RESEARCH ARTICLE

A Brief Study on the New Generation Concrete Replacing Cement and Fine Aggregate with Sugarcane Bagasse Ash and Robo Sand Along with Acid Resistant Studies

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ABSTRACT

This study shows how to make high-strength concrete using sugarcane bagasse ash (SCBA) as a pozzolanic ingredient and robo sand as fine particles. Waste reduction has centred on the exploitation of industrial and agricultural waste produced by industrial operations. Sugarcane bagasse ash is used to partially replace ordinary Portland cement (OPC). The cost of construction materials has an impact on the economy of all constructions these days. It is a major issue impacting the world's environmental housing system. To regulate, conventional aggregates, such as gravel, and fine aggregate, such as sand in concrete, will be employed. In the current study, bagasse ash and robo sand were used as the cement and fine aggregates in an experimental examination on an M30 grade concrete mix. The proportions of luggage ash and robot sand that were employed were 0% BA+0%, 5% BA+10%, 10% BA+20%, 15% BA+30%, and 20% BA+40%RS. With varying amounts of baggage ash and robo sand, the workability linked to the slump and compaction factor, strength related to the compressive, split tensile, and flexural strength values, and durability related to the acid resistance values are all calculated.

Keywords: Ordinary Portland cement, bagasse ash, robo sand, workability, strength, durability.

INTRODUCTION

Concrete is Concrete is made up of cement, fine and coarse particles, and water. High-performance concrete (HPC) meets a set of characteristics that are higher than those required by most applications, including but not limited to strength. Easy installation, compaction without segregation, early age strength, permeability, and other criteria are among them. The experts have spent a lot of time figuring out how to replace cement with baggage ash and robo sand without compromising strength. River sand (fine aggregate), one of the elements required in the manufacture of concrete, has grown increasingly costly and rare. As a result, alternative materials are in high demand. Food, clothes, and shelter are man's three fundamental requirements. Civil engineers are directly or indirectly involved with all of man's essential necessities. Man has come a long way in terms of creating shelter-building techniques. Originally, people lived in huts, which evolved into load-bearing houses throughout time. The growing cost of constructing construction materials is a major source of worry in today's built environment. The cost of construction materials is steadily rising. The annual output is estimated to reach more than a billion tonnes. Concrete production is expanding as a result of increased infrastructure development and building activities across the world. Concrete production necessitates aggregates, cement, water, and admixtures. The majority of the concrete is made up of typical aggregate sources.

The use of popular coarse mixture in large-scale concrete manufacturing in creation operations. The fast use of herbal aggregates increases worries concerning the upkeep of herbal aggregates reassets. Furthermore, operations associated with mixture mining and processing are the number one reassets of environmental concern. In mild of this, utilizing opportunity substances in area of herbal mixture withinside the production of concrete makes concrete a extra sustainable and ecologically pleasant constructing cloth. Most lecturers in recent times are concentrating at the utilisation of waste factors in concrete primarily based totally on their qualities. Ordinary Portland cement is a widely used building material all over the world. Today, academics from all around the world are working on ways to use commercial or agricultural trash as a source of raw materials for industry. This waste disposal is not only cost-effective, but it also has the potential to generate revenue and reduce pollution. A large amount of bagasse ash, a byproduct of the in-line sugar industry, and bagasse-biomass gas are currently being used in the electric power generation sector.Amorphous silica ash with pozzolanic properties is formed when this garbage is burned under controlled conditions. On ashes collected from the industries, a few experiments on pozzolanic interest and their effectiveness as binders, in part replacing cements, were carried out.

Fine aggregate is also used in the construction of concrete and mortar. As a result, excellent sand is required in building in order for structures to last long. The demand for natural river sand is outstripping supply, resulting in rapid depletion of natural sand resources. The widespread depletion of natural sand supplies also causes environmental issues such as river bank erosion and collapse, river bed lowering, and salty water incursion into the land. An experiment was conducted to determine the impact of varying dust content proportions on the characteristics of fresh and cured concrete. As a result, research is needed to find a suitable alternative that is environmentally acceptable, affordable, and performs better in terms of strength and durability

Materials used for the study

To begin with, we had to gather the materials required for this experimental study in order to make concrete; the specifics of our materials collection and specification are covered below.

Cement

Similar to argillaceous minerals coupled with shale or mud, Portland concrete is created from calcareous minerals combined with limestone or chalk. Wet and dry processes are used, depending on whether the rough trimmings are sticky or dry combined and crushed. Lime, silica, alumina, and iron oxide are the most regular key parts utilized in substantial production. At high temperatures, these oxides consolidate with each other inside the warmer, bringing about progressively convoluted mixes. Concrete hydration refers to the chemical processes that take place between concrete and water. Approaches can be used to copy concrete hydration. The first is a response framework, where concrete splits up to outline an incredibly drenched plan from which hydrated items support. Second, water corrupts concrete mixtures after a long enough time-line, starting the floor and moving steadily up to within. The response of cement with water is exothermic. The response produces a great deal of hotness. Hotness of hydration is the term for this kind of warmth discharge. In this experiment, ordinary Portland cement of grade 53 was used, adjusted to I.S. -12269-1987. I procured ultra-tech cement of grade 53 from the neighborhood of Hyderabad for the current examination. The cement bag used as an example in this inquiry is shown in the figure below.

Robo sand
Robo Sand is also known as artificial sand, which is made by crushing natural granite. Crushed granite aggregate created by crushing natural granite stone is known as Robo Sand. Robo Sand is an excellent alternative for river sand. One of the most important elements in the production of concrete is river sand. River sand has become scarce and pricey. Accordingly, gazing at stream sand is another option. Robo sand, some of the time called as smasher dust, can be utilized as a substitute for stream sand.Robo sand, as opposed to non-refined squander from the coarse aggregate industry, is a top notch material. Water used to assemble and fix cement ought to be perfect and without any trace of risky substances like oil, antacid, corrosive, and different poisons; as a general rule, cement ought to be made utilizing water proper for drinking.Robo sand is acceptable as a construction material since it has qualities comparable to river sand. Fine aggregate was replaced by Robo Sand or M-Sand. Robo Sand is made from crushed stone that has been rinsed to remove fine rock dirt and crushed into smaller granular sizes of river sand granules to increase the quality, according to IS: 2386-1975.

Sugarcane baggage ash
Silica (66.45 percent), alumina and ferric oxide (29.13 percent), calcium oxide (1.83 percent), magnesium oxide (0.83 percent), and sulfur trioxide make up sugarcane bagasse debris (0.56 percent). 0.72 percent of the time, there occurs a loss of ignition. Bagasse ash from sugarcane is gathered from a neighbouring sugarcane factory in Thiruvalam, Vellore. The bagasse ash was collected in a moist state and then dried. Bagasse ash is sieved to a size of 75. 2.28 is the specific gravity.

Fine Aggregates
A local open sand zone II with specific gravity 2.65, water absorption 2% and fineness modulus 2.92, changing according to the I.S. 383-1970. It's the aggregate that passes 4.75 mm of IS sifter and contains, in principle, such an unprecedented proportion of the coarser that is allowed by detail.

Coarse Aggregates
Particles with an expected measurement bigger than 4.75mm yet under 37.5mm are delegated coarse. They can begin from an assortment of sources, like essential, optional, and reused materials. On the ocean front or in the water, you might track down essential or perfect sums. A coarse, land-based mix that comes from the ocean is alluded to as "rock." Rock and harmed stone are gotten together with coarse aggregates. Squashed stone tends to the rest of the coarse outright in concrete, while rock tends to the rest. The coarse aggregates are the aggregates that are placed on IS4.75 strainer number, the crushed stone mix of 20 mm in size is incorporated from the vicinity of the quarry. Aggregates of length more critical than 20mm size are secluded by using sieving. The example of coarse totals used for this study is shown in the lower figure.

Water
The maximum critical factor is water, which, while mixed with cement, makes a paste that holds the combination together. Through a procedure called hydration, water allows concrete to harden. Water performs a crucial element within side the creation of "ideal" concrete because the water-to-cement ratio is the maximum essential aspect.

Mix Design And Trials Used For The Study

For this study, the mix is composed of M30 Grade Concrete having a mixture ratio of 1:1.86:2.89 at WLC=0.50 with regard to material properties. In order to obtain the optimum value of strength and durability, as shown in the following discussions, I have performed five experiments for this study of experimentation.

1. 0% Baggage ash + 0% Robo sand : Mix 1
2. 5% Baggage ash + 10% Robo sand : Mix 2
3. 10% Baggage ash + 20% Robo sand : Mix 3
4. 15% Baggage ash + 30% Robo sand : Mix 4
5. 20% Baggage ash + 40% Robo sand : Mix 5
6. 25% Baggage ash + 50% Robo sand : Mix 6

METHODOLOGY

We need to cast cubes, cylinders and prism specimens for compressive forces, split tensile forces, flexural strength and durability of different curing time periods in order to test the capacity and durability of concrete with baggage ash and robo sand on M30 grade concrete. Workability tests are also being performed on different trial mixtures, in addition to these strength tests. The following methodology is used for this project.

Batching

Batching is where a quantity of material required by the project is taken into account. Two methods for weighing the material shall be in general used, namely weight batching and volume batching. In the present study I was taken weight batching to measure the materials quantity.

Mixing of the Concrete

I mixed the materials according to the trail after measuring the quantity of material. To obtain a uniform mix within the material, we need to blend coarse aggregates, fine aggregates and other materials for some time before adding another mixture which will then be mixed again several times over this period of time. Then, to prepare a fresh concrete of M30 grade, add water according to the calculation in the mix plan.

Casting of Specimens

We need to cast samples such as cubes, cylinders and prisms for the purpose of checking their strength and durability when we mix Concrete materials. In order to ensure durability of the concrete in these five trial mixtures, we must cast 18 cubes for compressive strength, split tensile strength and flexural strength at 7 days 14 days 28 days 56 days 90 days 180 days curing time.

Curing of the Specimens

For tests on compressive strength, split tensile strength, and flexural strength, the specimens must be cured with each of the five experimental mixes for 7 days, 14 days, 28 days, 56 days, 90 days, and 180 days. The specimens must be cured at least for acid attack and alkaline attack tests when it comes to durability.

RESULTS AND ANA ANALYSIS

Slump cone test
Compaction factor
Compressive strength
Split tensile strength
Flexural strength
Acid resistance study

CONCLUSIONS

Following conclusions are presented below based on the experimental investigation's findings: -

1. The strength of M30 grade mix concrete is increased from 0%BA+0%RS to 25%BA+50%RS by swapping out the Bagasse ash and Robo sand, in comparison to regular concrete.
2. From 0%BA+25%RS to 25%BA+50%RS, the compaction factor values decrease as the percentage of bagasse ash and robo sand is increased.
3. The optimal values of compressive strength found at 20%BA+40%RS at 7days, 14days, 28days, 56days, 90days and 180 days curing with the values of 25.52N/mm2, 35.06N/mm2, 38.2 N/mm2, 40.2 N/mm2, 41.86 N/mm2 and 42.68 N/mm2. The strength values are decreasing after M4 mix.
4. The optimal values of split tensile strength found at 20%BA+40%RS at 7days, 14days, 28days, 56days, 90days and 180 days curing with the values of 2.74 N/mm2, 3.77 N/mm2, 4.14 N/mm2, 4.32 N/mm2, 4.51 N/mm2 and 4.58 N/mm2.
5. The optimal value of flexural strength is also obtained at M4 mix with 3.44 N/mm2, 4.73 N/mm2,5.16 N/mm2, 5.43 N/mm2, 5.65 N/mm2 and 5.76 N/mm2 for the respected 7days, 14days, 28days, 56days, 90days and 180 days curing.
6. Using Robo sand and bagasse ash in concrete enhances concrete quality and strength while also conserving natural river sand for future generations.
7. As a result, we came to the conclusion that Robo sand and bagasse ash will be employed in place of fine and coarse aggregate

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Figure 1: Ultra Tech OPC 53 Grade cement Bag

Figure 2: Fine aggregates

Figure 3:Coarse aggregates

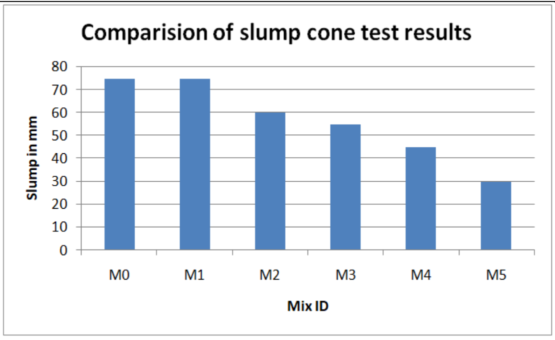

Figure 4. Comparison of slump cone values

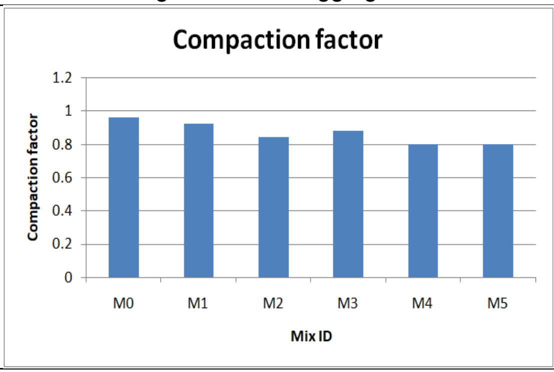

Figure 5. Comparison of compaction factor values

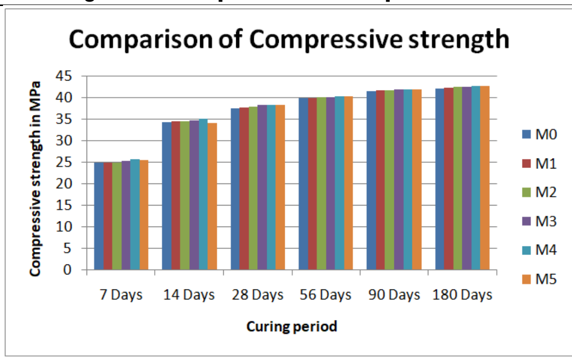

Figure 6. Comparison of compressive strength

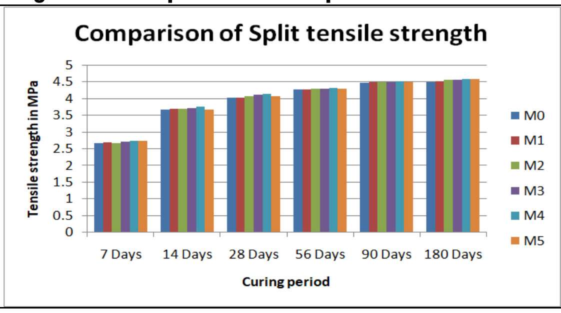

Figure 6. Comparison of split tensile strength

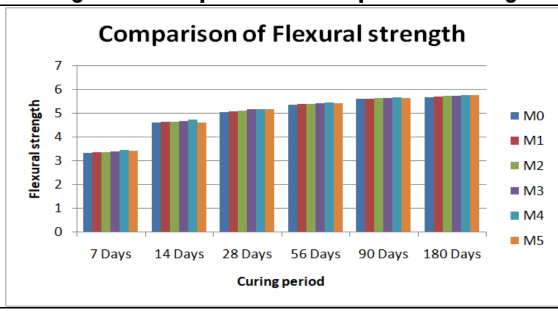

Figure 7. Comparison of flexural tensile strength

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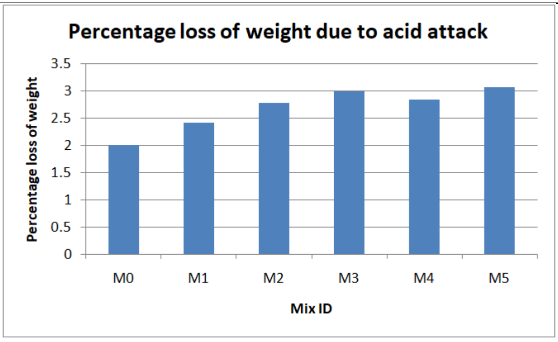

Figure 8. Comparison of Percentage loss of weight

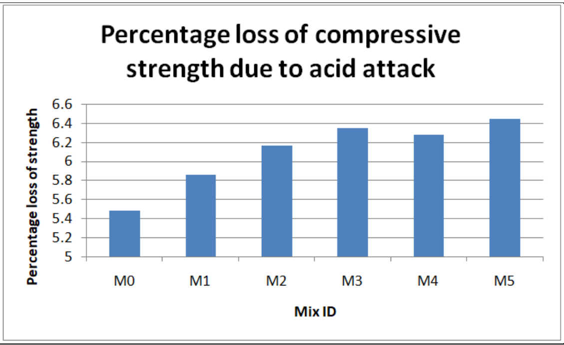

Figure 9. Comparison of Percentage loss of strength