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Properties of Concrete on Adding Polypropylene Fibre and Polyvinyl Chloride Fibre

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ABSTRACT- Concrete is a structure material that can't be ignored indeed if it's weak in tension and lead to environmental problems. Properties of concrete can be modified using fibre in concrete. Using fibre from waste of plastic in concrete to some chance increases strength as well as durability of concrete and break disposal problems of plastic waste in terrain. From electronic waste Polyvinyl chloride lines (PVC) are used as fibre and from polypropylene (PP) quilting bag of cement are used as fibre in concrete. Both are used in 0, 0.26, 0.51, 0.76 and 1% by weight of cement in concrete. Total 90 samples conforming of 9 cells with 0% fibre, 36 cells with PP fibre of 0.26%, 0.51%, 1, 36% cells of PVC fibre of 0.26%, 0.51%, 0.76%, 1% and 9 cubes of mongrel and average values are calculated. Both Fresh and harden properties of polypropylene fibre reinforced concrete and polyvinyl chloride fibre reinforced concrete is determined and mongrel of optimum values calculated is used in a single blend and compressive strength is calculated. Results show that 0.76% and 0.51% is optimum value of polyvinyl chloride fibre RCC and polypropylene fibre RCC with 49% and 17.5% increase in concrete strength compared to normal concrete independently and can be used in a single admixture. The mongrel fibre RCC of optimum values of PPFRC AND EFRC show 56% increase in compressive strength. In hybrid fibre concrete with reinforcement, polypropylene fibre keeps cracks small and polyvinyl chloride fibre shows improvement in mechanical properties.

KEYWORDS- Concrete, Crack bridging, Fibre Reinforced Concrete, Cement Bags, Electronic Waste

I. INTRODUCTION

A. General

Concrete with modified mechanical properties is termed as Fiber reinforced concrete and is mostly used now a days.Fibres are introduced in concrete to make it FRC.The fiber used may be natural, synthetic, or waste. Fiber used increases the tensile strength, prevents the crack and also increases the impact strength of concrete. By preventing or keeping the crack small in concrete therefore increases the durability of concrete and prevents it from entering the outside chemicals and hence prevents the concrete from the deterioration also. There are different types of fibers that can used in the FRC like glass fibers, steel fibers, coconut fibers, polymer fibres(polypropylene fibres). FRC increases various properties of concrete like compressive strength, tensile strength, flexural strength, ductility, high impact loading and higher bending resistance. Dynamic resistance, increases the structural integrity, delay the crack propagation in the hardened concrete (post-cracking effect) elastic modulus, loss control. The capability of fiber is to reduce cracks at maximum strain and increases its rigidity also continuity which reduces transport of sharp material into concrete. Addition of polypropylene fibres decreases the unit weight of concrete and increases its strength[13]. While as the purpose of steel reinforcement in the concrete is to enhance load bearing capacity while fibre in concrete help crack establishment. FRC is used as light weight Concrete because of its less self weight. Aspect rate is the parameter that describes fibres and is defined as length by periphery rate of fibre. Generally aspect rate lies between 30 to 150 but it may vary that's depending on fibre type. There are various sources of fibres employed in concrete. Colorful studies have used fibre from waste of different types polypropylene fibre made from post-consumer waste(food packaging), recycled black polyethylene tubes, E- waste plastic(insulation cables). All wastes present on earth are cause of pollution and produce some other terrain problems. Waste from electronic contain more poisonous material than external waste. Some electronic waste can be used in concrete as fibre[14]. Environmental pollution as well as disposal of solid waste is reduced by application of waste in concrete. Also enhances the mechanical properties of concrete. Using more than one fibres in concrete blend increases the needed properties of concrete also gives benefits of individual fibres. Hybrid fibre has been shown to be applicable to numerous types of RC structural elements. With addition of fibre content in concrete, concrete shows decrease in the slump. Drop in depression value doesn't always mean there's drop in workability, this loss can be due

to increase in the voids with the increase in the fibre.

B. Polypropylene Fibre Reinforced Concrete

Construction industries has developed a different types of fibres for FRC other than glass, natural or steel fibres. Polypropylene fibres are synthetic fibres that are attained by polymerization of propylene. Synthetic fibres are available in abundant phrasings that are uprooted from organic polymers and used in concrete, nominated as synthetic fibre FRC. From the growth of petrochemical and cloth diligence, exploration results synthetic fibres that are man- made. Fibre added in concrete have different sources like nylon, PP, PVC, PET. Polypropylene fibre is also nominated as polypropylene or PP. PP fibre have a colorful operations and are actually converted from propylene. PP fibres are non-polar and incompletely liquid and pertain Polyolefin group. Crack conformation in concrete have numerous reasons and is a serious problem if not treated. PP fibre work, for prohibiting cracks in concrete due to loss of moisture therefore PP fibre is preferred. PP fibre is also further heat resistant that's advantage over polyethylene fibre as they both work analogous.

C. Electronic Waste Fibre Reinforced Concrete

E-waste is generated from life ended E&E fellow that may be from circuit boards, computer, TV, plastic portion of string, contain dangerous material that make e-waste deadly than external waste. The main factors of e-waste are glass, metals and plastic. Occasionally both dangerous and harmless materials are present due to which disposal process becomes challenging, and also its disposal cause problem to the terrain and is imminence for developing countries. It is stated as world's rapid-fire growing waste as some kind of e-waste grow continuously as its consumption, generation pattern and rate is also rapid-fire and is epitomized in statistics 2022.Besides problem faced due to e-waste generation can also be the source of frugality reported by World Economic Forum. With the development in technology, use of electric and electronic (E&E) outfits is continuously adding and the outgrowth is increase in product of E&E outfits. Recycling of e-waste isn't preferred due to prominent cost so are exported to developing countries from developed countries. Various dangerous materials are present in e-waste that affects health as well terrain.

From 2015 to 2022, there's 76 %growth in generation, so the permanent solution is required for its disposal in developing countries. In developing countries harmful and dangerous effects are observed in developing due to the informal recycling of electronic waste. Solution for disposal of e-waste can be its use in construction industries. For this experimental study, the type of E-Waste which has been used is PVC (polyvinyl chloride). Polyvinyl chloride (PVC) from e-waste is used in construction industry because of its durability, mechanical properties, electrical, chemical, thermal resistance properties.

II. OBJECTIVES OF STUDY

- Enhancing the properties of M20 grade concrete with the addition of PVC and polypropylene waste.
- Determine the optimum quantity of PVC and Polypropylene

III. LITERATURE REVIEW

Hu et al. Mongrel of polypropylene fibre and polyvinyl alcohol fibre is used to resolve environmental adulterants (pollutants), weakest and further cost of cementitious compound used from history. Polyvinyl chloride summations also are delivered with cover ash in prominent volume. PP fibre added in blend is 0.5 by volume, 1,1.5 and 2 volume of PVA fibre, 10, 20 and 30 of PVC total and 69 of volume of cover ash is introduced. Results set up out that revision of cementitious compound with and without PVC aggregate diminishments, also delaying the PVC combination impact on drop of strength. Compressive strength suggests drop at 0.5 PP fibre whilst splitting tensile energy increases. At 2 of PVA fibre, compressive strength decreases up to 18.65 at the same time as blistering tensile strength will increase up to 100.5.[1]

Meza et al. In this study reclaimed waste is used to support concrete. Fibre used in study is polyethylene terephthalate(PET) bottles. Concrete with PET fibre exhibition rigidity and post cracking strength. Compression test, plasticity, flexural test, unyoking tensile test is conducted on 120 samples casted with fibre of varying aspect rate and chance. Design of trials is used that's a statistical system and three references are utilised a lower position of 2 kg/ m3 with aspect rate 50, an upper position of 10 kg/ m3 with aspect rate 100, and a central position 6 kg/ m3 with aspect rate 80.

Depression test demonstrated plasticity diminishments at fibre addition but PET added concrete exhibition a rare difference of 7.6. In between PET stringy concrete, concrete with maximum PET fibre plus advanced aspect rate parade stylish depression and is explained by low severity of PET concrete. Addition of PET fibre in concrete exhibition drop in compressive strength because of increase in air and porosity as adhesion between straight PET fibre and concrete blend. There's 9 to 16 of drop in blistering tensile strength with addition of PET fibre. Comparison in split tensile of PET fibre concrete presents only 8 of difference. Tensional durability is maximum at loftiest fibre chance plus loftiest aspect rate that means tensional durability increases up to 39 with increase in fibre content and aspect rate. 7 increase in flexural strength with addition of fibre. Volumetric weight drop with increase in fibre content. Fc increase and is over to 74 with addition of fibre.[2]

Cabrera-Covarrubias et al. In this exploration, recycled ceramic total (RCA) are used that replace natural summations. RCA are used at 10, 20, 30, 50, and 100 relief. Relation of porosity and RCA is determined by three different styles that are gas adsorption (N2), Scanning Electron Microscopy (SEM) image analysis and open porosity allowed establishment. Results illustrate increase in RCA increase porosity. 20 RCA is the optimum chance in recycled ceramic mortar and out of three styles open porosity explains physical and mechanical geste of RCM and is authentic. There's drop in viscosity with substituent and presents drop of 0.42 kg/ cm3 revealed by open porosity, face area increases up to 73 with RCA in RCM demonstrated by gas adsorption fashion[3].

Hadj Mostefa et al.[8] The study have make use of plastic in

concrete keeping view on consumption and its non-biodegradable nature. The ideal of the study is enhancement in bond strength of concrete, reduction in cracks with one environmental fact that's reduction of plastic waste.

Due to light weight, low cost, low viscosity, further continuity plastic is more habituated. Fibre used in a concrete is rosin Polythene Terephthalate (PET) acquired from plastic waste bottles that are used as holders. PET fibre is used with aspect rate 25 at0.5, 1, 1.5, 2 and 2.5. Fresh and harden test are conducted.

Depression test for plasticity presented drop in plasticity is due to interlocking clay fibre that results in blockage. Depression value keep diminishments with addition of fibre chance. Viscosity diminishments after 1 plastic fibre is added with adding clotted areas this is because fibre acted as course aggregate. Compressive strength is maximum at1.5 of plastic fibre. Maximum rise in compressive strength is 15- 57 compared to 0 plastic fibre. This concluded1.5 fibre can replace cement. Split tensile strength has parade positive effect of plastic fibre. The optimal value of fibre is1.5 that means replacing1.5 plastic fibre with cement increases resolve tensile strength up to24.30. Flexural strength also increases with increase in chance of fibre. Maximum flexural strength is achieved at1.50 plastic fibre that presents increases of 30- 33. In complete study1.50 fibre is optimal and minimise cracks and make material ductile that requires further energy to propagate [4].

Faiz Mohammad Khan et al.[11] studied synthetic fibre i.e. Polypropylene is utilized by volume fraction from 0.1% to 3%. At 1% Polypropylene fibre, highest growth incompressivestrengthandtensilestrengthisachieved.Inclusio noffibreimprovedflexuralstrengthcontinuously.

1%polypropylenefibreis concluded as optimum.[5]

Y. Dinesh et al.[12] Relative study is conducted in this exploration where fibre used is from plastic waste. PET fibre is utilised by weight of cement at 0.5, 1 and 1.5. Bleeding and permeability is minimised by PET fibre, also plastic loss and drying loss minimise crack propagation. Compression test conducted on PETRC revealed compressive strength increases with addition of fibre. Rise of 9.3 is attained. Rise in compressive strength is at 0.5 of PET fibre. At 1 of PET fibre, compressive strength is comparatively further than conventional concrete but lower than 0.5 PET fibre. Due to inflexibility and shape of PET fibre, cracked shells are interlocked when maximum cargo is applied but only at small fibre content. Increase in split tensile strength with addition of PET fibre is veritably small because of smooth face of PET fibre affect bond strength and have comparatively more superficial area also beach. Split tensile strength rise from 1.69 to 1.95 MPa and also decreases. Rise is at 0.5 of PET fibre.[6]

Dr. Hamed M. Jassim et al.[15] To conquer the limitations of concrete this is brittle nature of concrete and weak in pressure, study is carried out. Polypropylene fibre is added in concrete at colorful probabilities. Compression test, flexural test and splitting test is performed to observe consequences of polypropylene fibre on concrete blend. Polypropylene fibre brought in concrete at 0.50%, 1%and 1.50% with aspect rate of 50. Fresh parcels of admixture are demonstrated that concluded drop in depression from 180 mm to 40 mm when fibre is delivered. Results of compression test revealed that P fall down with addition of PP fibre. The drop of compressive. is 18.4%,20.4% and 23.7% at 0.50%, 1% and 1.50 %of PP fibres independently in comparison to 0% FRC analogous to compressive strength, resolve tensile strength also drop from 3.88 MPa to 3MPa at 0% to 0.5% of PP fibre. Negative impact of PP fibre on flexural strength is likewise determined. The drop is from 4.884 MPa to 4.72 MPa to 4.22 MPa to 4.16 MPa at 0 %,0.50%, 1% and 1.5% independently.[7]

Vitomir Premur et al.[16] The study in about environmental friendly methods for disposal of waste from electronics.Vitroplast FR4 present in printed circuit boards is generated after various treatments and is utilised in concrete. Vitroplast substitutes and at 5, 10, 15 and 20% and test are conducted. The compressive strength as well as volumetric weight decreases with rise in percentage of Vitroplast in concrete. The drop is up to 95%.[9][10]

IV. MATERIALS USED

A. Cement

Cement is a general term for all types of bonds, but in a more specific sense, it refers to the binders used in construction and civil engineering systems. cement acts as a binder between the reinforcement and aggregates. These cements are made of finely pulverized clinkers that when combined with water to form a solid mass. There are several types of cement available for various construction systems. Each variety of cement differs from the others in terms of its characteristics, operations, and composition utilised in product.OPC is available from cement enterprises in Malaysia in three grades 33, 43, and 53 grads of cement. Then for this experimental study, the OPC grade of 43 has been used with specific graveness 2.7 (see the table 1).

Table 1: Cement test results

S. No	Properties	Results
1	Normal consistency	30%
2	Specific gravity	2.7
3	Fineness	98%
4	Initial setting time	50 minutes
5	Final setting time	490 minutes
6	Soundness	2.5 mm

Figure 1: Cement sample

B. Fine aggregate

AsperIS3831970, aggregates that pass through 4.75 mm IS sieve are termed as fine aggregates. Fine aggregates may be: Crushed gravel sand: produced on crushing of natural gravel. Crushed stones and: produced on crushing of hard stones Natural sand: when there is natural disintegration of rocks and are deposited by glacier agencies, streams or rivers.
Natural sand is used in this study as illustrated in figure 2 with maximum size 4.75mm as a fine aggregate. Sand used in this study is of zone2 (see the table 2).

Table 2: Fine aggregate properties.

S. No.	Properties	Results	Limits as per IS Code
1	Specific gravity	2.41	2.3-2.7
2	Fineness modulus	2.813	2.1-3.37

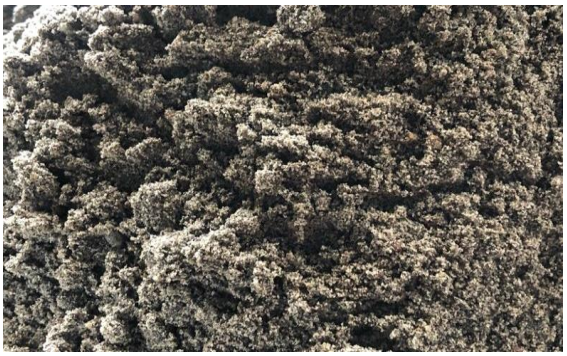

Figure 2: Sand sample

C. Coarse aggregate

As per IS383 1970, aggregates that are retained at 4.75mm sieve are termed as coarse aggregates.
Uneven, broken, irregular stones with range from 4.75 to 20mm are used as coarse aggregates shown in figure 3 and table 3.

Table 3: Properties of Coarse aggregate

S. No	Properties	Results	Limits as per IS Code
1	Specific gravity	2.539	2.6-2.8
2	Fineness modulus	2.95	2.9-3.2

Figure 3: Course aggregate sample

D. Polyvinyl Chloride fibre (PVC)

Polyvinyl chlorine is a synthetic material produced by polymerisation of plastic and about 45 million tons of polyvinyl chloride is generated per year.
PVC has two types:
Rigid polyvinyl chloride Flexible polyvinyl chloride Rigid PVC is used in construction of pipes, plastic bottles, bank and other cards. A plasticizer is used to make it flexible and soft. In Phonograph records, piping, insulating wires, flexible PVC is used. Polyvinylchloride (PVC) is a plastic material(e-waste).PVC cables used in the study were shown in figure 4 and copper wires that are present inside these cables are taken out carefully and the outer insulating portion is used in concrete. The outer casing can be cutted as per desire length. In this study PVC cables are cutted into the pieces of 30mmto 35 mm. Other properties of PVC fibre are given in table 4. PVC fibres are used at0%, 0.25%, 0.50%, 0.75% and 1.0%byweight of cement.

Table 4: Properties of PVC fibre

Length of fibre	32 to 35mm
Diameter of fibre	1mm
Aspect ratio	32-35

Figure 4: PVC fibre used in study

E. Polypropylene fibre

Polypropylene fibre used in the study is from packing bags of cement. Empty packing bags of cement are collected from construction site located near khonmoh (srinagar).These bags are collected and cleaned properly and the cutting is done. Cement packing bags of 30mm of length is used as polypropylene fibre. Figure 5 shows cement bags at construction site that are cleaned and cutted into 30 to 35mm pieces as shown in figure 6. These cutted pieces of waste packing bags of cement are used as polypropylene fibre. PP fibre used at 0%, 0.26%, 0.51%, 0.76% and 1.0% by weight of cement (see the table 5).

Figure 5: Polypropylene fibre used in study

Table 5: Properties of Polypropylene fibre

Length of fibre	32 to 35mm
Width of fibre	1mm
Aspect ratio	32 to 35mm

F. Mixing

Hand mixing is used and done on water tight platform. Firstly fine aggregates and cement is mixed uniformly and followed by the addition of coarse aggregates and mixed properly. Water is added in the mixture and mixed. Bleeding should be prevented while adding water, otherwise it may affect the strength of concrete. Super plasticizer is added with water. Mould should be cleaned and oiled, placing of concrete in mould is done in layers. Each layer is tamped by the tamping rod. While tamping make sure tamping rod penetration to previous layer.

Figure 6: Freshly casted cubes

G. Mixing of Fibre Concrete

Fine aggregates and cement are mixed properly and uniformly and fibres of 0.26%, 0.51%, 0.71% and 1% is added by wt. of cement. Fibres are added in mix, mixed properly and then coarse aggregates are added and mixed. Super plasticizer is added with water. Water is added slowly and mixed properly to avoid bleeding. Concrete mix is placed in mould, compacted, placed and finished (see the figure 7).

Figure 7: Mixing of fibre concrete

H. Casting and Curing

After 24 hours, moulds are opened with care so that the corners of concrete are not broken. For curing, the concrete cubes are placed in water. The duration of curing should be 3 days,14 days and 28 days. The water of curing tank should be clean and should have a ph value of 6.5 to 8.5(see the figure 8 & 9).

Figure 8: Cubes after curing

Figure 9: Cubes for compression test (28days)

V. TESTS PERFORMED

A. Slump test

Workability of freshly concrete is determined by the slump cone and this test is called as slump test (see the figure 10).

Figure 10: Slump cone

B. Compression test

Behaviour of material under compression load is determined by compression test. Concrete cube of 150 x 150 x 150mm is casted according to the grade. After curing, specimen is tested by placing between the two plates and load is applied gradually till the Maximum load applied is noted. To calculate compressive strength, load at failure is divided by the surface area of the specimen. Compressive strength is denoted by P (see the figure 11)..

P=F/A

Where,

F=failure load

A=area

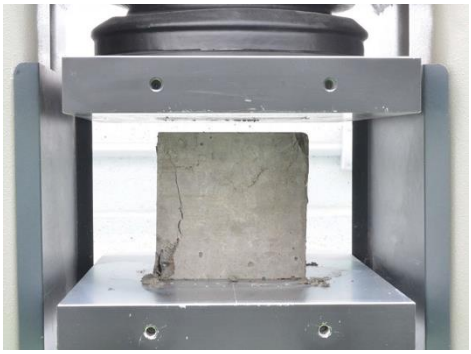

Figure 11: Compression test sample

VI. RESULTS

1. COMPRESSIVE STRENGTH TEST

A. Compressive strength of PVC and Polypropylene fibre reinforcement concrete at 3 days (see the table 6)

Table 6: Fluctuation in Compressive strength of cubes for3days

Combination %	Mix Number	Sample-1	Sample-2	Sample-3	Average st. N/mm^2
0 PP 0 PVC	M0	7.75	8.54	8.52	8.2
0.26 PP 0 PVC	M1	9.03	9.17	9.11	9.1
0.51 PP 0 PVC	M2	9.8	9.84	9.6	9.7
0.76 PP 0 PVC	M3	8.81	8.27	8.12	8.4
1.0 PP 0 PVC	M4	7.77	7.74	7.73	7.7
0 PP 0.26 PVC	M5	10.01	10.09	9.9	10
0 PP 0.51 PVC	M6	12.59	12.07	11.84	12.1
0 PP 0.76 PVC	M7	12.23	12.41	13.17	12.6
0 PP 1.0 PVC	M8	11.58	10.96	10.77	11.1
0.51 PP 0.76 PVC	M9	13.93	15.31	12.04	13.7

B. Compressive strength of PVC and Polypropylene fibre reinforcement concrete at 14 days (see the table 7)

Table 7: Fluctuation in Compressive Strength of cubes for 14days

Combination %	Mix Number	Sample-1	Sample-2	Sample-3	Average MPa
0 PP 0 PVC	M10	21.85	22.52	21.22	22.8
0.26 PP 0 PVC	M11	22.79	23.39	21.28	22.4
0.51 PP 0 PVC	M12	25.89	25.31	25.22	25.4
0.76 PP 0 PV	M13	23.08	18.37	19.78	20.4
1.0 PP 0 PVC	M14	17.02	15.4	18.31	16.9
0 PP 0.26 PVC	M15	22.46	21.86	21.67	21.9
0 PP 0.51 PVC	M16	29.28	28.51	28.34	28.7
0 PP 0.76 PVC	M17	32.69	33.34	32.07	32.7
0 PP 1.0 PVC	M18	28.47	28.51	25.19	27.39
0.51 PP 0.76 PVC	M19	33.63	33.25	33.32	33.4

C. Compressive strength of PVC and Polypropylene fibre reinforcement concrete at 28 days (see the table 8)

Table 8: Fluctuation in Compressive Strength of cubes for 28days

Combination %	Mix Number	Sample-1	Sample-2	Sample-3	Average MPa
0 PP 0 PVC	M20	24.21	23.52	23.67	23.8
0.26 PP 0 PVC	M21	24.55	25.34	25.42	25.1
0.51 PP 0 PVC	M22	28.2	28.13	28.27	28.2
0.76 PP 0 PV	M23	23.36	22.73	22.92	23.0
1.0 PP 0 PVC	M24	19.47	19.43	19.03	19.3
0 PP 0.26 PVC	M25	26.16	25.52	26.33	26.0
0 PP 0.51 PVC	M26	33.59	34.05	34.36	33.6
0 PP 0.75 PVC	M27	36.35	36.52	35.73	36.2
0 PP 1.0 PVC	M28	28.34	28.57	29.19	28.7
0.50 PP 0.75 PVC	M29	38.32	38.15	37.53	38.0

D. Effect on Workability Using Polypropylene Fibre Reinforced Concrete and Pvc Fibre Reinforced Concrete

Slump value in mm

Addition in fibre content leads to decrease in slump value. The decrease in slump with addition of 0.26% PP fibre and PVC fibre is 6% and 7% respectively, at 0.51% of PP fibre and PVC fibre, the decrease is 15% and 18% respectively, at 0.76% of PP fibre and PVC fibre, the decrease is 17% and 21% respectively, at 1% of PP fibre and PVC fibre, the decrease is 22% and 26% respectively. There is continuous decrease in slump value with respect to fibre content. This decrease doesn't indicate decrease in workability, decrease is because of increase in the entrapped air voids due to fibre content. The decrease in the slump value is 22% with the addition of PP fibre and is 26% with the addition of PVC fibre.

E. Comparison of Slump value of Normal Concrete and Hybrid fibre Reinforced Concrete

Slump value (mm)

Slump test is followed to determine the workability of fresh concrete. Mix of optimum values of PP-FRC and PVC-FRC i.e. 0.51% and 0.76% respectively, is used in a single mix termed as hybrid concrete which shows maximum decrease of 40% slump value without super plasticizer. Decrease in slump value is due to the air voids entrapped in concrete with addition of fibre that is why slump continuously decreases with the increase in the percentage of fibre in concrete. Super plasticizer decreases water content hence enhances workability.

F. Variation In Properties of Concrete Using Polypropylene Fibre

Compressive strength (N/mm^2)

Fibre is added at 0-1% by weight of cement where results are compared with 0% FRC. Compression strength of concrete cubes exhibit rise with rise in percentage of fibre. At 0.26% fibre content compressive strength increases 5.2%, at 0.51% fibre content compressive strength increases 17.5% that is the optimum value of fibre content giving compressive strength of 29.77N/mm^2. After 0.51% of PP fibre, addition in fibre percentage shows decrease in compressive strength decrease is 17.4% and 31.4% at 0.76% and 1.0%of PP fibre respectively.

G. Variation in Properties of Concrete using pvc Fibre

Compressive strength (N/mm^2)

Fibre is added at 0-1% by weight o cement where results are compared with 0% FRC. Compression strength of concrete cube results rise with inclusion of PVC fibre. At 0.26% fibre content compressive strength increases 8.7%, at 0.51% fibre content compressive strength increases 40%, at 0.76% fibre content compressive strength rises 49% that is the optimum value of fibre content giving compressive strength of 37.77N/mm^2.

H. Variation In Properties of Concrete Using Hybrid Fibre Reinforced Concrete

Compressive strength (N/mm^2)

The optimum dosage for PP-FRC and PVC-FRC is 0.51% and 0.76% respectively. Optimum value of both fibres are added in a single mix i.e. HFRC that exhibit maximum growth in compressive strength at 3, 14 and 28 days. The improvement in case of HFRC is 56% more compared to 0% fibre concrete i.e. NC and is maximum among all cases studied in project.

I. Comparison of compressive strength of polypropylene fibre reinforced concrete and pvc fibre reinforced concrete

Compressive strength (N/mm^2)

The comparative compressive strength of PPFRC and PVC fibre reinforced concrete at optimum percentage i.e. 0.51% of polypropylene fibre and 0.76% of PVC fibre. PP-FRC shows less increase compared to PVC-FRC.

VII. CONCLUSION

Mixing of fibre from waste to concrete is studied. Fibre added to concrete are cement packing bag from polypropylene fibre and polyvinyl chloride cable from e-waste fibre and are added in 0%, 0.26%, 0.51%, 0.76% and 1% with 0.5 W/C. After that, the compressive strength of concrete cubes is determined. Following are the points summarized based on experimental results while considering effect of PP fibre, PVC fibre from E-waste and hybrid.

- Inclusion of both fibres together and individually show improvement in mechanical properties compared with normal concrete with crack mechanism. Among all mixes maximum improvement is conveyed at 0.51% and 0.76% of PP fibre and PVC fibre respectively.
- Effect of fibres in cement matrix shows betterment in mechanical strength of reinforced concrete specimens. Improvement in mechanical strength is with addition of both fibres.
- Polypropylene fibre reinforced concrete with addition of 0.51% polypropylene fibre has achieved compressive strength of 29.77N/mm^2 i.e., 17.5% increase than the normal concrete. At 0.51% of PP fibre, the improvement is maximum.
- PVC fibre reinforced concrete shows increase in the compressive strength upto 49% at 0.76% fibre content, inclusion in fibre content decreases the strength after 0.76%.
- Hybrid fibre reinforced concrete shows maximum increase in the compressive strength with 39.55N/mm^2 that "s56% increase than the normal concrete, 5% increase than PVC-FRC and 32% increase than the PPFRC.
- Decrease in slump is upto 40% from 0% fibreto1% fibre to the hybrid of fibres.
- With Hybrid fibre reinforced concrete it is possible to improve the compressive strength of concrete and use of waste packing bags of cement and PVC cables that improve the mechanical properties and this can be considered as an economical and environmental friendly way of disposing waste.
- In FRC, until ultimate point is reached, specimen doesn't apart at 1st cracking.
- Difference in the failure of normal concrete and fibre reinforced
- concrete is observed during the experiment. Normal concrete breaks suddenly (brittle failure) while fibre reinforced concrete doesn't break suddenly i.e. ductile failure occurs in the FRC.

CONFLICTS OF INTEREST

The authors declared that they have no conflicts of interest.

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