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Experimental Investigation of Herbocrete-An Effective Use of Natural Admixtures

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ABSTRACT: Admixtures are materials and chemicals added to the concrete to augment its fresh state and modify the characteristics of concrete. Most of the admixtures are available in market in the form of chemical composition. These chemical admixtures are very expensive and severely pollute the surrounding environment. However the adding admixtures to concrete are not a new concept and it has been practiced and derived over several centuries in several countries. The natural admixtures materials such as milk, lard, Tung oil have been used as natural admixtures in ancient construction. In this project we are investigating the possibilities of using natural materials like "Terminaliachebula" (Kadukkai) and Chicken Eggshell as an admixture in cement mortar and plain cement concrete (PCC). Terminaliachebula extract is added in different concentrations of 2.5%, 5%, 7.5% to the cement concrete and its effects on workability and strength of concrete are studied. Terminaliachebula when added to cement mortar has no effect on workability but increases the compressive strength by 1.832 times of reference concrete. But the initial setting time of concrete is increased by 30 minutes of nominal OPC concrete. Diminish the drawback of adding kadukkai concrete is done by Eggshell which is used as retarders in PCC. Eggshell is mostly having calcium carbonate about 90-95%. Therefore the compressive strength of concrete with combination of kadukkai and eggshell powder is increased by 1.562 times of reference concrete. Similarly it influence to increase the tensile and flexural properties of concrete.

I. INTRODUCTION

In India the Construction industry is second largest industry. In past years, attempts are being made to amplify the fresh state and characteristics of cement concrete (compressive and tensile strength) by addition of chemical admixtures. This use of chemicals in construction leads to many types of influences in environment and different levels of pollution. Our ancestors have used various plants as admixture in construction for more than 10000 years ago to improve overall performance of the structure. Herbal admixture will definitely improve strength and durability of the mortar as well as concrete but at the same time does not create any harmful toxics to our environment. Keeping the above argument in mind, this study is to be carried out to prove the natural organic plants and bio wastages like eggshells used as alternative to chemical admixture. We aim at studying the possibility of using Terminaliachebula as admixtures in concrete in order to ensure an eco-friendly greener construction with sufficiently high strength, enhanced durability at reasonably lower cost.

In the uses of kadukkai as admixtures in concrete which is act as a retarders. Because initial setting time delayed while compare to normal concrete it increased by 30 minutes. Because of the chemical content of terminaliachebula which is having retarders chemicals. So we are introducing Eggshell powder as retarders in kadukkai concrete. Because of the chemical composition of eggshell which is contain 90-95% of calcium carbonate. Calcium carbonate is widely used as retarders in constructions. In India, 600000 tons of eggshells are produced in every year. So the disposals of wastes are easily overcome by using in construction activities.

A. Admixture in construction

Admixtures are ingredients other than water, aggregates, hydraulic cement, and fibers that are added to the cement batch immediately before or during mixing. A proper use of admixture offers certain beneficial effects to concrete, including improved quality, acceleration or retardation of setting time, enhanced frost and sulphate resistance, control of strength development, improve workability, and enhanced finish ability. It is estimated that 80% of concrete produce these days contains one or more types of admixtures. According to a survey by the National Ready Mix Concrete Association, 39% of all ready- mixed concrete producers use fly ash, and at least 70% of produced concrete contains a water-reducer admixture. In field there are two types of admixtures available such as chemical and mineral admixtures. Chemical admixtures are materials that are added to the constituents of a concrete mixture, in most cases, specified as a volume in relation to the mass of cement or total cementitious material. The admixture interacts with the hydrating

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cementitious system by physical and chemical actions, modification one or more of the properties of concrete in the fresh and/or hardened states. The most common type of chemical admixtures are Air entrainers, Water reducers (Super plasticizers), Accelerators, Retarders.

Mineral such as clay, shales, volcanic tuffs called pozzolanic materials, when it is added to cement concrete which is modifies the properties of cement concrete. It involve reduction of alkali aggregate reaction, lower costs and lower heat of hydration.

B. Problems associated with chemical admixture

Though chemical admixtures used in the construction industry serve a great deal in modifying the essential properties of concrete thereby helping in an effective constructional practice, they possess certain environmental risks. Chemical such as lignosuitonic acids, Hydroxylated polymers, Hydroxylatedcarboxylated acids, sulfonated melamine are used as water reducers. Calcium chloride, salts of formats, nitrates, nitrites, and thiocyanates are used as accelerators. Sulfonated melamine formaldehyde condensate, Polyether-polycarboxylates is used as Super plasticizers. All these chemicals through used in construction only, they find their way into the environment during any one of these stages such as Production, Transport, Storage / handling, Use of the concrete admixture, Service life of the building, Recycle of concrete for demolition, disposal of building waste and residues etc. Possibly, also production wastewater and wastewater from construction sites can be relevant sources for construction chemicals in the environment. Most of the above construction chemicals are polar organic compounds. Considering their polarity, they are assumed to leach from concrete into the aquatic environment. These water soluble chemicals leach from concrete and mix with groundwater and in some cases when the structures are present near streams or oceans, they enter these water currents and turn them toxic thus mildly affecting fishes and other aquatic organisms. When these chemicals pollute groundwater they also have significant bearing on human health.

C. Scope and Objective

The objective of the project is to study the feasibility of developing the properties of concrete using locally available kadukkai and the bio-degradable wastages like eggshell. So it is create eco-friendly concrete. The scope of this experimental work is to examine and evaluation the effect of kadukkai (Terminaliachebula), and kadukkai + eggshell on mainly with respect to its mechanical behaviour.

II. LITERATURE REVIEW

In this chapter, a brief review of the studies on natural admixture while using in plain cement concrete and discuss about mechanical behavior of structures reported various researches in published literature have been carried out. The review includes only experimental studies.

1. K.Vigneshbharathy, R.Sathishkumar (2013**)** They are investigating the mortar cubes with adding of kadukkai and taking the compressive strength, workability and porosity of mortar cubes. It gives the optimum results compared with reference mortar or ordinary mortar cubes. Terminaliachebula is used as admixtures in concrete in order to ensure an eco-friendly greener construction with sufficiently high strength, enhanced durability at reasonably lower cost. Terminaliachebula when added to cement mortar has no effect on workability but increases the compressive strength by 1.48 times of reference mortar.

2. Manmadhan Nair (2003)He is reclaiming heritage discussed about the renovation work carried out at Fort at Vettimurichakotta, Pazhavangadi, East Fort, West Fort, Puthen Street, Sreevaraham and Virakupurakkotta, Kerala, India using different composition of the plaster mixture which was discovered from a palm leaf manuscript found in the Padmanabhapuram Palace. An assortment of elements including a variety of herbs and fruits and a particular species of cactus were blended with palm jaggery and left to ferment for 15 days. This concoction was mixed with lime to prepare the plaster. From this literature study, some idea about the natural admixtures is used in both mortar and concrete. I have plan use the combination of kadukkai and eggshell powder in concrete for determining the compressive strength, flexural strength, split tensile strength.

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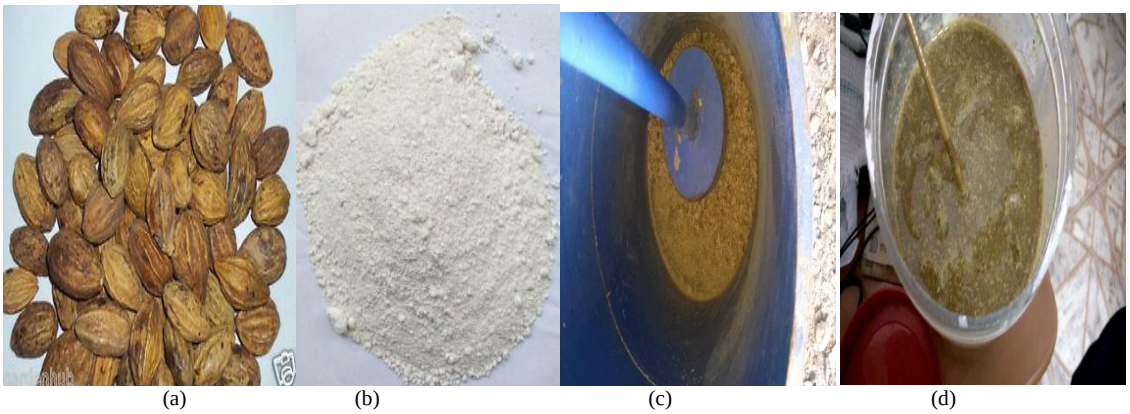
III. MATERIAL PREPARATION

A. Preparation of Kadukkai and eggshell powder

The kadukkai was crushed and ground. The ground kadukkai power was mixed with suitable quantity of water and kept(fermented) in a closed container for 3 days. The kadukkai fermented are filtered after 3 days and the filtered water was used in the mortar mixes for different rations. The mortar cubes is cast with the addition of kadukkai water was tested after 28 days of air curing for lime mortar and water curing for cement mortar.



(a) (b) (c) (d)

Fig.. 3.1. (a) Kadukkai (b) Eggshell powder (c) Kadukkai Crushing (d) kadukkai with water

The waste eggshell pieces are collected from commercial areas like restaurants, hotels and hostels. It was cleaned and dried in oven at 80 c in 2 days. Then it was crushed, grinded and powdered with help of crushing machines. The eggshell powder is partial replacement of cement. So it was sieved by 90microns sieved for replacement cement. Then required quantity of eggshell powder is taken in account.

B. Preparation of kadukkai paste concrete

The concrete consists of cement, sand, aggregates, water and admixtures. We are taking the mix ratio of 1:1.5:3 (I.e.) M20 grade of concrete. Firstly the cement, sand and aggregate are dry mixed about 30seconds. 0.4 is the water cement ratio for concrete. Then the water is mixed with kadukkai paste about three phase of preparation as 2.5%, 5%, 7.5% and for each mix, three trial specimens were cast for different periods of time like 7, 14, 28 days.

C. Preparation of kadukkai paste + eggshell powder concrete

In above preparation, the optimum value of kadukkai paste is determined. So the concrete is prepared with kadukkai paste in addition of eggshell powder which is replacement for cement with proportion of 5%, 10%, 15%. Eggshell powder is used as retarders in concrete. These each mix proportions were cast with three trial specimens for different periods of time.

IV. EXPERIMENTAL INVESTIGATION

A. Phases of experimental work

The experimental investigation was carried out in seven different phases. The various phase involved have been explained as follow:

- The first phase includes the collection of materials and preliminary investigation which were carried out on these constituents of the concrete.
- The second phase involves the preparation of ordinary concrete cubes. In this stage cement concrete was prepared by adding water, cement, coarse and fine aggregates. This concrete is used for casting cubes.
- The third phase includes the, fermentation of kadukkai only. Fermentation of kadukkai is carried out by crushing and grinding of kadukkai and allowed to be immersed in water for 3days, 7 days and 15 days. Then the water in which kadukkai is present filtered and the water is added to the concrete with different percentage of kadukkai paste (i.e.) 2.5%, 5%, 7.5%.

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- In the fourth phase the cube moulds were cast for mix proportions and combinations. For each mix three trial specimens were cast. The concrete cubes were then allowed to cure by means of carbonation that is exposed to the sunlight and water curing for cement concrete.
- In the fifth phase the testing of the kadukkai cast specimen in which the testes are workability test and compressive strength test conducted in laboratory for attaining optimum value of kadukkai paste.
- In the sixth phase preparation of eggshell powder used in partial replacement of cement. So the eggshell is powdered then it is sieved by 90 microns sieve for cement replacement.
- In the seventh phase the cube moulds were cast for mix proportions of kadukkai (optimum value) + eggshell combinations as 5%, 10%, 15%. For each mix three trial specimens were cast. The concrete cubes were then allowed to cure by means of carbonation that is exposed to the sunlight and water curing for cement concrete.
- Eighth phase involves the testing of the cast specimen for the workability test and compressive strength test.
- And in seventh phase the experimental data was observed and analyzed.

B. Test Procedure

The cubes with side 15cm shall be prepared from concrete ratio of 1:1.5:3 for both concrete (kadukkai and kadukkai + Eggshell) proportions. The moulds shall be filled by hand or trowel, the concrete being pressed in with the trowel, lightly tamped and finishing of concrete cube is done by vibrating machine. It should be stored in undisturbed suitable container for period of 24 hours and at room temperature. After the expiry of this period the specimens shall be takeout from the moulds and immersed in water in the laboratory for 28 days specimen. After the curing process using universal testing machine the compressive (cube) strength, tensile (beam size – 150X150X700) and flexural strength (cylinder- Dia 150) was determined. Table 1 shows the compressive, tensile and flexural strength of kadukkai concrete, Table 2 shows the compressive, tensile and flexural strength of combination of kadukkai and eggshell concrete.

Table 4.1 Comparative results of kadukkai concrete Vs plain concrete

S.No.	Specimen Details	Percentage of Kadukkai (%)	Period	Compressive strength (N/mm2)	Tensile strength (N/mm2)	Flexural strength (N/mm2)
1	Ordinary concrete	0	7 Days	13.50	1.708	3.15
			28 Days	19.97	2.137	4.2
2	Kadukkai Mixed concrete	2.5	7 Days	20.13	2.024	4.13
			28 Days	27.71	2.734	4.9
3		5	7 Days	27.11	2.488	4.87
			28 Days	36.5985	3.3588	5.75
4		7.5	7 Days	19.84	1.978	4.5
			28 Days	26.784	2.6703	5.12

Table 4.2 Comparative results of kadukkai and eggshell mixed concrete

S.No	Specimen Details	Percentage of Kadukkai (%)	Percentage of Eggshell powder (%)	Period	Compressive strength (N/mm2)	Tensile strength (N/mm2)	Flexural strength (N/mm2)
1	Ordinary concrete	0	0	7 Days	13.50	1.708	3.15
				28 Days	19.97	2.137	4.2
2	Kadukkai And eggshell concrete	5	5	7 Days	18.767	1.94	4.01
				28 Days	25.32	2.619	4.57
3		5	10	7 Days	23.11	2.22	4.68
				28 Days	31.198	2.997	5.08
4		5	15	7 Days	16.01	1.78	4.13
				28 Days	21.615	2.403	4.70

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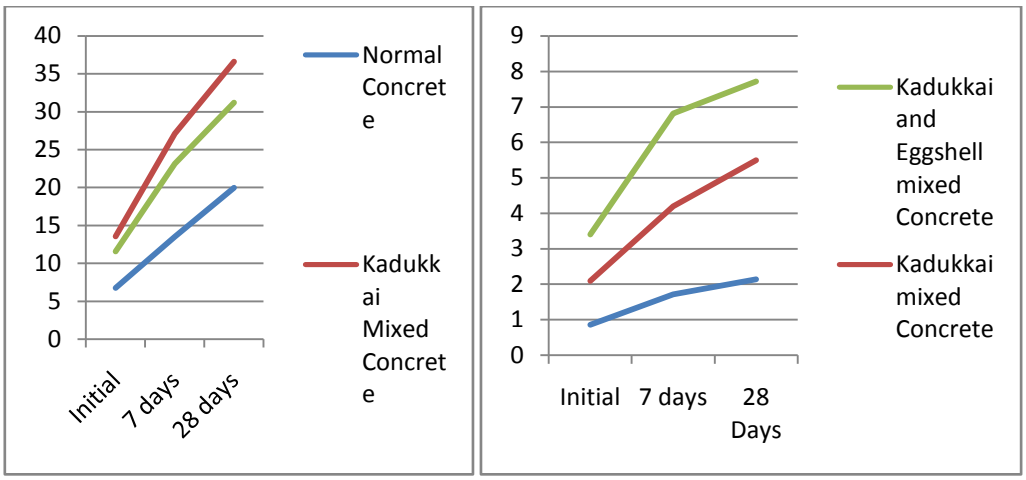

Fig. 4.1 compressive and tensile strength (normal concrete VsHerbocrete)

V. CONCLUSION

A. Discussions on results of concrete with Terminaliachebula

- The usage of natural admixture which leads to reduce the Co2 emission from the concrete and it change the mechanical behaviour of concrete.
- Different ratio of kadukkai is added to plain cement concrete and experimental test was carried out. Finally 5% of kadukkai with plain concrete gives the maximum strength compared to other proposition.
- To compared to nominal concrete the compressive strength of concrete is 1.832 times increased and flexural strength is 1.369 times increased (5% of Terminaliachebula extract)
- Similarly tensile strength of concrete is increased 1.5717 times of plain concrete. (5% of Terminaliachebula extract)
- It is acted as retarders in concrete so which is used to hot climatic condition at the same time which is not affecting the strength of concrete.

B. Discussions on results of Terminaliachebula and eggshell powder concrete

- In addition of eggshell powder with different ratio(5%, 10%, 15%) test was carried out. Finally form the experimental results we understand 10% of eggshell with kadukkai which give the maximum results.
- The compressive strength is increased by about 1.562 times of the plain cement concrete for 3 days fermentation of 5% of Terminaliachebula extract and 10% of eggshell powder.
- Similarly tensile strength of concrete is increased 1.402 times of plain concrete. And flexural strength is 1.209 times of plain concrete (5% of Terminaliachebula extract with 10% of eggshell)
- AdditionTerminaliachebula has no effect on the workability of cement mortar.

We have implemented an automatic text detection technique from an image for Inpainting. Our algorithm successfully detects the text region from the image which consists of mixed text-picture-graphic regions. We have applied our algorithm on many images and found that it successfully detect the text region.

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REFERENCES

[1] Thirumalini et all (2011) "Study on the performance enhancement of lime mortar used in ancient temples and monuments in India" Indian journal of science and technology
[2] Sabine ruckstuhl et all (2001) "Environmental Exposure assessment of Sulfonated Naphthalene formaldehyde condensates and Sulfonated Naphthalene applied as concrete Super plasticizers" Gordon research conference "Environmental science water" in Plymouth, N.I.L., USA,2000

ISSN: 2350-0328

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[3] M.O.A. Mtallib and A. Rabiu, "Effects of Eggshells Ash On The Setting Time Of Cement", Vol 3, 12 January 2011.
[4] ArashBarazesh, Hamidreza Saba, Mehdi Gharib, MoustafaYousefi Rad, "Laboratory Investigation of the Effect of Eggshell powder on Plasticity Index in Clay and Expansive Soils ", European Journal of Experimental Biology, 2012, 2 (6):2378-2384.
[5] Isaac O. Igwe, Genevive C. Onuegbu," Studies on Properties of Egg Shell and Fish Bone Powder Filled Polypropylene ", American Journal of Polymer Science 2012, 2(4): 56-61.
[6] O.O. Amu, A.B. Fajobi and B.O. Oke , "Effect of Eggshell Powder on the Stabilizing Potential of Lime on an Expansive Clay Soil", Research Journal of Agriculture and Biological Sciences 1(1): 80-84, 2005.

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