings, bridges etc. Hence, it has been properly labeled as the back bone to the infrastructure development of 4 nation, To meet this rapid infrastructure development a huge quantity of concrete is required, Unfortunately, India is not self-sufficient in the production of cement, the main ingredient of concrete and the demand for exceeds the supply and makes the construction activities very costlier. Hence, currently, the entire construction industry is in search of a suitable and effective the waste product that would consider minimizes the use of cement and ultimately reduces the construction cost. This project is about the effective use of the material eggshell as an additive in conventional concrete. India is second largest Eggshell powder has not being in use as a stabilizing material and it could be a good replacement for industrial lime, since its chemical composition is similar to that of lime. Chicken eggshell is a waste material from domestic sources such as poultries, hatcheries, restaurants, bakeries, homes and fast food joints. Eggshell waste falls within the category of waste food; they are materials from the preparation of foods and drinks. In recent years, special attention has been devoted to industrial sectors that are sources of pollution of the environment the industry produces large volumes of solid waste, which can end up in rivers, lakes, and coastal waters, The disposal of these wastes is a very important problem, which can risk to public health, Contamination of waste resources and polluting the environment, A large number of food plants are constantly accumulating subs quantities of eggshell waste, This natural solid waste, although nonhazardous is directly disposed in the environment. As a

consequence, a huge problem of pollution is generated. A Portland cement is composed of major oxides:lime (CaO), Silica(SiO), Alumina (Al,0s) and Iron (Fe:03).The lime gives the strength to concrete, Eggshell is rich in the lime so it is used as the replacement of binder in concrete. India ranks second in the world with annual egg production. These many egg shells will be a waste annually. Disposal of these egg shells is a big problem because if they are send to landfills attracts vermin and causes problems related to human health and environment. Egg shell are rich in calcium and has nearly same composition that of limestone. Use of eggshell waste instead of natural lime in cement can have benefits like conserving natural lime and utilizing waste material. The aim of the current study is to determine the potential use of these wastes as a cementing material for concrete.

MATERIALS AND METHODS

The material used for this experimental work are Cement, Fine aggregate, Coarse aggregate Eggshell, Eggshell ash, Cal-sil powder.

Cement:

Cement is a binder that sets and hardens and can bind other materials together. Ordinary Portland Cement (OPC) 53 grade is used. Cement is a binder that sets and hardens and can bind other materials together. A powdery substance. made by claiming lime and clay, mixed with water to form mortar or mixed with sand, gravel and water to make concrete.

Fine aggregate:

.The specific gravity of fine aggregate was 2.6.

Coarse aggregate:

Angular shape aggregate which passes through 20 mm sieve and retain on 10mm are used as coarse aggregate in this project work. The specific gravity of coarse aggregate was 2.64 and fineness modulus of 7 was found out 12.5mm.

Eggshell:

Eggshells are waste materials from hatcheries, homes, restaurant, bakery, poultryand fast food industries and can be readily collected in plenty. Eggshell wastedisposal contributes to environmental pollution. Challenges associated withdisposal of eggshells include cost, availability of disposal sites, odour, fliesandabrasiveness. However, they can be processed in to saleable productslike fertilizer,used in art work, human and art nutrition and building materials and to producecollagen from the membranes consist of collagen from the membranes.

Eggshell ash:

The eggshell were washed, dried and ground to powder using the blender Asieve was used (o obtain an Average particle size of 43 Sum.The eggshell was dried and directly fired in flame until a constant weightwas observed.The eggshell ash is prepared by fired by kerosene.

Cal-sil powder:

The Eggshell is fired with kerosene and eggshell ash is prepared.The glass wastes are broken and glass powder is prepared.The eggshell ash and glass powder is mixed.Mixed powder is kept in oven at above 300 deg.cel.

TESTING METHODS

FIELD TESTING:

From the stiff paste, pat a cake with sharp edges. Put it on a glass plate and Take it under water in a bucket. See that the shape of the cake is not disturbed while Taking it down to the bottom of the bucket. After 24 hours the cake should retain its Original shape and at the same time it should also set and attain some strength. If a sample of cement satisfies the above field tests it may be

concluded that the cement is not bad. The above tests do not really indicate that the cement is really good forimportant works. For using cement in important and major works it is incumbent on the Part of the user to test the cement in the laboratory to confirm the requirements of the cement. Indian Standard specifications with respect to its physical and chemical properties. No doubt, such confirmations will have been done at the factory laboratory before the production comes out from the factory. But the cement may go bad during transportation and storage prior to its use in works. The followingtests are usually conducted in the laboratory.

SETTING TIME TEST:

An arbitraty division has been made for the setting time of cement as initial setting time and final setting time. It is difficult to draw a rigid line between these two arbitrary divisions. For convenience, initial setting time is regarded as the time elapsed between the moments that the water is added to the cement, to the time that thepaste starts losing its plasticity. The final setting time is the time elapsed between the moment the water is added to the cement, and the time when the pastehas completely lost its plasticity and has attained sufficient firmness to resistdefinitecertainpressure.

In actual construction dealing with cement paste, mortar or concrete certaintime is required for mixing, transporting, placing, compacting and finishing.During this time cement paste, mortar, or concrete should be in plastic condition.The time interval for which the cement products remain in plastic condition isknown as the initial setting time. Normally a minimum of 30 minutes is given formixing and handling operations. The constituents and fineness of cement ismaintained in such a way that the concrete remains in plastic condition for certainminimum time.

THE VICAT APPARTUS SETTING TIME TEST:

The following procedure is adopted. Take 500 gm. of cement sample andgauge it with 0.85 times the water required to produce cement paste of standardconsistency (0.85 P). The paste shall be gauged and filled into the Vicatmould inspecified manner within 3-5 minutes. Start the stop watch the moment water isadded to the cement. The temperature of water and that of the test room, at the timeof gauging shall be within 27°C ± 2°C.

FINAL SETTING TIME:

Replace the needle (C) of the Vicat apparatus by a circular attachment (F) .The cement shall be considered as finally set when, upon, lowering the attachmentgently cover the surface of the test block, the centre needle makes an impression,while the circular cutting edge of the attachment fails to do so. In other words thepaste has attained such hardness that the centre needle does not pierce through thepaste more than 0.5 mm.

STRENGTH:

When we talk of strength we do not imply the strength of the parent rockfrom which the aggregates are produced, because the strength of the rock does notexactly represent the strength of the aggregate in concrete. Since concrete is anassemblage of individual pieces of aggregate bound together by cementingmaterial, its properties are based primarily on the quality of the cement paste.strength is dependant also on the bond between the cement paste and the aggregate.If either the strength of the paste or the bond between the paste and aggregate is low, a concrete of poor quality will be obtained irrespective of the strength of thelow, a concrete ofrock or aggregate. But when cement paste of good quality is provided and its bondwith the aggregate is satisfactory, then the mechanical properties of the rock oraggregate will influence the strength of concrete. From the above it can beconcluded that while strong aggregates cannot make strong concrete, for makingstrong concrete, strong aggregates are an essential requirement. In other words,from a weak rock or aggregate strong concrete cannot be made.

COMPRESSIVE STRENGTH: EGGSHELL ASH CONCRETE (7 DAYS)

S. NO	PERCENTAGE	LOAD (KN)	AREA (mm^2)	WEIGHT (Kg)	STRESS (N/mm^2)	DATE OF CASTING	DATE OF TESTING
1	5	480	22500	8.21	21.33	13.02.23	20.02.23
2	10	370	22500	8.20	16.44	13.02.23	20.02.23
3	15	320	22500	8.21	14.22	13.02.23	20.02.23

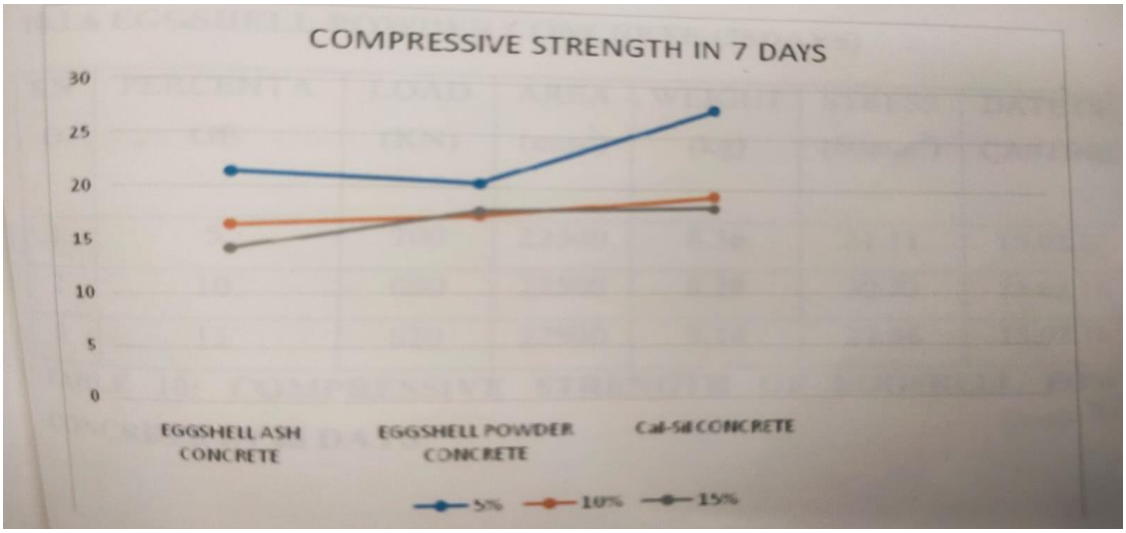
TABLE 1: COMPRESSIVE STRENGTH OF EGGSHELL ASH

CAL-SIL CONCRETE(7 DAYS)

S. NO	PERCENTAGE	LOAD (KN)	AREA (mm^2)	WEIGHT (Kg)	STRESS (N/mm^2)	DATE OF CASTING	DATE OF TESTING
1	5	490	22500	8.15	21.77	21.02.23	27.02.23
2	10	430	22500	8.07	19.33	21.02.23	27.02.23
3	15	410	22500	8.02	18.22	21.02.23	27.02.23

TABLE 2:COMPRESSIVE STRENGTH OF Cal-Sil CONCRETE IN 7 DAYS

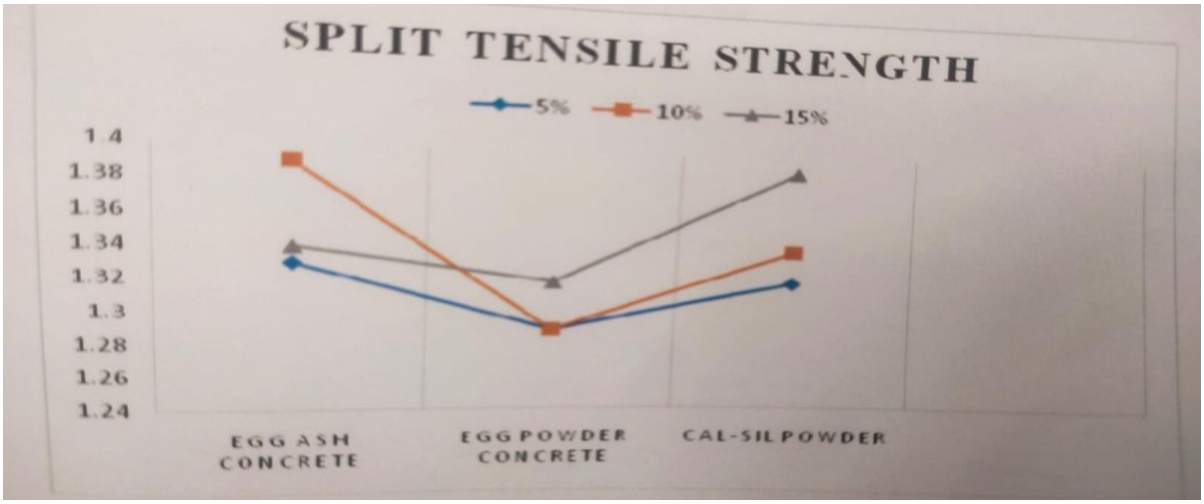
COMPARISION OF COMPRESSIVE STRENGTH IN 7 DAYS



Cal-Sil CONCRETE:

S.NO	PERCENTAGE	DIAMETER (mm)	LENGTH (mm)	LOAD (KN)	WEIGHT (kg)	SPLIT TENSILE STRENGTH (N/mm^2)
1	5%	150	300	93	12.87	1.32
2	10%	150	300	95	12.67	1.34
3	15%	150	300	98	13.03	1.39

TABLE 3:SPLIT TENSILE STRENGTH OF Cal-Sil CONCRETE IN 28 DAYS



COMPARISION OF SPLIT TENSILE STRENGTH IN 28 DAYS

CONCLUSION

Based on the results of these works it can be concluded that egg shell ash mixed cubes has equal strength with that of conventional concrete cubes in certain categories.M20 cubes takes equal load compared to conventional concrete, and It is equal grade concrete's load carrying capacity is slightly decreased. The Cost of the construction has been reduced by adding the waste eggshells to the materials of construction .The pollution in landfill by the decomposition of the egg shell has been reduced .The compressive strength & split tensile strength of 5% eggshell ash concrete, eggshell powder concrete, Cal-Sil concrete is higher than the all results in this experimental analysis.

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