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Use of Egg Shell as Partial Replacement of Fine Aggregate

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Abstract
The aim is to deal with utilization of waste eggshell in concrete. Waste of any kindin the environment when its concentration is. in excess can become a critical factor. for humans, animals, and vegetation. The utilization of the. waste is a priority today in order toachieve sustainable development. Using the waste material for construction can reduce the pollution to greater extent and could decrease the construction cost as well. Due to rapid growth. construction industry, the demand for materials like sand has increased drastically,causing deficiency of suitable. river sand in most part of the world. Instead of using the other materials as a replacement for fine aggregate we can use eggshell as replacement. The compressive strength of the concrete can. reduce due. to addition of eggshell alone, so to increase the compressive strength can use eggshell as replacement for fine aggregate. Therefore, comprehensive utilization of waste egg shell is important in saving resources, improving surroundings and for sustainable development. The quality. of lime in eggshell waste is influenced greatly by the extent of exposure to sunlight, raw water and weather conditions. In this study, attempts were made to investigate the suitability and reliability ofEgg shell waste in manufacture of concrete. The main objective of the project is to know the best percentage of the eggshell replacement which gives the maximum strength.

Keywords—Egg Shell, Fine aggregate

1. INTRODUCTION

Throughout the world, concrete is being widely used for the construction of most of the buildings, bridges etc. Hence, it has been properly labelled as the backbone to the infrastructure development of a nation. Researches have shown that it is possible to use recycled materials to replace some of the traditional mixture components in concrete products and produce a more sustainable building material. One common material that can be recycled and have the possibilityof use in concrete applications is used egg shell. Eggshell waste falls within the category of food waste, which is materials from the preparation of foods and drinks, if subjected to adequate treatment, and they could can be suitable alternative material for construction. Eggshell contains the major composition of calcium in it, which is the valuable component for the strength. Using Eggshell powder as fine aggregate gives the major strength in case of light weight concrete.

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One common material that can be recycled and have the possibility of use in concrete applications is used eggshell. Egg shell waste falls within the category of food waste. As a part ofthis technique the usage of Egg shells aggregate as the replacement material of fine aggregate along with the in order to show considerable increase in strength has been developed.

The Egg shells primarily contains calcium, magnesium carbonate (lime) and protein. To find the physical properties like Specific Gravity, Water Absorption, Grain size of Distribution. The size of aggregate in approximately pass in 4.75mm and retain in 2.36 mm sieve. To investigatethe performance of Egg shells aggregate at different percentage 5%, 10%, 15%, 20%, 25%, by weight of cement. To find the mechanical properties of Compressive and Spilt Tensile strength tobe find out in various percentage. To prepare the concrete for M20 grade mix design by using IS10262:2009.

2. Objectives:

- To study the strength variations of concrete by partial replacement of fine aggregate withegg shell.
- To determine the percentage which gives the sustainable strength.
- Egg shell could be useful building material which else could be dumped as waste (waste to wealth).
- To study the wet properties of concrete when fine aggregate is partially replaced with eggshell

3. Materials Used

Eggshell:

In general, eggshell waste is generated from not only households and food industries but also hatcheries. Eggshell contains of 1% magnesium carbonate, 1% calcium phosphate, 4% organic matter, and 94% calcium carbonate. Based on previous work, it was found that the thickness of its outer and inner eggshell is 0.55 and 0.015 mm, respectively. Interestingly, calcium,as the largest constituent of eggshell, affects the hardness of the eggshells. To solve the eggshell waste problem can be conducted by turning eggshells into hydroxyapatite powders or calcium compounds served as materials for concrete.

Fig 3.2 : Crushed Eggshells

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Fine aggregate

Clean and dry river sand available locally was used. Aggregates passing through 4.75 mm sieve and predominately retained on a 75 µm sieve angular and round in shape are weighed taken according to the basis of the mix design.

Cement:

Cement used was ordinary Portlandcement of Grade 43 meeting the requirement of Indian Standard (IS 8112- 1989). Ordinary Portland cement of 43 Grade was used in the concrete mixture, which was stored in a cool dry place during the course of the experimentation

Coarse aggregates:

The coarse aggregate used in the this project is of passing 20mm IS sieve and retaining 16mm IS sieve and grey in colour The coarse aggregate is free from dust, deleterious materials and soft particles. And it is well graded, hard and angular aggregates are use

.

4. Methodology

Total 36 cubes and 36 cylinders are casted by replacing 5%, 10%, 15%, 20% & 25% of fine aggregates. And tested after 7 days & 28 days of curing. The cubes and cylinders are tested for compression and split tensile test respectively.

5. Results and Discussion

Compressive strength test:

Table 1 Compressive strength obtained for different % of eggshell replacement.

Egg shell added in %	Fine aggregate added in %	7 days Compressive strength (N/mm^2)	28 days Compressive strength (N/mm^2)
0%	100%	14.65	22.53
5%	95%	12.62	17.58
10%	90%	13.83	18.61
15%	85%	14.06	19.16
20%	80%	15.62	21.52
25%	75%	14.86	19.53

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Split tensile strength test:

Table 2: Tensile strength obtained for certain % of eggshell replacement.

Egg shell added in %	Fine aggregate added in %	Tensile strength of the cubes after	
		7 days Compressive strength (N/mm^2)	28 days Compressive strength (N/mm^2)
0%	100%	1.5	2.6
5%	95%	0.62	1.43
10%	90%	0.94	1.92
15%	85%	1.13	2.25
20%	80%	1.62	2.83
25%	75%	1.43	2.76

6. Conclusion

- The concrete gives maximum strength at 20% of egg shell replacement.
- The concrete could be used for all construction work as it gives the same strength as that of nominal concrete.
- The construction cost could be reduced to significant amount as the usage of fine aggregate will be reduced.
- Can reduce the construction cost by using different building materials.
- Can reduce the usage of fine aggregate (consumes globally 8–12 million tons of natural aggregate annually).
- Infrastructure development at low cost.

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