

EXPERIMENTAL STUDY ON MECHANICAL PROPERTIES FOR M25 GRADE OF CONCRETE ADDING SILICA FUME AND RECYCLED COARSE AGGREGATES AS PARTIAL REPLACEMENT OF CEMENT AND COARSE AGGREGATE

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ABSTRACT

This project reports the results of an experimental study on mechanical properties for M25 grade of concrete adding silica fume and recycled coarse aggregate as partial replacement of cement and coarse aggregate. The use of recycled coarse aggregates in fresh concrete as a replacement for natural coarse aggregates has gained significant attention in recent years due to the potential environmental and economic benefits. The process started with the collection of raw materials for the preparation of concrete, according to the mentioned quantities that have obtained from concrete mix design. Various tests were conducted on the raw materials such as Fineness, Specific gravity, Normal consistency, Initial and final setting time of cement, Sieve analysis, Specific gravity of Fine aggregate, Sieve analysis of Coarse aggregate. And the mix design is followed and the materials were mixed and placed in moulds in 3 layers and tamping each for 25 times. The casted cubes were demoulded the next day and placed in a curing tank for 7, 14, and 28 days. After the 7-day curing period, the specimens were evaluated using compression testing equipment to determine the load values at which they failed. Similarly, tests were undertaken on cubes that had been cured for 14 and 28 days. The mixes were created using a combination of silica fume and recycled coarse aggregate in varying amounts, and tests were performed. The test results were recorded and shown on a bar graph. According to the experimental study we conclude that silica fume improves the mechanical properties of concrete and ability to fill the spaces between cement particles. As a result, incorporating RCA and silica fume into concrete manufacturing has the potential to improve concrete's sustainability and performance.

Keywords: *Recycled Concrete Aggregates, Mechanical Properties, Silica fume.*

1. INTRODUCTION

Concrete is a versatile building material composed of cement, water, and aggregates such as sand, gravel, or crushed stone. It is widely used in construction due to its strength, durability, and ability to be moulded into various shapes and sizes. Concrete structures can be found in bridges, roads, buildings, dams, and even in decorative elements like sculptures. Its popularity starts from its affordability and ease of use, making it a cornerstone of modern construction projects worldwide. It's used in all sorts of construction projects because it's affordable, durable, and can be moulded into nearly any shape. It is a building material made by mixing cement, aggregates, and water in precise proportions. Silica fume is a byproduct of silicon and ferrosilicon alloy production. It improves strength, durability, and reduces permeability. Silica fume concrete is composed of cement, silica fume, fine aggregate, coarse aggregate, and water. Fresh and hardened properties of silica fume concrete is superior to conventional concrete. For instance, it has higher compressive and flexural strength. Recycled coarse aggregate (RCA) refers to the coarse aggregate obtained from recycling concrete. It is produced by breaking up and crushing the concrete removed from old roads and buildings, and then separating the mortar from the rock. The use of RCA in new construction applications has gained popularity in recent years due to its potential to make construction more environmentally friendly.

2. OBJECTIVE

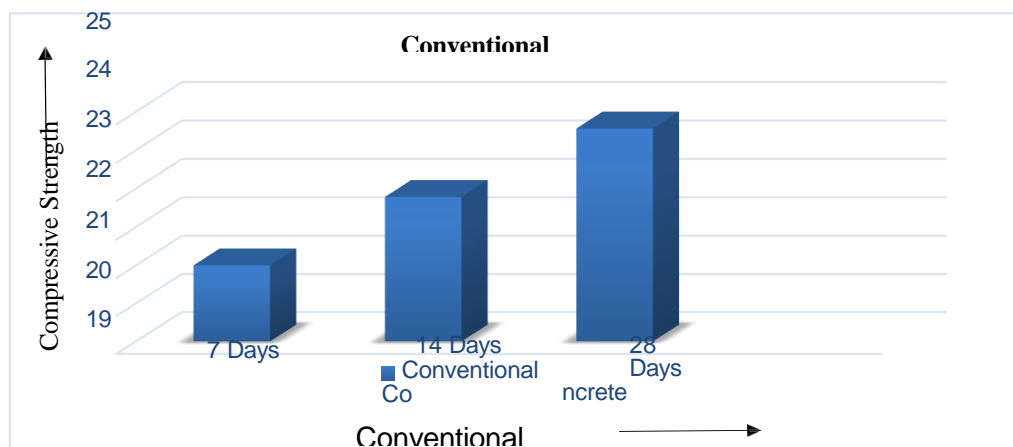
- To study the effect of Mechanical properties of M25 grade of concrete.
- To improve the load carrying capacity and their service life of concrete with silica fume and recycle coarse aggregate.
- To understand the impact of using recycle coarse aggregate and silica fume towards compression strength of concrete.
- To study and compare the mechanical properties of concrete with silica fume and RCA versus conventional concrete.
- To conduct experimental studies to investigate the physical properties of the materials employed in this project.
- To reduce additional stress of concrete waste on environment by recycling method.

3. METHODOLOGY

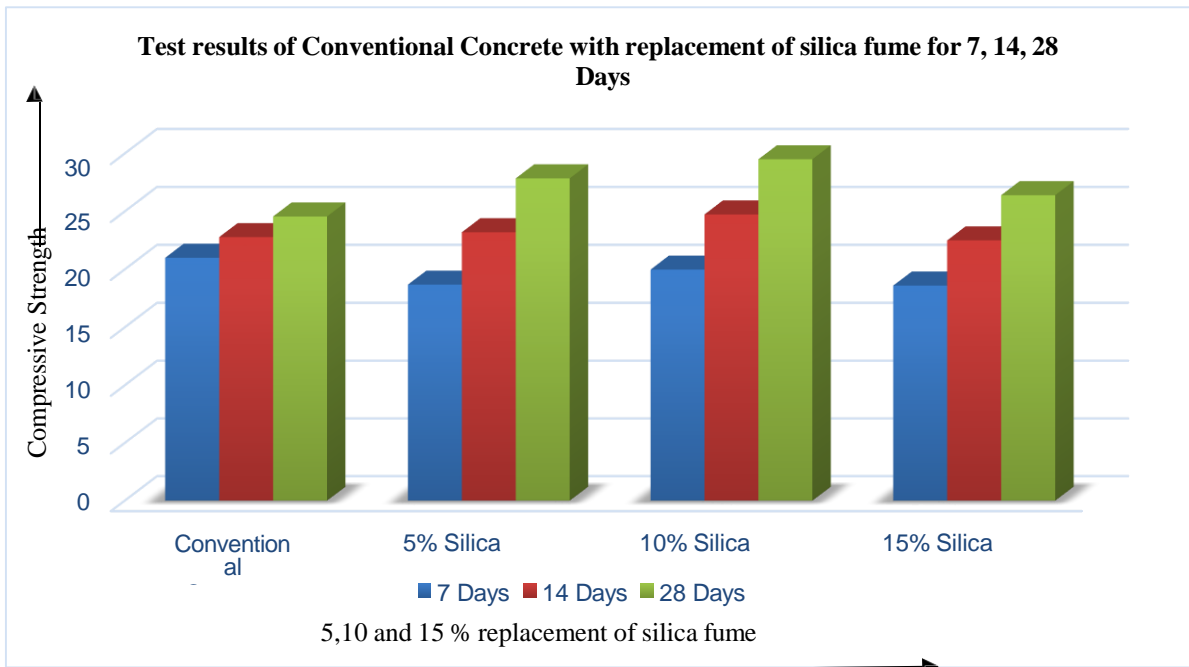
1. Data collection
2. Literature survey
3. Selection of materials
4. Properties of materials
5. Batching of Materials
6. Casting of concrete specimen
7. Testing on Concrete specimen
8. Test on Mechanical properties
9. Result Analysis & Discussion
10. Conclusion

4. RESULT AND DISCUSSION

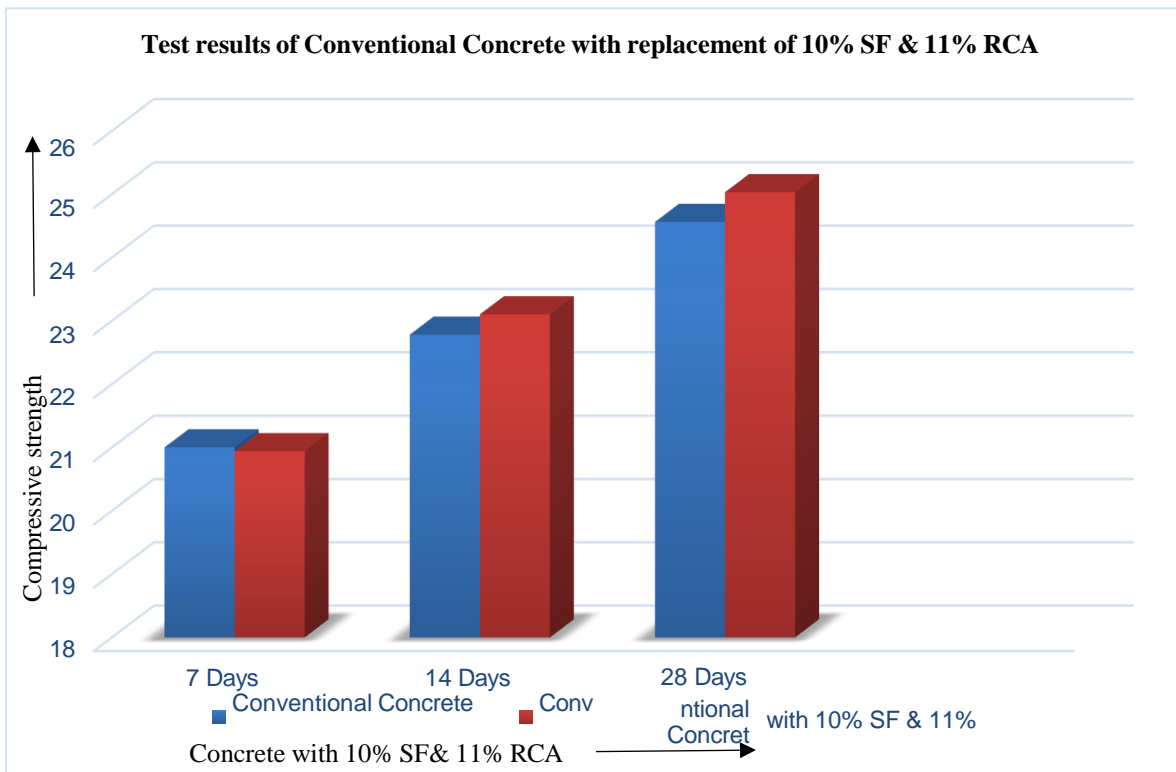
In this section, perform the results of experimental work. The results are displayed in graph format.



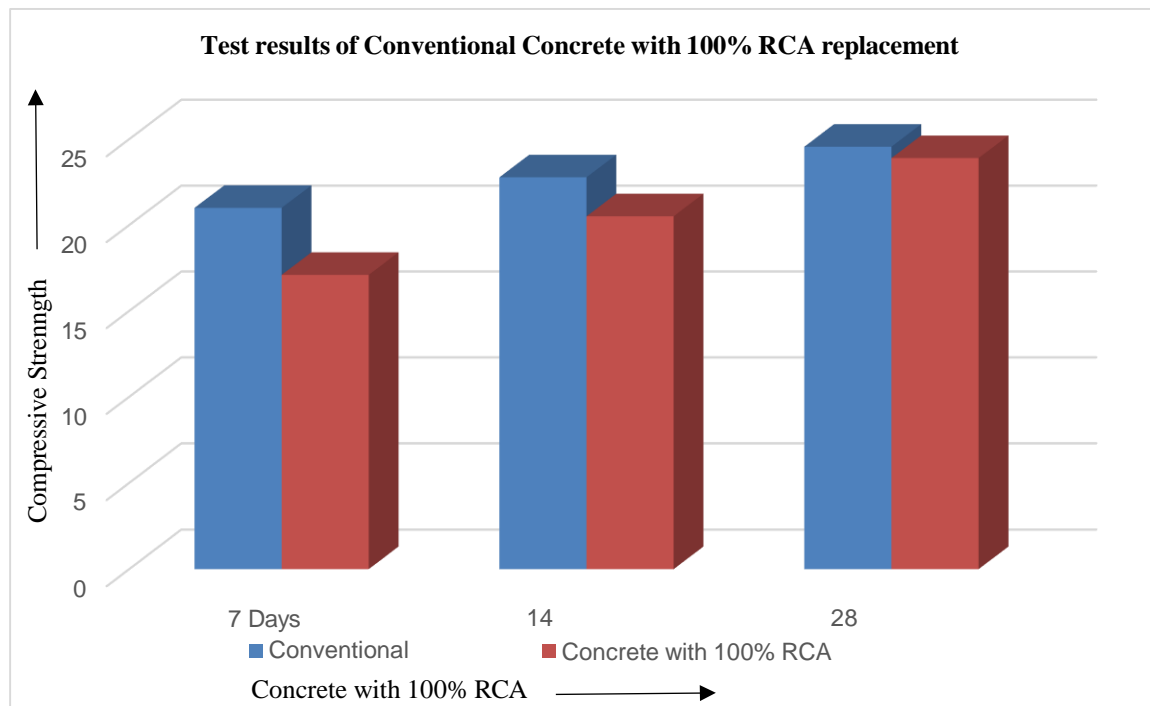
Graph 1 Test results of Conventional Concrete for 7, 14, 28 Days



Graph 2 Compressive strength test for concrete with replacement of silica fume for 7,14, 28 Days



Graph 3 Compressive strength test for concrete with replacement of 10% SF & 11% RCA



Graph 4 Compressive strength test for concrete with 100% RCA

5. CONCLUSION

Based on the experimental investigation carried out on concrete by using various percentages of silica fume i.e., 5%, 10%, 15% and replacement of 11% RCA.

- The results showed that adding 10% silica fume yielded the highest compressive strength when compared to using 5% and 15% silica fume. We noticed that 5% and 15% silica fume concrete strength was slightly lower than 10% silica fume due to its pozzolanic activity.
- When compared to conventional concrete, the M25 grade of concrete containing RCA 11% and 10% silica fume achieves its maximum strength after 28 days.

6. FUTURE SCOPE

- The experimental study will look at the mechanical properties of concrete made with silica fume and recycled coarse aggregate as a partial replacement for cement and coarse aggregate.
- The concrete mixture contains OPC 53 Grade, fine aggregate, coarse aggregate, and 20 mm RCA, as well as variable amounts of silica fume (5%, 10%, and 15% respectively).
- We anticipate that by performing this research, we will learn more about the effects of silica fume and RCA on the mechanical characteristics of concrete, as well as their potential benefits in building applications.

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