Experimental Study of Partial Replacement of Cement with Eggshell Powder in Concrete

[1]Nikita Vaidya, [2]Prof. M. P. Bastwadkar
[1]PG student, [2]Assistant Professor
[1]JSPM's ICOER, Pune,
[2]JSPM's ICOER, Pune

***Abstract* - In current days, a common trend exists to decrease usage of normal sources and recycle waste materials. Concrete plays the key position and a huge quantity of concrete in production. Eggshell waste is massive in global. And eggshell is made up with calcium so it is allowed to concrete as partial substitute of Portland cement. The purpose of this work is to observe the performance of waste eggshell powder (ESP) as partial alternative of Portland cement in concrete to improve the strength in addition to reuse of waste eggshell powder. Eggshell powder is used in numerous mixtures which can be replaced at 5% intervals from 0% to 20% through weight of cement in concrete. After curing period of 28 days, it is checked for its compressive strength, split tensile strength, flexural strength test and durability test are taken. These are in comparison with a normal mixture which is 0% of ESP and determine the best combination of replacing the material.**

***keywords* - Eggshell powder, cement, concrete.**

I. INTRODUCTION

. In presence, concrete is broadly used for the shape of greatest of the buildings, bridges and so forth. Presently, the entire construction industry is in exploration of the precise and operative the wasted product that could significantly minimized the use of cement and in the end decrease the manufacture cost of concrete. Therefore, right exchange is needed to manipulate the wastes in. The intention of this investigation work is to use the egg shell powder as a limited additional of cement. Egg shell powder is changed with the aid of 5%, 10%, 15% and 20% of weight of cement. An investigational research determines the strength functions such as split tensile, compressive and flexural strength take a look at of egg shell based totally concrete were investigated. In addition of eggshell powder, enhancing the strength parameter of concrete.

Energy performs an important role in successful of growing nations like India. In the context of short availability of non-renewable energy sources fixed with the necessities of huge quantities of energy for Building materials like cement, the position of the usage of commercial waste cannot be underneath anticipated. During manufacturing of 1 tonne of OPC we need approximately 1.1 tonnes of earth sources like limestone, etc. Further throughout manufacturing of one tonne of OPC a same quantity of CO2 is released into the surroundings. The CO2 emissions act as a silent killer within the environment as various paperwork. In this Backdrop, the look for less expensive substitute to OPC is a considered necessary one.

Fig 1 Eggshell Powder

II. LITERATURE REVIEW:

Manzoor Ahmad Allie (2018) In this paper, it is studied that quality of construction material is an important issue which enhances the stability of the structure, an attempt has been made to study the possibilities of using Eggshell powder in paver block. Cement was partially replaced by Eggshell Powder at 5% intervals from 0% to 25% by the method of replacement by weight. The

paver block Curing process is done for 7 days and 28 days, after curing it is checked for its Compressive Strength and flexural strength. It was noted that 13.4% increase of compressive strength at 10% replacement of Eggshell Powder. Flexural strength was also 19.5% increased at the same 10% replacement of Eggshell Powder. The result showed the Eggshell Powder can gives more strength if it was replaced as 10% of cement.

Pradeep Sharma (2018) In this study performed to decide the very best excellent percent of eggshell powder as partial cement replacement. The creation industries are looking for 'alternative material that may lessen the Construction cost. Over 5% of world CO2 emissions can be credited to Portland cement manufacturing. Demand for cement maintains to develop different ESP concretes were established through replacing 4 to 16% of ESP for cement. Concrete performs the important thing function and a large quantity of concrete is being implemented in every introduction exercise. The egg shell commonly that are disposed, is used as an exchange for the cement for the reason that shell is manufactured from calcium. An egg shell is utilized in first rate combos to discover the feasibility of the use of the egg shells as an exchange to cement. Intention of this task is to prevent the pollution of environment with the aid of the usage of the wrong disposal of the Eggshell waste, a live from eggshells domestic waste which includes schools, restaurant, bakeries, homes and rapid food accommodations, via the use of the usage of it as an additive fabric inform of ash & powder in traditional concrete with grade M35 because it's far usually utilized in manufacturing internet websites.

N. Parthasarathi (2017) In this paper, concrete is broadly used for the structures. Cement is main material in concrete but due to high demand of cement is costly. And to minimize the cost of structure, alternate material is required to manage the wastes in eco-friendly way. The intention of this research work is to apply the egg shell powder constrained extra of cement. Eggshell powder is changed by using 5%, 10% and 15% weight of cement. An experimental study proves the strength capabilities consisting of spilt tensile strength take a look at that is decreased with addition of eggshell powder, compressive strength test and flexural strength take a look at which can be increased up to 15%.

Amarnath Yerramala (2014) In this paper, it describes the usage of poultry waste in concrete thru the improvement of concrete and studied the Properties of concrete with eggshell powder (ESP) as cement alternative. Different ESP concretes had been advanced through replacing 5-15% of ESP for cement. Test are taken, compressive energy and split tensile strength take a look at turned into better than normal concrete for 5% of ESP alternative and it had lower strength than normal concrete with greater than 10% of substitute on the age of 7 & 28 days. The results proven that irrespective of ESP percentage substitute there has been proper relationship among compressive strength and split tensile strength.

D. Gowsika (2014) In this paper opinions the outcomes of experiments evaluating using egg shell powder from egg manufacturing company as partial opportunity for normal Portland cement in cement mortar. The chemical composition of the egg shell powder and compressive strength of the cement mortar changed into decided. The cement mortar of blend shares 1:3 where in cement is partly modified with egg shell powder as 5%, 10%, 15%, 20%, 25%, 30% with the aid of the use of weight of cement. The compressive strength turned into decided at curing a long time 28 days. There become a pointy lower in compressive power beyond 5% egg shell powder replacement. In this course, an experimental research of compressive strength, split tensile strength, and Flexural power changed into below taken to use egg shell powder and admixtures as partial alternative for cement in concrete.

S. Karthikeyan (2012) Reduce and Reuse of the opportunity substances is a whole lot energetic to preserve our strength assets. In the field of construction, the use of admixtures and re-utilization of available wastage substances is not a new one. But it is deals with a look at of Egg Shell Powder as a partial substitute of cement in concrete, to improve the strength in addition to reuse & reduce the egg shell wastage. The various traits of ESP are examined and it's far allowed to concrete as a partial alternative of cement. The numerous proportions such as 2.5, 5 and 7.5% are tried on this research and the strength performed by way of ESP concrete is much higher than a nominal concrete. Every admixture has its own strength. There became a pointy decrease inside the power while the proportion of ESP is beyond the extent of 5%.

Praveen Kumar (2006) Experimentally investigated the Partial Replacement of Cement with Egg Shell Powder. The goal of this takes a look at the chemical composition of the egg shell to locate its suitability of substitute within the concrete. To look at the probability of using the egg shell and silica fume as cement alternative cloth. To take a look at the strength parameters of the egg shell powder combined specimens and to examine it with traditional specimens. The scope of the look at is to the concrete samples and conduct the compressive strength check, split tensile strength take a look at and flexural power check at 7th & 28thday, with the desired mixtures of egg shell powder and evaluate it with the controlled concrete specimens. In this assignment M30 Concrete is designed for numerous combos. Egg shell with silica fumes are used in special combos to discover the possibility of using the Egg shells as a trade to cement Egg shell powder replaces 10%, 20% and 30% further with the silica fume by using 5%, 10%, 15% of weight of cement. Concrete is cast and Compressive check, split tensile and Flexural assessments were performed to discover the best combination which leads to optimum percent of power.

A. **Aim:** To find the effect of partial replacement of cement with eggshell powder in concrete.

B. **Objectives*:*** The objectives of this work is as follows:

1. To study the optimum mix proportion of partial replacement of eggshell powder for cement in concrete
2. To study the behavior of concrete specimen with the percentage variation of eggshell as cement from 0% to 20% at 5% intervals. The Compressive strength, flexural strength and split tensile strength properties have to be studied for each mix and to compare it with conventional concrete specimens.

III. MATERIALS AND METHOD

i) MATERIALS

a. Cement: Cement is the important required material for the construction of concrete. Cement is a well-known construction material and has engaged a very important place in construction work. There is a trade of cement obtained in marketplace

and every kind is used below satisfied illness due to its singular properties such as color and arrangement of cement. Although cement creates about 10% of the volume of the various concrete mixes, it is the active portion of the required medium and the best systematically managed element of concrete. In this investigation Portland cement of 53 grades was used. The specific gravity of cement is 3.14

b. **Coarse Aggregate**: The coarse aggregate is strongest and porous component of concrete. Presence of CA reduces the drying shrinkage and different dimensional adjustments happening on account of movement of moisture. The coarse aggregate used passes in 19 mm and retained in 11.9 mm sieve. It is nicely graded (must of different particle size and maximum dry packing density and minimal voids) and cubical in form. Specific gravity of coarse aggregate is 2.70

c. **Fine Aggregate**: The A fine aggregate received from the river is used for experimental motive. The less quantity of clay and silt. The lease from silt, clay, salt and natural material and it became clean and dry. Its size retained in 1.19-micron sieve.

d. **Eggshell Powder**: Eggshell is waste material produced from poultry farms, hotels, bakeries etc. in huge. Eggshell powder is made by crushing the eggshells. Eggshell made up with CaO which contain 50-55%. Also, silicon dioxide, aluminum, magnesium, phosphorous, sodium etc. are occurred which is very similar to cement properties so it can be used as partial replacement of cement. Eggshell powder was made by four steps. First is washing in which eggshells are clean 2-3 times by normal water. Second step is eggshells were dry for 4-5days at a temperature range of 25 ^{0}c to 30 ^{0}c. After drying, third step is grinding is which dried eggshells were grind in mixer. And fourth steps is sieving in which eggshell powder were sieve through 90micron sieve.

ii) METHOD

Concrete cube were casted having size of 150x150x150 in which cement was replaced by eggshell powder at 5% of interval from 0% to 20%. After curing period of 28days it will be checked by compressive strength. Similarly for split tensile strength, cylinder was casted having size of 15ox300 in which cement is replaced by eggshell powder at 5% of interval from 0% to 20%. After curing period cylinders were tested. Similarly for flexural strength, beam were casted which size was 250x150x650 by replacing cement by eggshell powder after 28days of curing beam were tested.

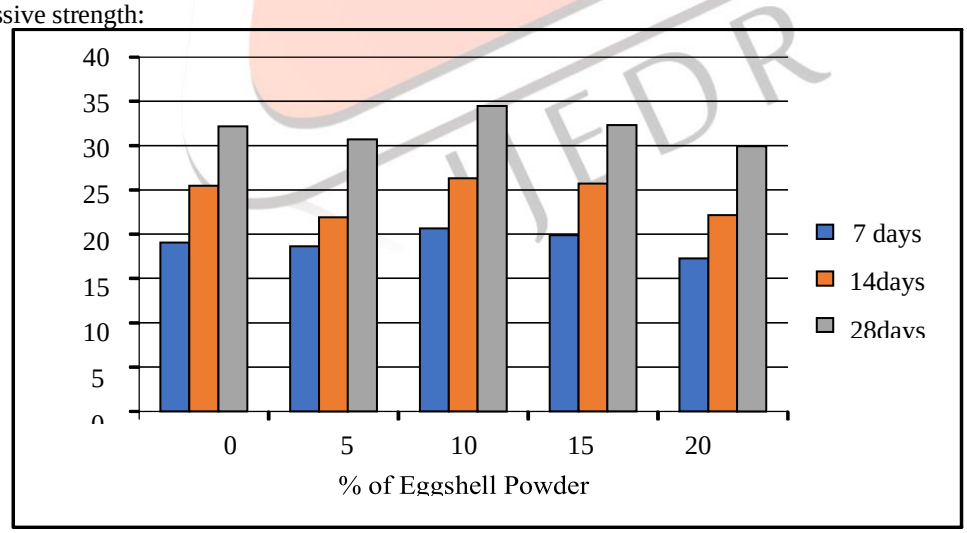
MIX PROPORTION

Cement	Fine aggregate	Coarse aggregate	Water
1	1.7	2.55	0.45

IV. RESULT

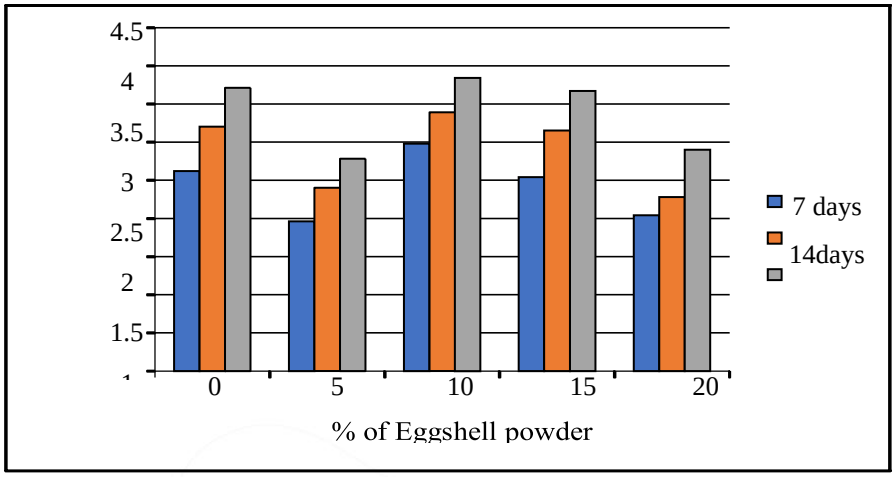
Testing of concrete: Compressive strength test, Split tensile test, Flexural strength test.

1. Compressive strength:



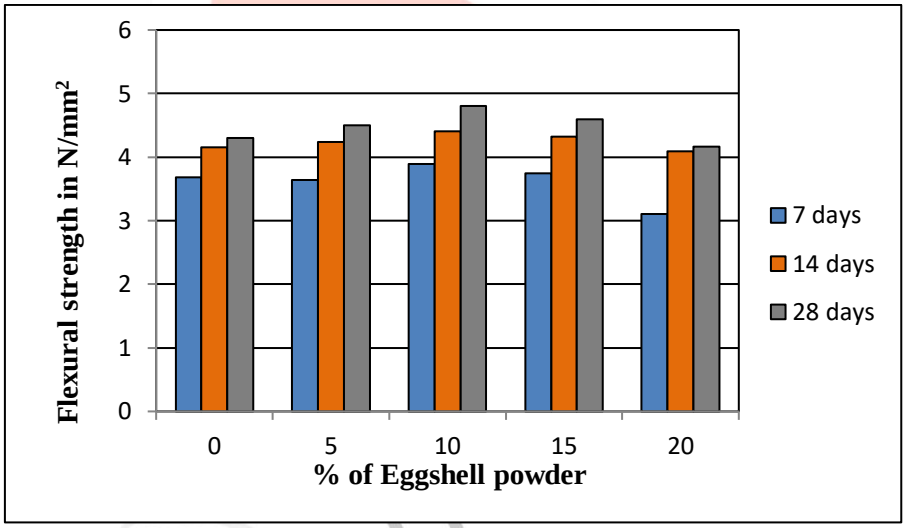
Graph of compressive strength

2. Split Tensile Strength:



Graph of split tensile strength

3. Flexural Strength:



Graph of Flexural Strength

V. CONCLUSION

It is observed that with this experiment the eggshell powder can be replacement for cement, it reduces the problem of disposal of eggshells. Compressive strength can be increased up to 7.15% than normal concrete with replacing cement up to 10% of ESP. The flexural strength can be increased up to 11.62% and 6.97% than normal concrete with replacing cement up to 10% and 15% of ESP respectively. The split tensile strength can be increased up to 3.5% than normal concrete with replacing cement up to 10% of ESP.

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