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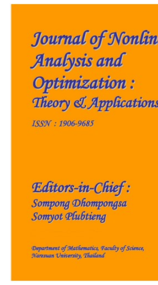

Study of mechanical properties on partial replacement of cement with eggs hell powder in concrete

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Abstract:
The primary material utilized in the construction industry is concrete. [1,2]The world's population is growing at an accelerated rate, which presents challenges for human habitation and waste management. Due to population-based waste and restrictions on the natural resources that can be used to make concrete, the construction industry needs to pay more attention to using alternative materials that can be mixed with concrete to create new products with mechanical properties that are identical to those of conventional ones.
Nowadays, recycling waste materials and reducing the use of regular sources is a popular trend. Concrete is produced in large quantities and serves a crucial role in construction.[3,4] Global eggshell waste is enormous. Furthermore, as eggshell contains calcium, it can be used in concrete as a partial replacement for Portland cement. In addition to reusing leftover eggshell powder, the goal of this investigation is to investigate how well it performs in concrete when used as a partial replacement for Portland cement. [5,6]Eggshell powder is a common ingredient in many combinations, and it can be added to concrete at intervals of 2%, 3%, or 7% by weight of cement. Following a 28-day curing period, it is examined for its.
For the manufacturing of concrete, the construction industry primarily relies on traditional ingredients like sand, granite, and cement.[7,8] The least expensive ingredient required to make concrete is cement, which is also severely lacking in many places, creating major issues with accessibility, cost, and environmental effects. the process also releases an equivalent amount of carbon dioxide into the atmosphere, which poses a serious risk to the environment in a number of ways. so the requirement for an OPC substitute is constant. An effort is being made to reduce environmental damage and provide inexpensive concrete.
The cubes are tested for Compression Test were Determined in the project.
KEYWORDS: Eggshell Powder, Replacing material, Cement, Concerte

1.INTRODUCTION
According to the Food and Agriculture Organization's (FAO) Statistics Division, India is currently the world's fourth-largest producer of broilers and the third-largest producer of eggs. With an annual growth rate of more than 14%, India is emerging as the second-largest poultry market in the world,

producing 61 million tons of eggs, or 3.6 percent of the world's total. The increase rate of egg production is 5-8% every year. Apart from this, the Ministry of Agriculture estimates that India produces 2.39 million tons of broiler meat annually, placing it sixth in the world for broiler production. [9,10]The estimated value of the poultry sector as a whole is 350 billion rupees. Every year, solely the food processing industry shapes almost 250,000 tons of leftover egg shells.

The report anticipated that India's egg manufacturers and key frames would need to provide between 10,000 and 11,000 tons of egg shell annually. [11]Since egg shell waste is mostly useless and eventually causes major environmental issues, the majority of it is dumped in landfills without any kind of processing.

In order to attain the wastes, a suitable substitute is therefore needed.The purpose of this study is to examine the egg shell's mechanical characteristics in order to determine whether concrete can replace it.[12,13] to determine whether using egg shells as a substitute for cement is feasible. to examine the egg shell powder mixed specimens' strength parameters and contrast them with those of traditional specimens.[14] The purpose of the project is to cast concrete specimens, test their compressive strength on days three, seven, and twenty-eight using the recommended mixes of egg shell powder, and compare the results to the controlled concrete specimens.

M30 Concrete is intended for multiple combinations in this project. The entire construction sector is currently looking for an appropriate and functional waste that might significantly cut cement usage and potentially slash production costs. As a result, waste management requires accessible alternatives.[15,16] Using eggshell powder as a restricted cement ingredient is the aim of this study. Eggshell Powder is replaced with Cement by 3%, 5%, and 7% by weight.

Experimentation reveals the compressive strength of eggshell based concrete. [17,18]It has been discovered that adding eggshell powder to concrete boosts its strength.In light of the limited availability of non-renewable energy sources and the high energy demands of construction materials such as cement, the significance of utilising industrial waste cannot be overstated. In order to produce one tonne of typical portland cement, approximately 1.1 tonnes of earth resources, such as limestone, are required.

2.MATERIAL AND METHODS

This experimental technique covers all preliminary testing to check the material's quality and its limitations within the technical criteria, such as aggregate analysis, specific gravity, and cement's water absorption.

Cement: Concrete is made by combining cement, a powdered material made of limestone and clay, with water, sand, and big stones. [19,20]In addition to binding other materials into aggregates, cement is a binder that continuously hardens. Water and cement react chemically to give cement its strength. We refer to this process as hydration. Cement typically loses 10% of its strength in a month after it is manufactured. The standard determination of fineness of cement (IS: 4031 - Part - 3) method was used to measure the cement's fineness.

Figure 1.Cement

Coarse Aggregates: Obtained coarse particles from nearby retailers. It was made at an area close to Noria bad, which is well-known in Pakistani construction circles for producing rough aggregates. [21,22,23]The sample of coarse aggregate with a 20 mm size was subjected to several tests, such as specific gravity, water absorption, and fineness modulus.

Table1.Properties of Fine Aggregates

Specific gravity	2.53
Fineness modulus	3.164
Water absorption	1.98%

Figure 2. Coarse Aggregates

Fine Aggregates:The fine aggregate is called the material that will pass through the No. 4 sieve and will remain on the No. 200 sieve. [24,25]The main purpose of the fine aggregate is to ensure that the concrete works, so it must have a round shape. Another goal is to fill the voids caused by a large population. Although all small aggregates have similar sizes, they differ in many ways. Small units come from local stores. [26,27]It is derived under the name Bolari sand, which is commonly used in local buildings. This quarry is considered the best in Sindi career. Many experiments have been conducted to detect the various properties of small aggregates, such as specific gravity, modulus of fineness and water absorption. The list of values is as follows.

Table2.Properties of Fine Aggregates

Specific gravity	2.63
Fineness modulus	2.98
Water absorption	1.24%

Figure 3.Fine Aggregates

Eggshell Powder: The hard outer shell of an egg is called its eggshell. [28]It is mostly made up of regular calcium carbonate. Proteins and other minerals make up the remainder. Dairy products and other foods include calcium, which is a necessary mineral. To turn egg shells into powder, an egg shell chopper is utilized.[29] In terms of making egg shell powder, the steps involved are grinding, drying, and cleaning the eggshell. The eggshell is split into small pieces before to cutting. Three devices are needed for the process: an eggshell grinder, an eggshell drier, and an eggshell sieve.[30,31] It is possible to personalize eggshell washing machines to meet your specific requirements.[32,33]The eggshells collected was crushed in grinder then after sieved through IS standards sieve size 90 microns its colour was pure white.

Figure 4.Eggshell Powder

3.Mixing:

Mix the concrete either by hand or in a laboratory batch mixer

- **Hand mixing:**Cement and fine aggregate should be mixed thoroughly and uniformly in colour on a watertight, non-absorbent platform.[34,35] Coarse aggregate should then be added and mixed with the cement and fine aggregate until the coarse aggregate is evenly distributed throughout the batch. Finally, water should be added and mixed until the concrete looks homogeneous and has the desired consistency.

Figure 5. Collecting Materials **Figure 6.Hand Mixing**

4.Casting:

Prepare the moulds by cleaning them and applying oil. Fill the moulds with concrete, layering it in layers about 5 cm thick.[36] Using a tamping rod (a steel bar with a diameter of 16 mm and a length of 60 cm, with a bullet tip at the bottom), compact each layer with at least 35 strokes. Use a trowel to level and smooth the upper surface.

Figure 7.Casting of cubes with and without moulds

5.Curing:

The first set of 12 test specimens are marked, taken out of the moulds, and maintained submerged in clean, fresh water until they are retrieved in time for the test.[37,38] They are then stored in moist air for a full day. [39]After the first batch is demoulded, the next batch of twelve test specimens is cast and kept in moulds for a full day. Following this, the specimens are taken out of the moulds and preserved in clean water until they are needed for testing.

Figure 8. Concrete cubes in curing tank

6.Compression Test:

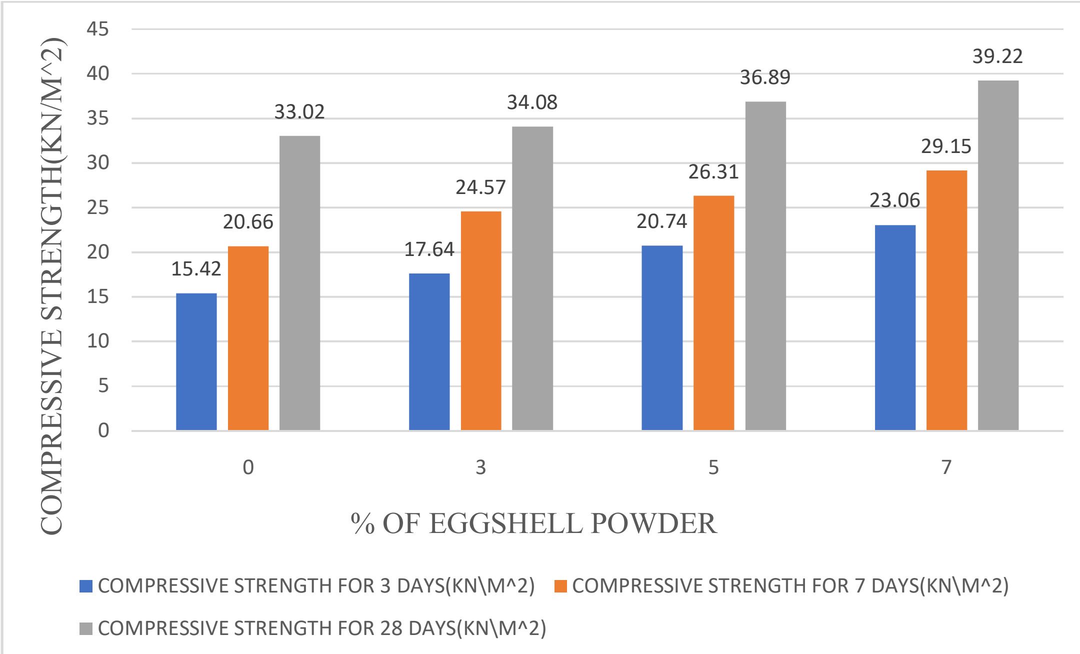
Procedure:

After the allotted curing period, remove the specimen from the water and wipe off any excess moisture. Consider the specimen's size. The testing machine's bearing surface should be cleaned.As you insert the specimen into the machine, make sure the load is applied to the cube cast's opposing sides.[40] Place the specimen in the center of the machine's base plate. Gently turn the movable part by hand until it makes contact with the specimen's top surface.

Apply the load steadily and without interruption at a rate of 140 kg/cm2/minute until the specimen gives out. Take note of the maximum load and any peculiarities in the failure type.

Figure 9 . Compressive strength of concrete cubes

RESULTS



As we see that by adding egg shell mixture at different percentages such as 3%,5% &7% at M30 grade of concrete. We can observe that there is a change in increasing compressive strengths at different curing period such as 3 days,7days & 28 days as compared normal conventional cube as shown in graph. So by observing graph we can say that by adding egg shell powder that there is a change in increasing compressive strength at 7% compared to conventional cube. So we can prefer egg shell powder as partial cement replacement at below 10 %,so there will a change in increase compressive strength compared to conventional cube.

CONCLUSION:

This experiment has shown that eggshell powder can be used in place of cement, which lessens the issue of eggshell disposal. By substituting cement up to 7% of ESP, compressive strength can be enhanced by up to 5.2% compared to regular concrete. At 3, 7, and 28 days of curing ages, the compressive strength was higher than regular concrete for 7% ESP supplementation. The results of the experiment show that egg shell powder by itself can be a good partial substitute for cement, increasing the strength characteristics while using less cement.

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