UTILIZATION OF WASTE SOFT DRINK BOTTLE CAPS AS FIBRE IN CONCRETE

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Abstract - *The development of construction materials have posed problems and challenge that initiated worldwide research programs and continued conventional and non conventional applications leading to ultimate economy. Researchers developed waste management strategies to apply for advantages for specific needs. The use of bottle caps in concrete provides environmental as well as economic benefits for all related industries, particularly in areas where a considerable amount of bottle cap wastes are produced. Owing to the exploitation of reinforcing steel for the preparation of reinforced concrete, usage of bottle caps as additional reinforcing material in concrete has been attempted. The bottle caps of the soft drinks and beverages and from some other sources are used as the additional reinforcing material the compressive strength, tensile strength and flexural strength characteristics of concrete are compared with the bottle cap concrete. The M20 grade of concrete was used to make concrete. All specimens were cured for 28 days before compression strength test, splitting tensile test and flexural strength test. The specimens were casted with various percentages of bottle cap reinforcements such as 0.25% and 0.30%. Both the specimens gave better results than the ordinary conventional concrete in all the aspects such as compressive strength, split tensile strength, flexural strength. Among the two percentages of adding additional reinforcement, 0.30% gave better result than 0.25%.*

1. INTRODUCTION *(Size 11 , cambria font)*

Concrete is relatively strong in compression but weak in tension and tends to be brittle in nature. In this stage the fibre reinforced concrete is need for that purpose while increasing the tensile strength, Flexural strength, Energy absorption capacity, toughness. The bottle caps will make deform into the small strips of fibre as used in concrete. Concrete is the most important element of the construction industry. Since durability is one of the critical problems to construct reinforced concrete structures with long service life and develop construction technologies due to some environmental and economic reasons in recent years, it is important to produce well-designed concrete as a durable construction material. Concrete has been the major instrument for providing stable and reliable structures. However, large amounts of natural sources such as sand, aggregate, water and cement as used in concrete production.

Concrete weak in tension and has limited ductility and little resistance to cracking. Micro cracks are present in concrete and because of its poor tensile strength. Most cracks in concrete are formed during its hardening stage. Concrete is the most widely used construction material. Because of its specialty of being cast in any desirable shape, it has replaced stone and brick masonry.

1.1 FIBRE REINFORCED CONCRETE

Fibre reinforced concrete is a composite material consisting of mixtures of cement, fine aggregate, coarse aggregate and discontinuos, discrete, uniformly dispersed suitable fibres.

1.2 General

Concrete is relatively brittle, and its tensile strength is typically only about one tenths of its compressive strength. Regular concrete is therefore normally reinforced with steel reinforcing bars. For many applications, it is becoming increasingly popular to reinforce the concrete with small, randomly distributed fibers. Their main purpose is to increase the energy absorption capacity and toughness of the material, but also increase tensile and flexural strength of concrete. Plain concrete possesses a very low tensile strength, limited ductility and little resistance to cracking. Internal micro cracks are inherently present in the concrete and its poor tensile strength is due to the propagation of such micro cracks, eventually leading to brittle fracture of the concrete. They however, do not increase the inherent tensile strength of concrete itself. In plain concrete and similar brittle materials, structural cracks develop even before loading, particularly due to drying shrinkage or other causes of volume change. It has been recognized that the addition of small, closely spaced and uniformly dispersed fibres to concrete would act as crack arrester and would substantially improve its static and dynamic properties.

1.3 Effect of Fibres in Concrete

Fibre are usually used in concrete to control plastic shrinkage cracking and drying shrinkage cracking. Some types of fibres produce greater impact and abrasion resistance in concrete.

The amount of fibre added to a concrete mix is measured as a percentage of total volume of the composite termed volume fraction. Volume fraction typically ranges from 0.1 to 3 %. Aspect ratio is calculated by dividing fibre length by its diameter or in thickness. A proper shape and higher aspect ratio are also needed to develop an adequate bond between the concrete and the fibre. Workability of SFRC is affected by fibre aspect ratio and volume fraction as well the workability of plain concrete. In FRC crack density is increased, but thecrack size is decreased. Structural applications

1.4 Application Of FRC The main Objective of our project is to compare the test Fibre reinforced can be primary or secondary reinforcement results of steel fibre reinforced concrete and plain cement in a wide range of construction projects, such as concrete.

Highway and roadways Compressive strength

Shotcrete in Mining, Tunneling Split tensile strength

Explosive and impact resistance structures Flexural test

1.5 Bottle Caps

- The steel bottle caps are made of steel with covering aluminium coatings. The bottle caps are cut into the small strips of fibre.
- Aspect ratios of bottle caps fibre are 30
- It is the capacity of a material or structure to withstand axially directed force.
- Compression test is carried out on cubes which have the nominal size of 15cmx15cmx15cm.
- Compressive strength of concrete formula Compressive strength of concrete= Max load carried by the specimen / Top surface area of the specimen.

1.6 Applications of SFRC

- SFRC has been used for application such as
- Highway and airport pavements
- Refractory linings
- Canal linings
- Industrial floorings and bridge-decks
- Precast applications - wall and roof panels, pipes, boats, staircase steps & manhole covers

2. Objectives

2.1 Compressive Strength

- Industrial flooring Compressive strength is obtained by conducting
- Mine support blocks compression test on hardened concrete.
- Concrete flatwork such as slabs and pavements on ground etc
- Precast elements
- Seismic resistance structures.

2.2 Split Tensile Strength

Split tensile strength is obtained by conducting tensile test on hardened Concrete.

Split tensile test is carried out by placing a cylindrical specimen horizontally in between the loading surfaces of compression testing machine and the load is applied until failure of the cylinder, along the vertical chamber splitting tensile strength of concrete formula According to IS456, split tensile strength of concrete = 0.7 *

Fck

The splitting tensile strength, Tsp = 2P / π DL

Where P is the applied load, D is the diameter of the specimen and L is length of the specimen Accordingly P = 0.7 Fck x π DL / 2

Expected load = P x factor of safety

Tsp = 2P/ pi DL where P here is the actual failure load

2.3 Flexural Test

Flexural strength is obtained by conducting flexural test on hardened concrete. It is defined as a material's ability to resist deformation under load. It is to estimate the load at which the concrete member may crack. Flexural test is carried out on prisms and beam which has nominal size of 50cmX10cmX10cm and 1100x100x150cm.

Flexural strength of concrete formula

Flexural strength test Flexural strength is calculated using the equation: F= PL/ (bd 2)----------3 Where, F= Flexural strength of concrete (in MPa). P= Failure load (in N). L= Effective span of the beam (400mm).

Literature Review The volume of fibre in the concrete was varied up to 1.5%.

ENHANCING THE COMPRESSIVE STRENGTH OF CONCRETE USING SOFT DRINK BOTTLE CAPS AS FIBRES R.saravana kumar, gabriela rajan

Compression test has been carried out of on M20 grade concrete cubes and the various percentage of fibre at a dosage of 0.1%, 0.15%, 0.20%, and 0.25%. The concrete incorporated with 0.1% of fibre the compressive strength of the concrete has been increased by 8.9% corresponding over the conventional concrete. For 0.15% of addition of fiber to concrete the compressive strength of the concrete has been increased by 13.96% compare to the conventional concrete. The concrete with 0.2% addition of fiber the compressive strength of the concrete has been increased by 18.7% than that of conventional concrete. When the fibre dosage is increased upto 0.25% the compressive strength of the concrete has been increased by 23.85% corresponding over the conventional concrete. The compressive strength and flexural strength has been increased in the above mixes.

PROPERTIES OF CONCRETE REINFORCED WITH DIFFERENT KIND OF INDUSTRIAL WASTE FIBRE MATERIAL

Mohammed Seddik Meddah, Mohamed Bencheikh

The effects of the incorporation of various types of waste metallic fibres (WMF) and polypropylene fibres (WPF) on the mechanical properties of fibre Reinforced concrete were experimentally investigated. A normal concrete with a compressive strength of 30MPa was used as a control mixture. The compressive strength was also observed with the composites containing more than 2% of the WMF. The compression strength and flexural strength were increased in the fibres

UTILIZATION OF BOTTLE CAPS TO ENHANCE THE FLEXURAL STRENGTH OF CONCRETE

R.saravana kumar, gabriela rajan

This experimental study deals with the behavior of split tensile strength of concrete when mixed with soft drink bottle caps. This incorporation of bottle cap fiber can cause a change in the failure mode under compressive deformation from brittle to ductile. The flexural strength of M20 grade concrete included with steel fiber has been increased by

4.61%, 8.31%, 10.29%, and 13.35% for 0.1%, 0.15%. 0.2%, 0.25% respectively. The flexural strength of M25 grade concrete added with steel fiber has been increased by 2.03%, 4.22%, 7.65% and 10.49%. The tensile strength M30 grade concrete incorporate with steel fiber has been increased by 2.9%, 5.64%, 8.44%, and 11.08% for 0.1%, 0.15%, 0.2%, 0.25% respectively.

COMPRESSIVE BEHAVIOUR OF STEEL FIBRE REINFORCED CONCRETER. D. Neves and J. C. O. Fernandes de Almeida

An experimental study to investigate the influence of matrix strength, fibre content and diameter on the compressive behaviour of steel fibre reinforced concrete is presented. Two types of matrix and fibres were tested. Concrete compressive strengths of 35 and 60 MPa, 0, 38 and 0, 55 mm fibre diameter, and 30 mm fibre length, were considered.

Test results indicated that the addition of fibres to concrete enhances its toughness and strain at peak stress, but can slightly reduce the Young's modulus. Simple expressions are proposed to estimate the Young's modulus and the strain at peak stress, from the compressive strength results, knowing fibre volume, length and diameter. Fibre influence in maximum compressive strength it is variable, depending on matrix and fibre characteristics. Strain at peak stress increases with concrete Strength.

COMPARATIVE STUDY OF STEEL FIBER REINFORCED OVER CONVENTIONAL CONCRETE

Vikrant S Vairagade, Kavita S. Kene, Tejas R Patil To study the compressive strength, and tensile strength of steel fiber reinforced concrete (SFRC) containing fibers of 0% and 0.5% volume fraction of hook end Steel fibers of 50 and 53.85 aspect ratio were used. A result data obtained has been analyzed and compared with a control specimen (0% fiber). A relationship between Compressive strength vs. days, and tensile strength vs. days represented graphically. Result data clearly shows percentage increase in7 and 28 days Compressive strength and Tensile strength for M-20 Grade of Concrete. By addition of 0.5% hook end steel fibers increases compressive strength of concrete up to 10%. Used of 50 mm long fiber with same volume of fraction gives 20% extra split tensile strength over fiber 35 mm in length. Addition of 0.5% steel fiber reduces the slump value of fresh concrete. This problem of workability and flow property of concrete can be overcome by using suitable admixtures such as Superplasticizers.

EXPERIMENTAL INVESTIGATION ON FIBRE REINFORCED CONCRETE USING WASTE MATERIALS

G.Murali, C.M.Vivek Vardhan

An experimental study influence of addition of waste materials like lathe waste, soft drink bottle caps, empty waste tins, waste steel powder from workshop at a dosage of 1% of total weight of concrete as fibres. The lathe waste, empty tins, soft drink bottle caps were deformed into the rectangular strips of 3mm width and 10mm length. That concrete blocks incorporated with steel powder increased its compressive strength by 41.25% and tensile strength by 40.81%. Soft drink bottle caps reinforced blocks exhibited an increase in flexural strength of concrete by 25.88%. Better split tensile strength was achieved with the addition of the steel powder waste in concrete. The strength has increased upto 40.87% when compared to that of the conventional concrete specimen. In flexure the specimen with soft drink bottle caps as waste material was found to be good. While adding the soft drink bottle caps the flexural strength increased by 25.88% that of the conventional concrete.

IMPROVEMENT OF THE COMPRESSIVE STRENGTH OF MORTAR IN THE ARID CLIMATES BY VALORIZATION OF DUNE SAND AND PNEUMATIC WASTE METAL FIBERS

AllaouaBelferrag, AbdelouahedKriker, Mohamed Elmouldi Khenfer

In this work we studied the effect of the addition of a new type of metal fibers, resulting from used tires, on the compressive strength of dune sand concrete. This formulation is a contribution to the valorization of the dune sand and used tires, in order to take part in the protection of the environment and reduction of the costs of construction materials.Three types of fibers were tested, having 30, 40 and 60 mm lengths, and diameters of 0.9, 0.28 and 0.9 mm respectively. The fiber volume fraction in the concrete was 1% and 1.5%. The results obtained show an improvement of the compressive strength for the metal fiber reinforced sand dune concrete (MFSC) compared to the concrete without fibers.The improvement of the compressive strength of the MFSC mixtures is governed by the size, fiber volume fraction, the bond between fibers and the dune sand concrete, the aspect ratio, and fibers orientation. The maximum of compressive strength was obtained by the introduction of fiber having the highest aspect ratio.A new type of metal fibers resulting from pneumatic waste was used to reinforce concrete. Reduction of the materials cost and preservation of the environment by the valorization of dune sand and pneumatic waste. The used fibers had a positive effect on the improvement of the compressive strength.

FIBER REINFORCED GEOPOLYMER FROM SYNERGETIC UTILIZATION OF FLY ASH AND WASTE TIRE

Gabor Mucsi Agnes, Szenczi Sandor Nagy

Fiber reinforced geopolymer and its technology using fly ash and waste tire was developed and investigated. The fibre reinforcement originated from shredded car tire was processed by a preparation technology consisting communition and separation steps resulted in various fractions in size and quality. Furthermore, the binder of the composite was made of mechanically activated fly ash and activator solution (NaOH and Na-K water glass). The goal of the present work was to examine the effect of addition of various quality steel fibres, in the ratio of 1, 3, 5 w/w%, on the compressive- and flexural strength as well as on the structure of geopolymer. Meanwhile, most processes of the suggested technology of fly ash and waste tire preparation were tested in pilot scale. As a result of the experiments, it was found that specimens containing pure steel fibers have higher strength than geopolymer containing rubber contamination beside steel fiber. Increasing the amount of fiber has a positive effect on the development of strength. Steel fiber reinforcement in 5w/w% reached significant growth in compressive strength and three times growth in flexural strength as compared to the neat geopolymer. The fracture was analyzed by scanning electron microscope. Furthermore, FTIR results shown difference in the material structure between the inner part of geopolymer matrix and the interface of geopolymer – rubber. SEM results confirmed the satisfactory strength results concerning the bonding between steel fiber and geopolymer matrix.

EFFECT OF GRANULOMETRIC CORRECTION OF DUNE SAND AND PNEUMATIC WASTE METAL FIBERS ON SHRINKAGE OF CONCRETE IN ARID CLIMATES AllaouaBelferrag, AbdelouahedKriker, Mohamed Elmouldi Khenfer

This paper reports result of a study conducted to investigate the effect of granulometric correction of dune sand and addition of pneumatic waste metal fibers on the drying shrinkage of dune sand concrete. Valorization of these materials provides both economic and environmental advantages.

A correction of the granulometry of dune sand (DS) by river sand (RS) was undertaken with the proportions of 50% DS + 50% RS and 40% DS + 60% RS. Two types of fibers f_1 (l_f = 20, d = 0.28 mm) and f_2 (l_f = 30, d = 0.28 mm) with *l/d* ratios of respectively 71.43 and 107.14 were incorporated with volume fractions of 0.5% and 1%.

For the sands obtained from mixing DS and RS, an improvement of fineness modulus of dune sand, and the sand equivalent of river sand were observed, compared respectively to 100% DS and 100% RS. The granulometric correction of dune sand and the addition of fibers reduced the drying shrinkage. The maximum of shrinkage reduction was obtained for the mixtures prepared with 40% DS and 60% RS. The fibers having the highest aspect ratio and a volume fraction of 1% presented a more significant effect on drying shrinkage. The more significant reduction of shrinkage was 40.53% compared to concrete without fibers. Weight loss was higher for the fiber reinforced sand concretes compared to plain sand concretes.

COMPRESSIVE AND FLEXURAL BEHAVIOURS OF A NEW STEEL-FIBRE-REINFORCED RECYCLED AGGREGATE CONCRETE WITH CRUMB RUBBER

XieJian-he, Guo yong-chang, liu li-sha xie zhi hong
Using recycled concrete and crumb rubber as aggregates to produce green concrete is a promising technology toward sustainability in the construction industry. In this

study, the compressive and flexural behaviours of a new type of concrete material, rubber crumb and steel-fibre-reinforced recycled aggregate concrete (RSRAC), are investigated. To popularise the application of this new type of green building material, an experimental study was conducted to investigate the effect of the rubber content on the compressive and flexural behaviours of RSRAC. A total of 18 cubes (150 mm) and 18 cylinders (150 mm × 200 mm) were tested under axial compressive loading, and 18 prisms of 150 × 150 × 550 mm were tested subjected to three-point bending. The crumb rubber content was varied in the investigation at levels of 0%, 4%, 8%, 12% and 16% by volume substitution of sand. Recycled concrete aggregate (RCA) was introduced into the concrete mixture by 100% volume substitution of natural coarse aggregate (NCA), and 1% volumetric quantity of steel fibre was added to the concrete mixture. The effect of the rubber content on the compressive and flexural strength, failure mode, modulus of elasticity and toughness of RSRAC was analysed. The results indicate that RSRAC with an optimal rubber content displays good compressive behaviour compared with normal NCA concrete. RSRAC is also a more environmentally friendly alternative to normal rubber concrete for use in the flexural members of concrete structures.

MICROSTRUCTURE-LINKED STRENGTH PROPERTIES AND IMPACT RESPONSE OF CONVENTIONAL AND RECYCLED CONCRETE REINFORCED WITH STEEL AND SYNTHETIC MACRO FIBRES

Savaş Erdem Andrew ,Robert Dawson Nicholas ,Howard Thom

The effectiveness of the same volume of steel and synthetic macro fibres on impact resistance and microstructure associated mechanical behaviour is studied for concretes made with two different coarse aggregates-gravel and incinerator bottom ash (IBA). The microstructure–strength relationships were analyzed via electron microscopy and Xray computed tomography (CT). The analysis indicated that increased paste strength was not so significant for the mix properties of plain IBA concrete as extensive cracks through the aggregate took place likely due to a reduced grain–grain interlocking and inter-particle friction as a result of the distinct pore structure, and fibre orientation in gravel concrete produced a line of weakness for failure to take place along. The results also show that the increase with the steel fibre inclusion in the post-peak stress, absorbed energy values, impact life for IBA concrete is much higher than those for gravel concrete. Overall, the research suggests that fibrereinforced IBA concrete would be very promising as a multifunctional construction material.

First work to analyze the impact response and toughness of IBA concrete with and without fibres. Less homogenous microstructure leads to accelerated failure with less energy dissipation. Fibre orientation may produce a line of weakness along which failure could take place. Highly porous internal structure of IBA could lead to a reduction in the grain–grain interlocking.

EFFECT OF FIBER REINFORCEMENT AND DISTRIBUTION ON UNCONFINED COMPRESSIVE STRENGTH OF FIBERREINFORCED CEMENTED SAND

Sung-SikPark

A series of unconfined compression tests were carried out to examine the effect of fiber reinforcement and distribution on the strength of fiber-reinforced cemented sand (FRCS). Nakdong River sand, polyvinyl alcohol (PVA) fiber, cement and water were mixed and compacted into a cylindrical sample with five equal layers. PVA fibers were randomly distributed at a predetermined layer among the five compacted layers. The strength of the FRCS increases as the number of fiber inclusion layers increases. A fiber-reinforced specimen, where fibers were evenly distributed throughout the five layers, was twice as strong as a non-fiber-reinforced specimen. Using the same amount of fibers to reinforce two different specimens, a specimen with five fiber inclusion layers was 1.5 times stronger than a specimen with one fiber inclusion layer at the middle of the specimen. The fiber reinforcement and distribution throughout the entire specimen resulted in a significant increase in the strength of the FRCS.

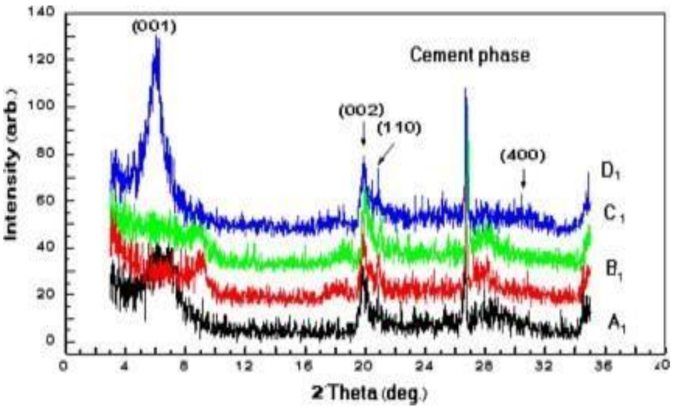
AN EXPERIMENTAL SURVEY ON COMBINED EFFECTS OF FIBERS AND NANOSILICA ON THE MECHANICAL, RHEOLOGICAL, AND DURABILITY PROPERTIES OF SELFCOMPACTING CONCRETE

Morteza H.Beigi, JavadBerenjian, OmidLotfi Omran, ArefSadeghi Nik, Iman M.Nikbin

Previous studies have shown that application of fibers in concrete enhances scratching, flexural and tensile strength. Self-Compacting Concrete (SCC) is a highly flowable and coherent concrete able to self-compact under its own weight. On the other hand, nanosilica particles and artificial pozzolans possessing high efficiency in concrete technology can improve structural properties of cement-based materials. Previous studies have suggested self-compacting and fiber-reinforced concretes for more stable and efficient buildings. Therefore, the present study aimed to evaluate the effects of nanosilica and different concrete reinforcing fibers including steel, polypropylene and glass on the performance of concrete. In this study mechanical (compressive, splitting tensile and flexural strength, toughness and modulus of elasticity), rheological (L-Box, slump flow, T50) and durability (resist chloride ion penetration (RCPT) and water absorption) properties are assessed. In addition, microstructural properties of concrete were assessed using Atomic Force Microscopy (AFM) and X-Ray Diffraction (XRD) techniques. Totally, 40 concrete mixes , labeled as A, B, C and D, with nanosilica contents of 0, 2, 4 and 6 weight percent (wt.%) of cement, respectively and three types of reinforcing fibers (steel: 0.2, 0.3 and 0.5 volume percent (v%) and polypropylene:

0.1, 0.15 and 0.2 v% and glass: 0.15, 0.2 and 0.3 v%) were evaluated. The results of the study showed that the presence of both nanosilica and reinforcing fibers in optimal percentages, can improve the mechanical properties and durability of self-compacting concrete significantly.

Graphical abstract



STUDY ON MECHANICAL PROPERTIES OF ENVIRONMENT FRIENDLY ALUMINIUM E-WASTE COMPOSITE WITH FLY ASH AND E-GLASS FIBER

SiddharthPatel, R.S.Rana, Swadesh KumarSingh

In the present scenario e- waste is an important subject to solve and to utilise in a better way for the betterment of the human society. E-waste mainly contains many useful materials such as Aluminium, copper, Lead, Gold, etc. these materials are recyclable and can be utilised in making a better material composite by using a suitable reinforcement. Here study focused on the e-waste like printed circuit boards which contains aluminium in its heat sinks. These heat sinks are made up of Aluminium alloy specially from AL6061 and AL6063. Our study basically focused on AL6061 and these AL6061 is taken as matrix material and reinforcement as fly ash and e-glass fiber. Here fly ash is varied with respect to weight percentage and e-glass fiber is kept constant with some weight%. After that the sample composite was prepared by the stir casting method. Four different samples were taken (0, 3, 6, 9% fly ash) and it was found that the tensile, compressive, yield strength increases with increasing the fly ash%. Hardness increases and toughness decreases by increasing the fly ash% with an exception in sample 3 for the hardness.

THE FEASIBILITY OF IMPROVING IMPACT RESISTANCE AND STRENGTH PROPERTIES OF SUSTAINABLE CONCRETE COMPOSITES BY ADDING WASTE METALIZED PLASTIC FIBRES

Hossein Mohammad, Hosseini Mahmood, Md. Tahir Abdul Rahman Mohd Sam

Waste plastic results in waste discarding disaster and consequently cause significant harms to the environment. The utilisation of industrial wastes in the production of sustainable concrete has attracted much consideration in recent years because of the low-cost of waste materials along with saving a significant place for landfill purposes and also enhance the performance of concrete. In this paper, the feasibility of waste metalized plastic (WMP) fibres and palm oil fuel ash (POFA) in the production of concrete composites was investigated by assessing the impact resistance and strength properties. Six concrete mixes containing WMP fibres varying from 0 to 1.25% with a length of 20 mm were made of ordinary Portland cement (OPC). A different six concrete mixtures with the same fibre content were made, where 20% POFA substituted OPC. The combination of WMP fibres and POFA reduced the slump values of concrete mixes. The inclusion of WMP fibres to OPC and POFA concrete mixes decreased the compressive strength. However, at the curing period of 91 days, the POFA-based mixes obtained higher compressive strength values than those of OPC-based mixtures. The positive interaction among WMP fibres and POFA consequently improved the impact resistance, flexural and splitting tensile strengths, thereby developing the energy absorption capacity and concrete ductility. It is concluded that the utilisation of WMP fibres and POFA in the production of sustainable concrete composites is potential to enhance the impact resistance and strength properties of concrete components that can be used in structural and nonstructural applications.

4. METHODOLOGY

4.1 Literature Collection

In this step, we had collected several literatures about the Steel fibre reinforced concrete. We had studied the advantages of Steel fibre using concrete. From the literature we conclude that the adding of bottle caps of concrete had attained maximum strength while compared to the Conventional concrete.

4.2 Material study

This deals with study of properties of materials used in this project.

4.3 Material collection

Ordinary Portland Cement (53 Grade)

Fine Aggregate

Coarse Aggregate

Bottle caps

4.4 Mix Design

Grade of concrete was taken as M20 in conventional and Fibre reinforced concrete using in the design mix was done as per IS: 10262-2009 and IS: 456-2000.

4.5 Casting

In this process we had casted cubes, cylinders, prisms and Beams.

4.6 Curing and testing

After 24 hours cubes, cylinders, prisms and Beam were demoulded and allowed to cure for 28days. The compression test, split tensile test and flexural test were done for the specimens.

5. EXPERIMENTAL INVESTIGATION

5.1 Experimental Investigation

This experimental study aimed to investigate the compressive strength, flexural strength, tensile strength of concrete with the proportion of bottle caps as adding of concrete. In the present work the materials used in this project such as cement, Fine aggregates, Coarse aggregates and water.

5.2 MATERIALS

5.2.1 CEMENT

The cement used should confirm to IS specifications. There are several types of cements are available commercially in the market of which Portland cement is the most wellknown& available everywhere. OPC 53 grade was used for this study. The physical properties of the cement tested according to standard procedure conform to the requirement of IS 12269: 1989. The physical properties of cement are listed below in Table 1. Table 1 Physical properties of cement

PROPERTIES	RESULTS
Specific Gravity	3.15
Fineness	1.5%
Normal consistency	30%
Soundness	1.1 mm
Initial setting time	43 min
Final setting time	243 min
Compressive strength at 3days	26.27 N/mm2
Compressive strength at 7days	33.13 N/mm2
Compressive strength at 28days	44.25 N/mm2

5.2.2 FINE AGGREGETE

Locally available river sand passing through 4.75mm IS sieve conforming to the recommendation of IS 383-1970 is used.

Specific gravity of fine aggregate is 2.59.

IS Sieve No.	Quantity retained (Grams)	Cumulative retained %	Cumulative percentage passing	Limits for percentage passing
10mm	0	0	100	100
4.75mm	70	1.4	98.6	90-100
2.36mm	200	5.4	94.6	75-100
1.18mm	1050	26.4	73.6	55-100
600	1600	58.4	41.6	35-59
300	1600	90.4	9.6	8-30
150	430	99	1	0-10
Residue	50	100	0	-
Grading zone of fine aggregate –Zone II				

5.2.3 COARSE AGGREGATE

Coarse aggregates to be used for production of concrete must be strong, impermeable, durable & capable of producing a sufficient workable mix to achieve proper strength. The size of the coarse aggregate used in 20mm.

Specific gravity of coarse aggregate is 2.63.

IS Sieve No.	Quantity retained (Grams)	Cumulative retained %	Cumulative percentage passing	Limits for percentage passing
40mm	0	0	100	100
20mm	600	12	88	85-100
10mm	3400	80	20	0-20
4.75mm	1000	100	0	0-5

5.2.4 WATER

The quantity of mixing water for concrete has an effect on the resulting hardened concrete. Impurities in water may interface with setting of cement adversely affect the strength and durability of concrete. Fresh and clean water which is free from organic matter, silt, oil, and acid material as per standard is used for casting and curing the specimen.

5.2.5 BOTTLE CAPS AS FIBRE

The steel bottle caps are made of steel with covering aluminium coatings. The bottle caps are cut into the small strips of fibre.

Aspect ratios of bottle caps fibre are 30

6. MIX DESIGN

The concrete has been designed as per IS method. The following mix proportions were shown table 3.6s

6.1 CONVENTIONAL AND FIBRE REINFORCED CONCRETE

M20

MATERIALS	NS C	HS C	HP C
Cement (kg/m3)	477	500	522.5
Fine aggregate (kg/m3)	701	640	638
Coarse aggregate (kg/m3)	1078	1170	1166
Water (l/m3)	203	160	160
Fly ash(kg/m3)	-	50	-
Silica Fume (kg/m3)	-	-	27.5
Super plasticizer (l/m3)	-	3.2	3.2

CONCLUSION

Thus we had concluded this project by utilizing waste soft drink bottle caps as fibre in the concrete mix and it could be possible to utilize the bottle caps in concrete in an effective manner. If our idea is proven successful on the above tests, then it will give a huge enhancement in the field of waste management and improvement in concrete strength and durability as we expected.

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