International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 05 | May - 2023 SJIF 2023: 8.176 ISSN: 2582-3930

A Review of multi blended mix Concrete made of Rise Husk Ash (RHA), Egg Shell Powder (ESP), and Fly Ash (FA)

Rochak Mishra[1], Kamlesh Kumar Choudhary[2]

[1](M.tech Student of Department of civil engineering, Saraswati Institute of Engineering & Technology, Jabalpur)
[2](HOD of civil engineering Department, Saraswati Institute of Engineering & Technology, Jabalpur, India
Email: prof.kamlesh.siet@gmail.com)

Abstract - Due to its massive consumption of natural resources and the pollution it causes during production, the conventional concrete building sector is no longer viable. Waste products can be used as cementitious materials in concrete, which will utilise less cement overall and lower building costs. In the current experiment, egg shell powder and rice hush ash are employed in place of cement. At the end of 7 and 28 days, these mixes' compressive strength, spit tensile strength, and flexural strength are evaluated and compared to standard concrete.

Key Words: multi blended mix Concrete ,Rise Husk Ash (RHA), Egg Shell Powder (ESP), and Fly Ash (FA)

1.INTRODUCTION

It has been observed that numerous study reports have come to light regarding the evaluation of the individual effectiveness of concrete made with a blend of fly ash and rice husk ash. However, there are few study reports that focused on the combined execution of fly ash and rice husk ash. The primary goal of the current investigation is to precisely evaluate Fly ash, Rice Husk Ash (RHA), and Egg Shell Powder (ESP) in order to investigate the viability of using these materials as cement substitutes in the concrete industry. The most versatile pozzolan is fly ash, which is widely used in all concrete construction projects. It is universally acknowledged that the employment of fine fly ash upgrades the qualities of mortar and concrete. Although the addition of fly ash increases the porosity of the paste, the average pore size decreases, leaving a minimally porous paste. In light of the use of fly ash, the interfacial domain of the interface between aggregate and matrix also becomes refined. In India, the total production of coal ash is thought to have exceeded 10 metric tonnes in 2010. Several researchers have turned to the use of large volumes of Class F fly ashes in concrete in an effort to scale up the employment of fly ash and to fine-tune the properties of the material.

2.LITERATURE REVIEW

M Susmitha, A. Ram Kumar, Kasi Rekha (2022)

This research centres around the growth of the strength and permeability attributes of concrete by optimal substitution of cement with joint ratio of Fly ash (FA) and Rice husk ash (RHA) with Synthesis Egg shell powder (ESP). Two categories of ash such as fly ash, rice husk ash with four distinct contents of 5%, 10%, 20%, 30%, and 40% in terms of weight were performed for the substitution of cement and addition of a persistent 5% egg shell powder in every substitution. At first we have evaluated the physical and chemical attributes of fly ash, rice husk ash and egg shell powder. substitution by combined FA (15%), RHA (15%) with additive ESP (5%), and subsequently tends to drop down with every supplementary accumulation of substitution outside this level.

Akhila T1 , Dr.M.S.Shobha (2022)

Nowadays the conventional concrete construction industry is not sustainable due to huge consumption of natural materials and environmental pollution created during its production. The use of waste product as a cementitious material in concrete will reduce the use of cement and ultimately the construction cost. In the present investigation Rice Hush Ash and Egg Shell Powder are used as a replacement of cement. The compressive strength, spit tensile strength and flexural strength of these mixes are tested and compared with the normal concrete at the end of 7 and 28 days and also the microstructure of rice husk ash and egg shell of varying percentages was determined by Scanning Electron Microscope (SEM).

I. H. Wagan a , A. H. Memon a, *, N. A. Memon a , F. T. Memon a , M. H. Lashari a (2022)

Pakistan is an agricultural country and one of the major crops is Rice crop. It produces a substantial amount of rice husk during the processing g of the rice. A substantial amount of Rice Husk Ash (RHA) is produced on the burning of rice husk used as fuel in the rice mills while generating steam for parboiling process of rice grains. This ash causes the environmental problems also if not dumped properly. RHA is believed to have siliceous properties which may be used as supplementary cementitious material in concrete. As the suitability of supplementary cementitious materials is dependent upon the source of rice husk, temperature of burning of husk, its fineness and other properties. This study is focused on to determine the effect of rice husk ash produced by burning of the rice husk obtained from the local rice mills. Experimental investigation carried includes the determination of workability and compressive strength of concrete with different dosage of RHA from 5% to 30% with an increment of 5% tested at 1day, 3days, 7days and 28 days of the age of concrete. The results are compared with corresponding concrete without RHA and tested at the same ages. The results show the reduction in both the parameter; workability and compressive strength due to RHA particularly at its higher dosage beyond 10% by weight of cement.

Dr.S.G.Makarande , C. H. Lohabare, Prof.G.D.Dhawale , Prof. A. B. Dehane (2019).

In this study centers around the growth of strength and permeability of concrete by partial replacement of cement with joint ratio of fly ash, rise husk ash with synthetic egg shell powder (ESP). Two categories of fly ash and rise husk ash with four distinct content of 5%, 10%, 15%, 20%, 30% in terms of weight was perform for the substitution of cement and addition of a persistent 5%egg shell powder in every Substitution. Concrete is being widely use for construction of most of building, bridges etc. Hence it is the most important part to the infrastructure development of a nation. To meet out this rapid infrastructure development a high quantity of concrete is required and cement is the main ingredient of concrete and demand for exceed the supply make the

construction activity costlier. To minimize the use of cement and ultimately reduce the construction cost use effective waste material like fly ash, rise husk ash and egg shell powder with cement replacement.

Poornima K B, N B Darshan, Manjunath R T, Revanasiddappa K R, Sanjay M T (2019)

Effective deployment of bio-waste has been given importance in our society for environmental and economic concerns. Reclamation of eggshell from hatcheries, home, bakeries and industries is an efficient and cost productive way to reduce waste disposal and prevent serious environmental pollution. Egg shells waste constitutes essential organic and inorganic materials that can be composted with other materials for enhancing the pre-existing property. The major concern in any civil sector is efficient construction with minimal cost investment. Cement is one of the pivotal components for construction. It is the backbone to the infrastructure development.

J.S. Patel, Dr K.B. Parikh, Prof. A.R. Darji (2017)

Approximately, yearly concrete production is about 10 billion cubic meters. Cement is a very important constituent of concrete, and approximately 4180 million tons of cement were produced in 2014 globally. Production of one ton of cement releases approximately one ton of CO2 which makes up 7% of all CO2 emissions produced globally. Hence, there is necessity to

3. USED MATERIALS

Concrete

Concrete is a structural material used in construction that is made up of aggregate, or hard, chemically inert particulate material (typically sand and gravel), which is then bound together by cement and water. The most popular bonding material among the ancient Assyrians and Babylonians was clay. The use of lime and gypsum as binders allowed the Egyptians to create a substance that is more comparable to modern concrete.

Cement

Cements in a general sense are adhesive and cohesive materials which are capable of bonding together particles of solid matter into a compact durable mass. For civil engineering works, they are restricted to calcareous cements containing compounds of lime as their chief constituent, its primary function being to bind the fine (sand) and coarse (grits) "aggregate particles together Cements used in construction industry may be classified as hydraulic and non-hydraulic. The latter does not set and harden in water such as non-hydraulic Lime or which are unstable in water, e.g. Plaster of Paris. The hydraulic cement set and hardens in water and give a product which is stable. Portland cement is one such.

Figure no. 1 Cement

Rice husk ash (RHA)

Rice husk ash is used in concrete construction as an alternative of cement. The types, properties, advantages and uses of rice husk in construction is discussed. The rice paddy milling industries give the by-product rice husk. Due to the increasing rate of environmental pollution and the consideration of sustainability factor have made the idea of utilizing rice husk. The reasons behind the usage of rice husk as an alternative for cement in concrete manufacturing are explained in the following sections. To have a proper idea on the performance of rice husk in concrete, a detailed study on its properties must be done. About 100 million tons of rice paddy manufacture by-products are obtained around the world. They have a very low bulk density of 90 to 150kg/m^3. This results in a greater value of dry volume. The rice husk itself has a very rough surface which is abrasive in nature. These are hence resistant to natural degradation. This would result in improper disposal problems. So, a way to use these by-products to make a new product is the best sustainable idea. Among all industries to reuse this product, cement, and concrete manufacturing industries are the ones who can use rice husk in a better way.

Figure no. 2 Rise husk ash before and after grinding

Egg Shell Powder (ESP)

Eggshell known as a smooth surface that is desirable compared rough eggshells fracture more easily. Most good quality eggshells of commercial layers contain approximately 2.2 grams of calcium in the form of calcium carbonate. About 95% of the dry eggshell is calcium carbonate weighing 5.5 grams. The average eggshell contains about 0.3% of magnesium, phosphorous, and traces of sodium, zinc, potassium, iron, copper and manganese. There are many factor influences in quality of eggshell which is nutrient adequacy, flock health problem, environmental condition and breeding. Apart from that, the controlling rate of egg weight also contributes to a good quality of eggshell and it is not depends on the thick eggshell mean strong.

Figure no. 3 Egg Shell Powder (ESP)

Sometimes, thinner eggshell is stronger than thicker eggshell. This fact is due to shape and organization of organic and inorganic component of the shell. Eggshell waste can be used as fertilizer, animal feed ingredients and other such uses. However, majority of the eggshell waste is deposited as landfills. Eggshell waste in landfills attracts vermin due to

attached membrane and causes problems associated with human health and environment. The aim of this review is to spread awareness of egg shell powder as a constructional material.

Fly Ash

Fly ash is finely divided residue resulting from the combustion of powdered coat and transported by the flue gases and collected by electrostatic precipitation. In U.K. it is referred as pulverized fuel ash (PFA). Fly ash is the most widely used pozzolanic material all over the world.

Fly ash was first used in large scale in the construction of Hungry Horse dam in America in the approximate amount of 30 per cent by weight of cement. Later of it was used in Canyon and Ferry dams etc. In India, Fly ash was used in Rihand dam construction replacing cement up to about 15 per cent. In the recent time, the importance and use of Fly ash in concrete has grown so much that it has almost become a common ingredient in concrete, particularly for making high strength and high performance concrete. Extensive research has been done all over the world on the benefits that could be accrued in the utilization of Fly ash as a supplementary cementitious material. High volume Fly ash concrete is a subject of current interest all over the world.

Figure no. 4 fly ash

Aggregate

Construction aggregate, or simply aggregate, is a broad category of coarse- to medium-grained particulate material used in construction, including sand, gravel, crushed stone, slag, recycled concrete and geosynthetic aggregates. Aggregates are the most mined materials in the world. Aggregates are a component of composite materials such as concrete and asphalt; the aggregate serves as reinforcement to add strength to the overall composite material. Due to the relatively high hydraulic conductivity value as compared to most soils, aggregates are widely used in drainage applications such as foundation and French drains, septic drain fields, retaining wall drains, and roadside edge drains.

Fine Aggregate

It is the aggregate most of which passes through a 4.75 mm. IS sieve and contains only that much coarser material as is permitted by the specifications. Sand is generally considered to have a lower size limit of about 0.07 mm. Material between 0.06 mm and 0.002 mm is classified as silt, and still smaller particles are called clay. The soft deposit consisting of sand, silt and clay in about equal proportions is termed loam. The fine aggregate may be one of the following types:

(I) Natural sand, i.e. the fine aggregate resulting from natural disintegration of rock and/or that which has been deposited by stream and glacial agencies,

(II) Crushed stone sand, i.e. the fine aggregate produced by crushing hard stone, or

(III) Crushed gravel sand, i.e. the fine aggregate produced by crushing natural gravel.

According to size, the fine aggregate may be described as coarse, medium and fine sands. Depending upon the particle size distribution, IS: 383-1970 has divided the fine aggregate into four grading zones. The grading zones become progressively finer from grading zone I to grading zone IV.

Figure no. 5 Sand as a Fine Aggregate

Coarse Aggregate

The aggregates most of which are retained on the 4.75 mm IS sieve and contain only that much of fine material as is permitted by the specifications are termed coarse aggregates. The coarse aggregate may be one of the following types:

(I) Crushed gravel or stone obtained by the crushing of gravel or hard stone,

(II) Uncrushed gravel or stone resulting from the natural disintegration of rock, or

(III) Partially crushed gravel or stone obtained as a product of the blending of the above two types.

The graded coarse aggregate is described by its nominal size, i.e. 40mm, 20mm, 16mm, and 12.5mm, etc. For example, a graded aggregate of nominal size 12.5mm means an aggregate most of which passes the 12.5mm IS sieve. Since the aggregates are formed due to natural disintegration of rocks or by the artificial crushing of rock or gravel, they derive many of their properties from the parent rocks. These properties are chemical and mineral composition, petrographic description, specific gravity, hardness, strength physical and chemical stability, pore structure, and colour. Some other properties of the aggregates not possessed by the parent rocks are particle shape and size, surface texture, absorption, etc. All these properties may have a considerable effect on the quality of concrete in fresh and hardened states.

Figure no.6 Coarse Aggregate

Water in Concrete

The amount of water in concrete controls many fresh and hardened properties in concrete including workability, compressive strengths, permeability and water tightness, durability and weathering, drying shrinkage and potential for cracking.

The amount of water in concrete controls many fresh and hardened properties in concrete including workability, compressive strengths, permeability and water tightness,

durability and weathering, drying shrinkage and potential for cracking. For these reasons, limiting and controlling the amount of water in concrete is important for both constructability and service life.

4.PROBLEM OF STATMENTS

- To investigate the structural behavior of concrete that has been blended with rise husk ash, egg shell powder, and fly ash (FA).
- To determine the percentage that gives the maximum workability of multi-blended concrete when compared to conventional concrete.
- To determine the percentage that gives the maximum Compressive strength of multi-blended concrete when compared to conventional concrete.
- To determine the percentage that gives the maximum Flexural strength of multi-blended concrete when compared to conventional concrete.

6.CONCLUSION

The concrete mix made using Rise Husk Ash (RHA), Egg Shell Powder (ESP), AND Fly Ash (FA) as partial replacement of Cement showed good workability and Fluidity similar to normal concrete mixes.

The workability of concrete increased with the addition of Rise Husk Ash (RHA), Egg Shell Powder (ESP), AND Fly Ash (FA) as partial replacement of Cement.

The compressive strength of concrete increased with the addition of Rise Husk Ash (RHA), Egg Shell Powder (ESP), AND Fly Ash (FA) as partial replacement of Cement. (at 7 days,14 days, and 28 days).

The flexural strength of concrete increased with the addition of granite dust (GD) , Copper Slag (CS) and iron dust (ID) as partial replacement of sand.

7.REFERENCES

1) M Susmitha, A. Ram Kumar, Kasi Rekha (2022) “Permeability and strength parameters of concrete Using fly ash, rice husk ash, and egg shell powders” Journal of Engineering Sciences Vol 13 Issue 11,2022, ISSN:0377-9254 www.jespublication.com Page 106
2) Akhila T1 , Dr.M.S.Shobha (2022) “Partial Replacement of Rice Husk Ash and Egg Shell Powder for Cement on Normal Concrete” International Journal of Engineering Research and Applications www.ijera.com ISSN: 2248-9622, Vol. 12, Issue 9, September 2022, pp. 76-83
3) Dr.S.G.Makarande , C. H. Lohabare, Prof.G.D.Dhawale , Prof. A. B. Dehane (2019) “Study the Strength Property of Concrete Using Fly Ash (FA), Rise Husk Ash (RHA) and Egg Shell Powder (Esp)” Ire 1701654 Iconic Research And Engineering Journals © Oct 2019 | IRE Journals | Volume 3 Issue 4 | ISSN: 2456-8880
4) Specification for 33,43,53 Grade ordinary portland cement IS 269 - 2015
5) Specification for coarse and fine aggregate IS 383-2016
6) Methods of test for aggregate for concrete particle size and shape IS 2386 (Part I) 1963
7) Methods of test for aggregate for concrete estimation of deleterious materials and organic impurities. IS 2386 (Part II) 1963
8) IS: 456 – code of practice for plain and reinforced concrete.
9) IS: 383 – specifications for fine and coarse aggregate from natural sources for concrete.
10) IS: 2386 – methods of tests for aggregate for concrete. (nine parts)
11) IS: 2430 – methods of sampling.
12) IS: 4082 – specifications for storage of materials.