

Replacement of Coarse Aggregate in Concrete with Aluminium Caps

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ABSTRACT: Using aluminium caps will help to reduce crack in concrete. Furthermore, the usage of aluminium caps in construction can reduce of environmental pollution. In this study, aluminium caps to be used in concrete to determine whether there is an increase in the compressive and tensile strength of the concrete. The objective of this study is to determine the compressive and tensile strength of different concrete mix with aluminium caps. Compressive strength and tensile strength of specimens is to be tested on days 7, 14 and 28 after curing is carried out. The utilization of aluminium caps in concrete production not only solves the problem of disposing solid waste but helps conserve natural resources.

KEYWORDS: Aluminium caps, compressive strength, tensile strength

I. INTRODUCTION

The major problem arises in today's environment is handling and disposal of waste materials. In today's proliferation of food carts there are several stores use Aluminium as major role for the packing the food products. The beverage cans, aerosol cans, and Aluminium foils are the major waste products of daily life. The Aluminium manufactures are also focused for the collection of scrap materials in order to extract the secondary Aluminium. This can help to reduce the time in manufacturing by mixing the optimized combination of recycled products. On other hand it has a challenging task for the India to recycle these Industrial waste products we need to move forward for the scrap recycling techniques. On the Focus of Segregation of waste material, the current study is carried on reuse of Aluminium caps in concrete as coarse aggregate. The caps from various beverage bottles are collected and partial replacement of coarse aggregate is experimentally analyzed. It is also proved that various testing in studied to know about the durability properties of Aluminium which is used in Architectural buildings. Even the Aluminium doors were been used for the concreting under the hot weather conditions, this studies show the better durability at 20% of Aluminium doors waste mixed for concrete. Even the Aluminium doors were been used for the concreting under the hot weather conditions, this studies show the better durability at 20% of Aluminium doors waste mixed for concrete. The application of Aluminium in concrete composite structures helped out to reduce the corrosion problem and widely used in bridge construction. The various form of beams like triangular cross section beams, arch like thin walled beams are implemented in the studies in order to overcome the corrosion related problems and to enhance the durability of the structure.

II. RELATED WORK

This study serves as performance indicators concrete workability and strength be mixed using a plastic bottle, sand, cement and water. The importance of this alternatively stone replacement to reduce plastic waste that is hard to lapse and to avoid waste of waste that can be adapted to something that can be used in the development of technology in the future (Nazliah Nasir & Dr. Mohd Yunus Ishak m. 2015). In addition to reducing the pollution of nature, it also saves costs and apply the concept of 3R which Reduce, Reuse and Recycle. In this study, the determination of the type of form cutting PBAP that will affect the strength of concrete, water absorption rate during the process of curing, workability replaced coarse aggregate to PBAP type deduction PBAP and compressive strength of concrete using concrete in volume percentage PBAP specified content on a regular basis will be viewed through two forms of tests to be carried out, namely compression tests and slump test. To ensure the success of this study, the materials to be used are as coarse aggregate, cement, sand, water and plastic water bottle cap diameter not

more and not less 31mm. In this experimental investigation iron slag rendered as scrap was used as coarse aggregate in place of crushed stone in the preparation of concrete. Iron slag showed better performance as a replacing material. There was increase in the value of compressive strength (T.S.Thandavamoorthy m.2016) In this experimental investigation iron slag rendered as scrap was used as coarse aggregate in place of crushed stone in the preparation of concrete. Iron slag showed better performance as a replacing material. There was increase in the value of compressive strength. It was observed that at 75 per cent replacement level the compressive strength after 28 days of curing attained a value of 50.33 N/mm². This was found to be 2.2 per cent greater than that of normal concrete. • The split tensile strength for the corresponding replacement level was found to be 2.26 N/mm² that was 14.14 per cent higher than the normal concrete.

III.MATERIAL REQUIREMENTS

ALUMINIUM CAPS

Aluminum bottle cap material is widely used in the packaging of products, because aluminum has good oxidation resistance, forming a dense oxide film on the surface of aluminum, which protects the physical properties of the product, sealing is good, to ensure that the product does not come into contact with the outside world. Therefore, it has a very wide range of uses. Brief introduction of several aluminum bottle caps which are common in our daily life.



CEMENT

The cement water paste has its characteristic properties of adhesion and cohesion by which it can bond well with aggregate to form a strong rock like mass called concrete as a consequence of the chemical reaction between cement and water. Cement is the most widely used material in existence and is only behind water as the planet's most consumed resource.

FINE AGGREGATES

Fine aggregates generally consist of natural sand or crushed stone with most particles passing through a 9.5 mm sieve.

COARSE AGGREGATE

Aggregates are coarse particulate rock-like material consisting of a collection of particles ranging in size from < 0.1mm to > 50 mm, it includes gravel, crushed rock, sand, recycled concrete, slag, and synthetic aggregate.

WATER

Water is an important ingredient of concrete because hydration takes place only in the presence of water. The water, which is used for making concrete, should be clean and free from harmful impurities such as oil, alkali, acid etc. In general, the water which is fit for drinking but not for mixing concrete some specifications also accept water for making concrete if pH value of water lies between 6 and 8.

MOULDS

Cubical moulds of size 150 mm x 150 mm x 150 mm were used to prepare the specimens for determining the compressive strength of normal concrete. Care was taken during casting and compaction. Beam moulds of size 500 mm x 100 mm x 100 mm were used to prepare the concrete specimens for two-point loading. All the specimens were prepared in accordance with Indian Standard Specifications IS 516 – 1959. All the moulds were cleaned and oiled properly. They were securely tightened to correct dimensions and prevent leakage of slurry.



IV.MIX DESIGN

Mix design can be defined as the process of selecting ingredients of concrete and determining their relative proportion with the objective of producing concrete of certain minimum strength and durability as economically as possible. Two types of concrete mixes are normally used in the construction field. For normal works, nominal mix is used whereas for very important structures designed mix is used.

The mix design is done based on the Indian Standard Method (IS 10262;2009).

Water	Cement	Fine aggregate	Coarse aggregate
0.4	1	1.4	2.3

V. CASTING AND CURING OF TEST SPECIMEN

BATCHING

Weigh batching

Weigh batching is the correct method for measuring the materials. For important concrete invariably, weigh batching system is adopted. Use the weigh system in batching. Facilities accuracy, flexibility and simplicity. Different types of weigh batches are available, in smaller works, the weigh arrangement consist of two buckets, each connected through a system of levers to a spring-loaded dial which indicated the load. A simple spring balance or the common platform weighing machines also can be used for small works.

Automatic batch plants are available in small or large capacity. In this the operator has only to press one or two buttons to put into motion and weighing of all the different materials and the flow of each being cut off when the correct weigh is reached.

MIXING

Hand mixing

Hand mixing should be done over an impervious concrete or brick floor of sufficiently large size to take one bag of cement. Spread out the measured quantity of coarse aggregate and fine aggregate in alternate layers. Pour cement on the top of it, and mix them dry by shovel, turning the mixture over an again until uniformity of colour is achieved. This uniform mix is spread out in thickness of about 20 cm water is taken in water-can fitted with a rose-head and sprinkled over the mixture and simultaneously tuned over. This operation is continued till such time is good uniform, homogeneous concrete is obtained.

COMPACTIONOF CONCRETE

Compaction of concrete is the process adopted for expelling entrapped air from the concrete. The test specimens are made as soon as practicable after mixing and in such a way as to produce full compaction of concrete with neither segregation nor excessive laitance. Each layer is compacted by hand or by vibration. When compacting by hand the standard tamping bar is used and the strokes of bar are distributed in a uniform manner over the cross section of the mould. The number of strokes per layer required to produce the specified conditions vary according to the type of the concrete.

CASTING OF SPECIMEN

Moulds were properly fixed with screws and oil is applied on the surface for easy demoulding. Concrete is prepared in the mixture and put in a tray. In this tray required quantity of bottle cap fibres are added and mixed properly. Fresh properties of concrete are determined. The specimens are cast. In the next day, specimens were demoulded and put in a curing tank.



VI. EXPERIMENTAL RESULTS

COMPRESSIVE STRENGTH TEST

Table1. 7th day compressive strength test results

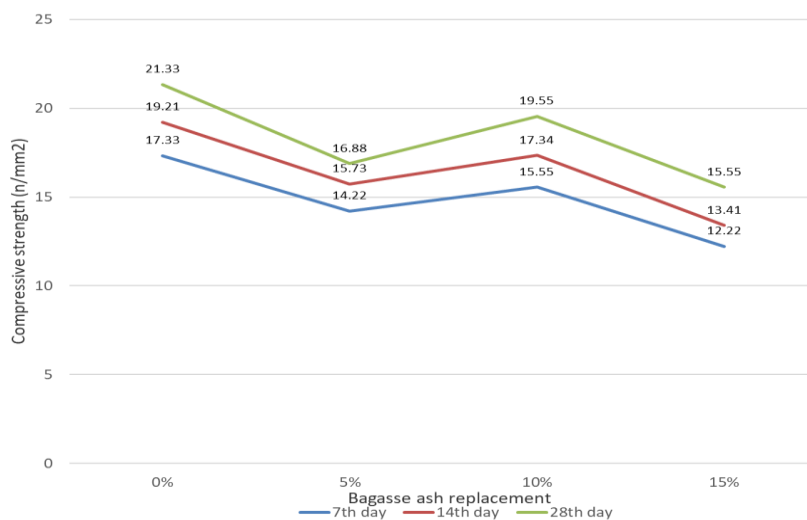
Mix type	Compressive strength (N/mm ²)
Aluminium Caps 0%	17.33
Aluminium Caps 5%	13.92
Aluminium Caps 10%	15.32
Aluminium Caps 15%	11.34

Table 2. 14th day compressive strength test results

Mix type	Compressive strength (N/mm ²)
Aluminium Caps 0%	19.21
Aluminium Caps 5%	14.78
Aluminium Caps 10%	16.66
Aluminium Caps 15%	13.40

Table 3 28th day compressive strength test results

Mix type	Compressive strength (N/mm ²)
Aluminium Caps 0%	21.33
Aluminium Caps 5%	16.88
Aluminium Caps 10%	18.88
Aluminium Caps 15%	15.20





SPLIT TENSILE STRENGTH TEST

Table 4 7th day split tensile strength test result

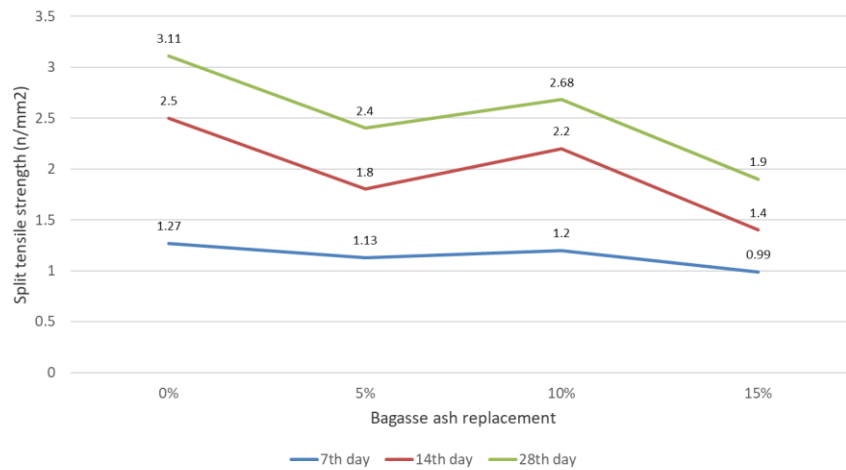
Mix type	Spilt tensile strength (N/mm ²)
Aluminium Caps 0%	1.27
Aluminium Caps 5%	1.11
Aluminium Caps 10%	1.2
Aluminium Caps 15%	0.77

Table 5 14th day split tensile strength test result

Mix type	Spilt tensile strength (N/mm ²)
Aluminium Caps 0%	2.5
Aluminium Caps 5%	1.7
Aluminium Caps 10%	2.3
Aluminium Caps 15%	1.3

Table 6 28th day split tensile strength test result

Mix type	Spilt tensile strength (N/mm ²)
Aluminium Caps 0%	3.11
Aluminium Caps 5%	2.2
Aluminium Caps 10%	2.7
Aluminium Caps 15%	1.3



FLEXURAL STRENGTH TEST

Table 7 7th day flexural strength test result

Mix type	Flexural strength (N/mm ²)
Aluminium Caps 0%	1.8
Aluminium Caps 5%	0.8
Aluminium Caps 10%	1.19
Aluminium Caps 15%	0.6



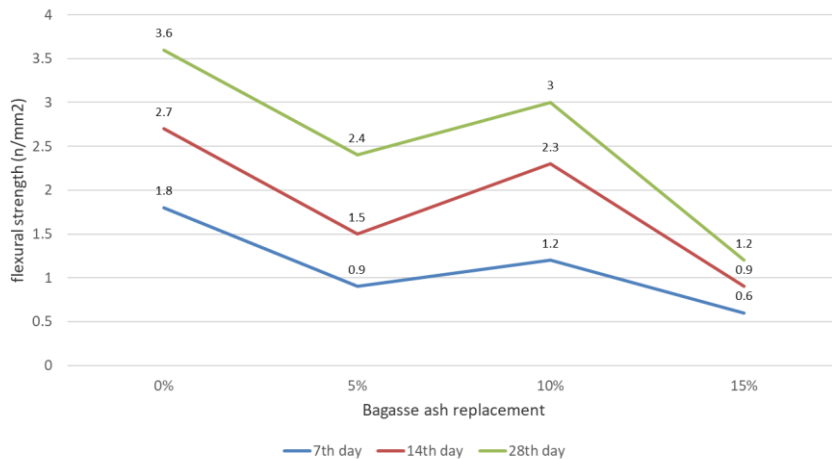
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Table 7 14th day flexural strength test result

Mix type	Flexural strength (N/mm ²)
Aluminium Caps 0%	2.7
Aluminium Caps 5%	1.3
Aluminium Caps 10%	2.23
Aluminium Caps 15%	0.8

Table 7 28th day flexural strength test result

Mix type	Flexural strength (N/mm ²)
Aluminium Caps 0%	3.6
Aluminium Caps 5%	2.25
Aluminium Caps 10%	2.9
Aluminium Caps 15%	1.19



VII. CONCLUSION

From the experimental investigation, the following conclusions are obtained:

- Compressive strength, split tensile strength and the flexural strength are obtained near to the value of the normal concrete
- In the 15% replacement shows gradual reduction in the strength.
- In 5% replacement the compressive strength is reduced compared to the normal concrete, it shows that the addition of aluminium caps reduces the compressive strength.
- In 10%, the strength reduction due to the aluminium caps are compensated with the addition of the aluminium caps.
- The higher percentage of the replacement is not good for the concrete.
- The optimum of addition of the aluminium caps are 10 %.

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