Review of Studies on Concrete Incorporating Partial Replacement of Cement With Egg Shell Powder And Fly Ash

Ms. Dalve Arti Dattatray[1], Prof. G.N.Shete[2]
[1]Dept of Structural Engineering
[2]Assistant Professor, Dept of Structural Engineering
[1, 2] Mahatma Basweshwar Education Society's, M. S. Bidve Engineering College, Latur

Abstract- *The utilization of alternative materials in concrete production has garnered significant attention due to its potential to enhance both material performance and environmental sustainability. This review presents a comprehensive synthesis of studies exploring the incorporation of eggshell powder (ESP) and supplementary cementitious materials in concrete formulations. The primary objective of these investigations is to assess the feasibility and benefits of utilizing these materials as partial replacements for traditional cement and fine aggregates. The studies encompass a wide spectrum of research, encompassing both laboratory experiments and theoretical analyses. Key findings highlight the potential of these materials to enhance concrete's compressive, tensile, and flexural strengths. The studies underscore that an optimal content of ESP and supplementary materials can lead to improved strength characteristics, workability, and durability. However, beyond certain thresholds, diminishing returns are observed, emphasizing the critical importance of proportion optimization. Furthermore, the environmental impact of using these materials is a critical aspect of the investigations. The reviewed studies collectively suggest that incorporating ESP and supplementary materials can contribute to reducing carbon emissions associated with traditional cement production. This aligns with contemporary sustainability goals and supports the drive towards greener construction practices. However, challenges are also noted, particularly regarding the durability of the modified concrete under specific environmental conditions. The studies emphasize the need for a holistic assessment that considers both short-term mechanical benefits and long-term performance, including resistance to chloride ingress, sulfate attack, and acid exposure. In conclusion, this review underscores the potential benefits of incorporating eggshell powder and supplementary cementitious materials in concrete production. The findings highlight the importance of meticulous material optimization to harness their positive effects while addressing environmental concerns. This review contributes to the body of knowledge guiding sustainable construction practices and encourages further research in this burgeoning field.*

Keywords- Egg shell powder, fly ash, concrete, cement, aggregate

I. INTRODUCTION

During the world, concrete is presence broadly used for the structure of greatest of the buildings, bridges etc. Presently, the complete construction industry is in exploration of an appropriate and operative the unused product that would greatly minimalize the use of cement and eventually decrease the creation cost. Such a substitute material are egg shell powder and silica fume. Greatest of egg shell waste is willing in landfills short of any pre-treatment since it is conventionally unusable and eventually makes thoughtful eco glitches. Therefore, proper alternate is required to manage the wastes in eco-friendly way. The goal of this investigation work is to use the egg shell powder, silica fume as a limited additional of cement. Egg shell powder is replaced by 5%, 10% and 15% in addition with the silica fume by 2.5%, 5%, and 7.5% of weight of cement. An experimental research demonstrates the strength features such as split tensile strength, compressive strength, and flexural strength test of egg shell based concrete were investigated. It is found the strength of the concrete rises with the adding of egg shell powder and silica fume and finally the comparison is made for the egg shell and silica fume added strength of concrete

Energy plays a crucial role in growth of developing countries like India. In the context of low availability of non-renewable energy resources coupled with the requirements of large quantities of energy for Building materials like cement, the importance of using industrial waste cannot be under estimated. During manufacturing of one tonnes of Ordinary Portland Cement we need about 1.1 tonnes of earth resources like limestone, etc. Further during manufacturing of 1 tonnes of Ordinary Portland Cement an equal amount of carbon-di-oxide are released into the atmosphere. The carbon-di-oxide emissions act as a silent killer in the environment as various forms. In this Backdrop, the search for cheaper substitute to OPC is a needful one.

Earlier works on the combination concrete conducted by scholars have led us to the point that the eggshell ash can be used as an additive in concrete production. Eggshells are agricultural waste materials generated from chick hatcheries, bakeries, and fast-food restaurant among others, which can litter the environment and consequently constituting environmental problems or pollution which would require proper handling.

1.1 General

Energy plays a crucial role in growth of developing countries like India. In the context of low availability of non-renewable energy resources coupled with the requirements of large quantities of energy for Building materials like cement, the importance of using industrial waste cannot be under estimated. During manufacturing of one tones of Ordinary Portland Cement, we need about 1.1 tons of earth resources like limestone, etc. Further during manufacturing of 1tones of Ordinary Portland Cement an equal amount of carbon-di-oxide are released into the atmosphere. The carbon-di-oxide emissions act as a silent killer in the environment as various forms. In this Backdrop, the search for cheaper substitute to throughout the world, waste products are seriously polluting the environment. There are many types of waste disposal system such as land filling, open burning, drains clogged up with rubbish and river fill definitely indicate solid waste is a major environmental problem in India.

1.2 Materials used

1.2.1 Cement

Cement is the important required material for the construction of concrete. Cement is a well-known construction material and has engaged a vital place in construction work. There is a change of cement obtainable in market and each type is used under convinced illness due to its singular properties such as Color and arrangement of cement. Although cement creates only about ten percentage of the volume of the various concrete mix, it is the active portion of the compulsory medium and the only systematically controlled component of concrete. The physicalproperties of cement, chemical composition of cement are shown in Table-1 and Table-2 respectively cement .

1.2.2 COARSE AGGREGATE

Without aggregate, large castings of neat cement, paste would essentially self-destruct upon drying. Coarse aggregates are particles greater than 4.75 mm, but generally range between 9.5 mm to 37.5 mm in diameter. They can either be from primary, secondary or recycled.

Fig. 1 Coarse Aggregate

1.2.3 FINE AGGREGATE

The finer aggregate has a better positive effect on the properties of fresh concrete and hardened in high performance concrete. Thus, fine aggregate is playing an important role in the concrete mixture.

1.3 Egg Shell Powder

Eggshell consists of several mutually growing layers of CaCO3, the innermost layer-maxillary 3 layer grows on the outermost egg membrane and creates the base on which palisade layer constitutes the thickest part of the eggshell. The top layer is a vertical layer covered by the organic cuticle. The eggshell primarily contains calcium, magnesium carbonate (lime) and protein. In many other countries, it is the accepted practice for eggshell to be dried and use as a source of calcium in animal feeds. The quality of lime in eggshell waste is influenced greatly by the extent of exposure to sunlight, raw water and harsh weather conditions. It is the fine grained powder with suitable proportion which is sieved to the required size before use with concrete/mortar.

Eggshell known as a smooth surface that is desirable compared rough eggshells fracture more easily. Most good quality eggshells from commercial layers contain approximately 2.2 grams of calcium in the form of calcium carbonate. About 95% of the dry eggshell is calcium.

Fig 2. Egg shell powder

1.3.1 History of egg shell powder

Every day, the world's egg companies process an estimated one million eggs. In the process to produce liquid and powdered egg products, these companies also generate huge volumes of wastes. In this environment-conscious world, disposal of eggshells and paper egg trays represents a significant cost and in many countries, legislation requires eggshells to be heat-treated so that they do not become a source of disease to humans or animals. A 'green' solution Danish engineering company, Sunoco Environmental Solutions, has developed a new way to deal with these wastes in an environmentally friendly and safe way. Eggshells and trays are processed together, the trays forming the fuel to burn the shells. Rather than worthless ash from heating at low temperatures, the resulting residue from incineration is burnt limestone (also known as quicklime), a chemical with many industrial uses, including the building industry. Ordinary Portland Cement of 53grade confirming to IS 12269- 1987 was used in this study. River sand confirming to grading zone III of Is 383-1970 was used as a fine aggregate. Well graded coarse aggregate passing through 20mm sieve according to IS 383-1970 was used. Well graded coarse aggregate passing through 20mm sieve according to IS 383-1970 was used. Egg shell procured from local industry. It grained and sieved to the required size before used in concrete mix. Saw dust was obtained from sawmill and saw dust ash was obtained by incineration process and sieved before used. Fly ash was collected from Salem steel Plant, Salem, Tamilnadu and sieved before used confirming to IS 3812 (part I). Micro silica was a byproduct of the silicon and Ferro-silicon production. Portable water was used in the investigations for both mixing and curing purposes.

1.3.2 ADVANTAGES OF EGG SHELL:

- Considerable reduction in alkali-silica and sulfate expansions.
- Meets the most stringent environmental regulations nationwide.
- Ideal for painting in occupied spaces.
- Excellent durability and washable finish.
- Resist mold and mildew on the paint film.
- Saves money; less material required. Meets strict performance and aesthetic requirements.
- Considerable reduction in alkali-silica and sulfate expansions.
- Meets the most stringent environmental regulations nationwide.
- Ideal for painting in occupied spaces.

1.4 History of Fly ash

Fly ash is a byproduct of burning coal in power plants, and its history dates back to the 1930s when power plants began producing it in large quantities. In the early days, fly ash was considered a nuisance and was often disposed of in landfills or ponds, leading to environmental problems. During World War II, there was a shortage of cement, which led to the use of fly ash as a substitute for cement in concrete production. This marked the beginning of the use of fly ash as a construction material.

In the 1950s, research was conducted on the use of fly ash in concrete, and it was found to have several benefits, including increased durability, improved workability, and reduced permeability. This led to the widespread adoption of fly ash as a concrete additive in the 1960s.

In the 1970s, the Environmental Protection Agency (EPA) began regulating the disposal of fly ash due to its environmental impact. The EPA classified fly ash as a hazardous waste, which led to the implementation of strict regulations on its disposal. This prompted the power industry to find ways to reuse fly ash instead of disposing of it.

In the 1980s, the use of fly ash as a soil stabilizer and filler in road construction became popular. It was found to improve the strength and stability of soil, reducing the need for costly and environmentally damaging excavation and disposal of soil.

In the 1990s, the use of fly ash as a construction material continued to expand. It was used in the production of lightweight concrete blocks and as a raw material in the production of glass and ceramics.

In the 21st century, the use of fly ash has continued to evolve. It is now commonly used in the production of high-performance concrete, geopolymer concrete, and other advanced building materials. Research is also being conducted on the use of fly ash in the production of biodegradable plastics and other sustainable materials.

1.4.1 Fly ash

Fly ash is a fine powder that is produced as a byproduct of burning pulverized coal in electric power plants. It is one of the most commonly generated industrial wastes in the world, with millions of tons being produced every year. Fly ash is composed of a mixture of inorganic and organic materials, including silicon dioxide, aluminum oxide, iron oxide, calcium oxide, and magnesium oxide. The chemical

composition of fly ash varies depending on the type of coal being burned, the combustion conditions, and the type of emission control equipment used. The disposal of fly ash is a significant environmental concern, as it can contaminate air and water resources if not handled properly. Fly ash can also be a valuable resource when used as a cement replacement in the construction industry, due to its pozzolanic properties. It has been used in a variety of applications, such as making concrete, bricks, and road construction.

Fly ash is a fine powder that is a byproduct of burning pulverized coal in electric power generating plants. It is typically composed of oxides of silicon (SiO2), aluminum (Al2O3), iron (Fe2O3), calcium (CaO), and magnesium (MgO), along with smaller amounts of other compounds. Fly ash is usually collected from the flue gases by electrostatic precipitators or bag filters.

Fig 3 Fly ash

Fly ash has a wide range of applications, including use as a cement replacement in concrete, as a soil stabilizer, in road construction, and in the manufacture of building materials such as bricks and blocks. It is also used in agriculture to improve soil fertility and as a component in animal feed. However, fly ash can contain trace amounts of heavy metals, so its disposal is regulated by environmental agencies to prevent contamination of soil and water resources.

1.5 ADVANTAGES OF FLY ASH

Fly ash is a fine powder that is a by-product of burning coal in power plants. It is rich in mineral content and has a range of advantages, as follows:

1. **Concrete production**: Fly ash can be used as a partial replacement for cement in concrete production. It improves the strength, durability, and workability of concrete, and reduces the amount of cement required.
2. **Soil stabilization**: Fly ash can be used to stabilize soil and improve its engineering properties, including strength, permeability, and compressibility.
3. **Reduced greenhouse gas emissions**: By using fly ash in concrete production, less cement is required, which reduces the carbon footprint of the construction industry.
4. **Cost-effective**: Fly ash is an inexpensive by-product that can be used as a substitute for expensive materials, such as cement and lime.
5. **Reduced waste**: Fly ash is a by-product of coal combustion that would otherwise be disposed of in landfills. By using fly ash, waste can be reduced, and resources can be conserved.
6. **Improved quality of construction**: Fly ash improves the quality of concrete by reducing permeability and shrinkage, which improves the durability and longevity of concrete structures.
7. **Improved workability**: Fly ash makes concrete more workable, which allows for easier placement and finishing of concrete.

II. LITERATURE REVIEW

Amarnath Yerramala studied the Properties of concrete with eggshell powder as cement replacement. This paper describes research into use of poultry waste in concrete through the development of concrete incorporating eggshell powder (ESP). Different ESP concretes were developed by replacing 5-15% of ESP for cement. The results indicated that ESP can successfully be used as partial replacement of cement in concrete production. The data presented cover strength development and transport properties. With respect to the results, at 5% ESP replacement the strengths were higher than control concrete and indicate that 5% ESP is an optimum content for maximum strength. In order to investigate properties of ESP concretes, five mixes were employed in this study. Several laboratory trial mixes were carried out with 300kg/m3 cement. Water to cementitious ratio, coarse and fine aggregate quantities was arrived for concretes to be tested from the trial mixes. In this study, Compressive loading tests on concretes were conducted on a compression testing machine of capacity 2000 KN. For the compressive strength test, a loading rate of 2.5 kN/s was applied as per IS: 516ñ1959 [10]. The test was conducted on 150mm cube specimens at 1, 7 and 28 days. Compressive strength was higher than control concrete for 5 % ESP replacement at 7 and 28 days of curing ages. ESP replacements greater than 10 % had lower strength than control concrete. Addition of fly ash improved compressive strength of ESP concrete.

D.Gowsika et al experimentally investigated the Egg Shell Powder as Partial Replacement with Cement in Concrete. This paper reports the results of experiments evaluating the use of egg shell powder from egg production industry as partial replacement for ordinary Portland cement in cement mortar.

The chemical composition of the egg shell powder and compressive strength of the cement mortar was determined. The cement mortar of mix proportion 1:3 in which cement is partially replaced with egg shell powder as 5%, 10%, 15%, 20%, 25%, 30% by weight of cement. The compressive strength was determined at curing ages 28 days. There was a sharp decrease in compressive strength beyond 5% egg shell powder substitution. The admixtures used are Saw Dust ash, Fly Ash and Micro silica to enhance the strength of the concrete mix with 5% egg shell powder as partial replacement for cement. In this direction, an experimental investigation of compressive strength, split tensile strength, and Flexural strength was undertaken to use egg shell powder and admixtures as partial replacement for cement in concrete.

Praveen Kumar R et al experimentally investigated the Partial Replacement of Cement with Egg Shell Powder. The aim of this study is to study the chemical composition of the egg shell to find its suitability of replacement in the concrete. To examine the feasibility of utilizing the egg shell and silica fume as cement replacement material. To study the strength parameters of the egg shell powder mixed specimens and to compare it with conventional specimens. The scope of the study is to cast the concrete specimens and conduct the compressive strength test, split tensile strength test and flexural strength test at 7th & 28thday, with the specified combinations of egg shell powder and compare it with the controlled concrete specimens. In this project M30 Concrete is designed for various combinations. A combination of Egg shell with silica fumes are used in different combinations to find the feasibility of using the Egg shells as an alternate to cement Egg shell powder replaces 10%, 20% and 30% in addition with the silica fume by 5%, 10%, 15% of weight of cement. Concrete is cast and Compressive test, Tensile and Flexural tests were carried out to find the best combination which results in optimum percentage of strength

T.KARUN KUMAR et.al conducted to study the properties of concrete containing copper slag as a partial replacement of fine aggregates in the concrete mix design. Various durability tests will be conducted on such concrete of M30 grade and M40 grade to know the compressive strength, split tensile strength, flexural strength by varying proportions of copper slag (CS) with fine aggregates by 0%, 5%, 10%, 15%, 20%,25%,30% and Egg shell powder (ESP) as cement by 0%, 5%, 10%, 15%, 20%, 25%,30% by weight. The obtained results will be compared with the conventional concrete, there by knowing the changes in the properties of concrete containing copper slag as a partial replacement of fine aggregates.

G. Anisha studied Egg shell which is made of calcium is thrown away as a waste. When the calcium carbonate is heated a binding material called Calcium Oxide (Lime) is obtained. As lime is the major compound of Portland cement, eggshell powder can be used as partial replacement of fine aggregate. Fly Ash is one of the residues generated in the combustion of coal. Fly ash includes substantial amounts if Silicon dioxide (SiO2) and Calcium Oxide (CaO). 75 million tons of fly ash which are rich in Silica is disposed to landfill as a waste annually in India. This project aims at examining the feasibility of eggshell powder as a partial replacement of fine aggregate and also to observe the affect of fly ash on the proposed concrete. In the present study, concrete cubes of grade M30 and M40 were prepared in the laboratory by replacing the fine aggregate with fly ash and egg shell powder at combined proportions of 0%, 7%, 14%, 21%, 28%, 35% & 42% by weight. Tests are conducted at 7 days and 28 days on concrete cubes, cylinders and flexural beams to study compressive strength, split tensile strength and flexural strength/ finally the results are compared with the normal conventional concrete and the effect of fly ash on it is studied.

Dhanalakshmi M et.al examine the carbon dioxide produced by cement industries causes environmental pollution and global warming. In 1000Kg of cement manufacturing processes approximately 900Kg of CO2 is emitted. In order to reduce the impact of cement production on atmosphere, wastes by products are used as admixture in this study, so that environmental pollution and natural resources consumption is reduced. 75million tones of fly ash which are rich in silica are disposed to landfill as a waste annually in India. Egg shell powder which is rich in calcium is thrown away as a waste. In the present study, these two wastes are used as a partial replacement of cement and various properties like workability, compressive strength, and density were determined. Egg shell powder are varied upto 12.5% (0%, 2.5%, 5%, 7.5%, 10% and 12.5%) and fly ash is added to optimum egg shell powder content cement concrete from 0% to 30% (0%, 5%, 10%, 15%, 20%, 25% and 30%).

M.S. Sugirtha et.al summarizes the upshot of various research papers deals with the investigations on cement concrete proportioned with eggshell powder as a substitute mantle for cement. Although, it aims to understand the approaches covered by main research streams in area so as to highlight the advantages and uses of calcium rich material. Developed, developing countries nowadays exploits the potentiality of chicken eggshell powder and in a way they were fruitfully cast it on as an ingredient of animal and poultry feed, land fertilizer and even an excellent substitute option in construction industries. These marginal usages fed in to the minimization of open land disposal scenarios which associates

landfill problems, human and environmental health issues. This paper briefly reveals the investigations endured on strength and structural characteristics of conventional cement concrete that are evenly proportioned with calcium rich eggshell powder and their potential feasibilities were exemplified.

Vijayvenkatesh Chandrasekaran et.al studied Cement developed manufacturing is solitary carbon-dioxide emitting sources besides deformation in addition to ablaze of fossil fuel. Emission of greenhouse gages, such as emitted CO2 to the ambiance. The employment identified the option of by glass fine particles as the incomplete substitute as 0%, 20%, 30%, 40% and intended for its compressive strength up to 7, 14 & 28 existence of era and be compared by conventional concrete. Departure squanders fabric failed to emphasize waste can be old additional efficiently and cause an environmental problem. Glass powder and eggshell powder material is very fine powder material obtained as byproducts of glass during sawing and shaping, and not recycling its causes an environmental problem in the world. The option of using it glass ash powder separately as partial replacement of cement on concrete where studied and evaluated based upon % replacement of cement on concrete where studied and evaluated based upon % of the partial cement replacement with both glass powder.

Vinayaka H Yadav et.al examine the major problem the world is facing today is the environmental pollution. In the construction industry mainly the production of Portland cement will causes the emission of pollutants results in environmental pollution. The carbon dioxide produced by cement industries causes environmental pollution and global warming. In 1000Kg of cement manufacturing processes approximately 900Kg of CO2 is emitted. In order to reduce the impact of cement production on atmosphere, wastes by products are used as admixture in this study, so that environmental pollution and natural resources consumption is reduced., in the present study, Egg shell powder are varied up to 12.5Percentage (7.5, 10 and 12.5) and GGBS is added to optimum egg shell powder content cement concrete from 20% to 35 Percentage (20, 25, 30 and 35). These two wastes are used as a partial replacement of cement and various properties like workability, compressive strength, and split tensile strength and shear strength were determined.

C.NAGARAJU et.al determine Concrete is always expected to be stronger and more durable than in the past while beingcost and energy efficient. Moreover, the major advantages that concrete possesses over theconstruction materials have to be conserved. The possibility of being fabricated practicallyanywhere, the ability to make the form imposed by the shape of a mould and a low cost of components and manufacture. These factors have driven advances in improving the performance of concrete over years and continue to do so the need for improving the performance of concrete and concern for the environmental impact arising from the continually increasing demand for concrete has lead the growing use of alternative material components. An experimental investigation will be conducted to study the properties of concrete containing copper slag as a partial repla cement of fine aggregates in the concrete mix design. Various durability tests will be conducted on such concrete of M30 grade and M40 grade to know the compressive strength, split tensile strength by varying proportions of copper slag (CS) with fine aggregates by 0%, 5%, 10%, 15%, 20% and 25% and Egg shell powder(ESP) as cement by 0%, 5%, 10%, 15%, 20%, 25% by weight. The obtained results will be compared with the conventional concrete, there by knowing the changes in the properties of concrete containing copper slag as a partial replacement of fine aggregates.

Chong Beng Wei et.al examine Solid waste management is one the leading problems faced by developing nations. In Malaysia, the average per capita generation of municipal waste is about 0.85 kg per person per day, and this number is only expected to raise as the population grows and nation becomes more industrialized. One of the wastes is eggshell waste, as Malaysians have among the largest egg consumption in the world. This paper presents the properties of cement mortar with fine eggshell powder as partial replacement of cement. Type-N mortar was prepared with cement: sand: water ratio of 1: 2.75: 0.60 and the percentages of cement replacement tested are 2.5%, 5%, 7.5% and 10% by weight of cement. Flow table test was conducted to access the fresh properties of mortar, while compressive test and flexural test were carried out to determine the mechanical properties. Water absorption and acid resistance eggshell mortar were also studied. From the result, eggshell mortar has similar flow consistency with the control. 5% eggshell produces mortar with optimal compressive and flexural strength and the water absorption of eggshell mortar is lower compared to control. However, eggshell mortar loses more weight when subjected to acid attack.

Mr. DHARAVATH VENKATESH et.al studied With increasing industrialization, the industrial by products (wastes) are being accumulated to a large extent, leading to environmental and economic concerns related to their disposal (land filling). Egg shells are the biodegradable waste obtained from chick hatcheries, bakeries, fast food restaurants. Among other biodegradable wastes, this can damage the surroundings and thus leads to ecological issues/contamination which would need appropriate treatment. In the ever-soaring tasks to change

waste to wealth, the efficiency of adopting eggshells to advantageous application constitutes a concept worth recognizing. It is systematically acknowledged that the egg shell chiefly consists of calcium compounds. It is estimated that roughly 90 million tons of hen egg are generated throughout the world every year. In India, 77.7 billion eggs are produced in the year 2010- 2011.Cement is an energy extensive industrial commodity and leads to the emission of a vast amount of greenhouse gases. By reducing the demand of cement, natural reserves of limestone can be preserved, energy can be saved and pollution due to CO2 can be reduced. In this project, concrete will be casted for M30 grade and the partial replacement of cement with egg shells powder (ESP) in the range of 0%, 2.5%, 5%, 7.5%, 10% and 12.5% by weight of cement. The workability, compressive strength and tensile strength were conducted and results were analyzed.

Batham Geeta et.al has investigate Reuse of recycled or waste materials for the construction of civil structures is an issue of great importance in this century. Addition of waste products in concrete is also very common now days. It is worldwide recognized that the reuse and recycle of industrial and agricultural by adding in a proportion instead of conventional material for concrete production has many beneficial feature rather than dumping it or burying it in a landfill. In this study, literature review has been conducted to investigate the effect of agriculture waste such as fly ash, groundnut shell, oyster shell, tobacco waste, and egg shell powder waste on characteristics strength properties of concrete. Review of work done by various researchers are studied and compiled here. Incorporation of agriculture waste and ESP waste affects workability, strength and durability properties significantly.

Sriramoju Ravi Kiran et.al studied different materials with pozzolanic properties such as fly ash. Condensed silica fume, blast furnace slag and rice husk ash have played an important part in the production of high performance concrete. During the late 20th century, three has been an increase in the consumption of mineral admixture by the cement and concrete industries[4]. The increasing demand for cement and concrete is met by the partial replacement for energy intensive Portland cement. Pozzolanic materials have long demonstration their effectiveness in producing high performance concrete. Artificial pozzolanas such as supplementary cementing material in many part of the world[2]. This work evaluates the compressive strength of rice husk ash (RHA, Wheat Straw Ash (WSA), Fly Ash, (FA) as a partial replacement for OPC in concrete[1]. The main aim of this work is to determine the optimum %(10, 20, 30) of Rice husk ash (RHA), Wheat Straw Ash (WSA), Fly Ash, (FA), as partial replacement of cement for M40 grade of concrete[3]. In addition, results show that Rice husk ash(RHA), Wheat Straw Ash (WSA), Fly Ash, (FA), - /* (GP) as an artificial pozzolanic material has enhanced the durability of concrete.

Kamran Basi et.al studied the use of SCM‟s was done from the ancient Greeks who incorporated volcanic ash with hydraulic lime to create a cementitious mortar. The Greeks passed this knowledge on to the Romans, who constructed such engineering marvels as the Roman aqueducts and the Coliseum, which still stand today. Early SCMs consisted of natural, readily available materials such as volcanic ash. Nowadays, most concrete mixture contains supplementary cementitious material that forms part of the cementitious component. These materials are majority byproducts from other processes or natural materials. The major benefits of SCM is its ability to replace certain amount of Portland cement and still able to display cementitious property, thus reducing the cost of using Portland cement. More recently, strict air-pollution controls and regulations have produced an abundance of industrial byproducts that can be used as supplementary cementitious materials such as Pozzocrete, Saw dust ash, Rice husk ash, Egg shell powder, Sugarcane bagasse ash, etc. The use of such byproducts in concrete construction not only prevents these products from being land-filled but also enhances the properties of concrete in the fresh and hardened states. This paper presents a brief history and review of Egg shell powder in concrete with the aim of introducing the technology.

B W Chong et.al has investigate sustainable concrete is currently a widely studied topic in order to reduce the environmental impact of cement. Substitute materials are usually industrial and municipal wastes. Eggshell powder as cement replacement is a viable option to produce green concrete. At the same time, it improves the disposal of eggshell, which is thrown away as household waste and mostly ends up in the landfill. This paper reviews the constituents, production techniques and properties of eggshell concrete (ESC). The paper presents the chemical compound of eggshell and the suitability of the waste as cement replacement. This is followed by a discussion of the fresh, hardened and durability properties based on a variety of previous studies. At the optimal content of 10%, ESC has various advantages compared to conventional concrete. The advantages are associated with the high calcium content and good filling effect of eggshell powder. This includes improved hardened properties, reduced setting time, and increased resistance to water penetration and carbonation. Eggshell is also an accelerator to the hydration process. However, ESC shows weakness in chloride and sulphate environment due to the vulnerability of eggshell to these compounds. While

studies on the material are available significantly, researches on durability properties of ESC should be enhanced.

Hussein M. Hamada et.al presents the results of the latest studies on the utilization of ESP as a filler, cement and fine aggregate. The chemical composition, physical properties and fresh and hardened properties of ESP concrete at different proportions are also presented. Results indicate the potential of using ESP with other pozzolanic materials to improve concrete properties and reduce cement production, thereby minimizing environmental pollution. The compressive, flexural and tensile strengths have also been improved with the use of some materials with ESP as cement replacement. However, some studies reported a reduction when cement is replaced with high percentages of ESP, particularly those larger than 10%.

DhirajNaxine et.al relevant study done on the fine aggregate and cement replacement with egg shell powder & copper slag were discussed. Also effect of cement and fine aggregate replacement on compressive strength and durability of concrete had been discussed. From study it has been observed that the egg shell powder and the copper slag can't affect much the durability and strength parameters up to 6% and 40% replacement of cement and fine aggregate. Also observed that copper slag and egg shell powder reduced impact of concrete on environment but still need to improve the manufacturing process of copper slag.

BYSANI MYTHILI et.al This project reports the results of experiments evaluating the utilization of egg shell powder from egg production trade as partial replacement for standard cement in cement mortar. The chemical composition of the egg shell powder and compressive strength of the cement mortar made up our minds. The cement mortar of combine proportion 1:3 during which cement is part replaced with egg shell powder as 5%, 10%, 15%, 20%, 25%, 30% half-hour by weight of cement.. There was a pointy decrease in compressive strength on the far side five-hitter egg shell powder substitution. The compressive strength made up our minds at hardening ages 28 days the admixtures used are Saw dirt ash, ash and small oxide to reinforce the strength of the concrete combine with 5% egg shell powder as partial replacement for cement. During this direction, associate degree experimental investigation of compressive strength, split durability, and Flexural strength was undertaken to use egg shell powder and admixtures as partial replacement for cement in concrete.

PROBLEM STATEMENTS

In India, waste disposal is one of the factors contributing the environmental problem and increasing dramatically year by year. According to Antara News (2011), In India, the egg consumption of the Indian people which is still low. In Indian the per capita egg consumption of the people was recorded at one egg per week while in Indian the per capita egg consumption was noted at three per day. The objective of the studies reviewed is to investigate and evaluate the potential benefits and feasibility of incorporating eggshell powder and other supplementary cementitious materials in concrete production.

III. CONCLUSION

- To encapsulate the collective insights garnered from the reviewed studies, it becomes apparent that the integration of eggshell powder and supplementary cementitious materials within concrete formulations is a proposition of substantial merit. These investigations collectively illuminate a pathway towards sustainable construction practices that not only enhance the mechanical characteristics of concrete but also address some of the pressing environmental predicaments associated with conventional cement production.
- The studies resonate with a shared theme: the potential to leverage waste materials or byproducts from various industries to replace or augment traditional cement components. Eggshell powder, often deemed a discardable waste, emerges as an unlikely hero, offering calcium-rich properties that contribute to the overall matrix's strength. This process inherently mitigates the ecological strain of waste disposal, forging a constructive synergy between waste reduction and construction.
- The studies accentuate the importance of meticulous proportioning. Whether it be the percentage of eggshell powder, copper slag, or other supplementary materials, the equilibrium struck directly correlates with the resultant concrete's properties. The optimal balance seems to be the fulcrum upon which the success of such substitutions pivots. Indeed, beyond a certain threshold, some studies indicate diminishing returns in terms of compressive and tensile strengths.
- Furthermore, the environmental dividends are substantial. By substituting part of the cement with waste materials, carbon emissions associated with cement production can be curtailed. This reduction aligns with contemporary sustainability imperatives,

aiding in the overarching goal of lessening the construction industry's carbon footprint.

- However, challenges remain in areas such as durability and resistance to specific environmental factors. It is evident that while the incorporation of these materials can enhance some aspects of concrete performance, they may exhibit vulnerabilities when exposed to chloride, sulfate, or acid attack. These findings highlight the importance of a holistic view of concrete's lifecycle, considering both its production and its long-term behavior.
- In a world grappling with waste management, climate change, and resource scarcity, the synthesis of construction materials that bridge technical prowess with environmental conscientiousness is crucial. The reviewed studies not only underscore the feasibility of such materials but also underscore the imperative for continued research. The road to sustainable construction might be nuanced, necessitating a careful calibration of material constituents, a judicious application of findings, and an unwavering commitment to balancing structural integrity with environmental responsibility.

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