STUDY ON CONCRETE WITH JUTE AS ADMIXTURE AND RUBBER AS AGGREGATE

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Abstract - This project study on the effect of plastic jute fibre as admixture in concrete and also the feasibility of substituting coarse aggregate by using waste tyre rubber in concrete. Utilizing the waste tyre rubber as partial substitute for coarse aggregate in reduce problem of disposing the waste and it show increase in the strength of concrete. Compressive strength and flexural strength test are performed on the casted specimen, which proved that strength of specimens are increased. These test were conducted on specimen made by concrete without tyre rubber, with tyre rubber in such a way that 10%, 20%, 30% of aggregate substituted by tyre rubber. Also compressive strength test were conducted on concrete specimen with 0.6%, 1.2%, 1.8% on jute with respect to concrete and comparisons had done. It is observed that there is a considerable change in behavior of concrete due to addition of tyre rubber and jute. The flexural strength and compressive strength are found to be improved due to addition of tyre rubber and jute fibre up to an optimum percentage. This project suggest an alternate way in disposal of waste tyre rubber and also a cost effective way to improve property of concrete by addition of fibre.

Key words: jute fibre, tyre aggregate, flexural strength, compressive strength, fineness modulus, specific gravity

1. INTRODUCTION

At present the disposal of waste is one of major problem facing today tires is becoming a major waste management problem in the world. It is estimated that 1.2 billions of waste tire rubber produced globally per year. It is estimated that 11% of post consumer tires are exported and 27% are sent to landfill, stockpiled or dumped illegally and only 4% is used for civil engineering projects.

Hence efforts have been taken to identify the potential application of waste tires in civil engineering projects. In this context, our present study aims to investigate the optimal use of waste tire rubber as coarse aggregate in concrete composite.

It has been seen in developing nations like India, there has been acute shortage of durable and low cost housing construction materials. The design of sturdy, Low- Cost and Sustainable construction for building is technological challenge in present days. With applicable use of fiber in cement composites looks possible to manage the inherent issues of cement composites and additionally for the effective construction. As we all know cement composites lacks in some characteristics such as Cement composites behaves brittle with low tensile strength and due to its poor resistance to cracks opening, need of increase in durability of such composites must be taken in to account with some kind of modification in it. We can create our composites sturdy by increase the number of steel in it however it'll it will increase the burden and price of structure. So here suggestion of addition of fiber in cement composites would possibly work. There are different types of fibers are present in market which might be used as reinforcement in cement concrete like Steel Fiber, Fiber of Polymer, carbon fiber and different types of natural fiber additionally like Jute, Sisal, Sugarcane Baggase, rice husk etc. For our experimental purpose we've got taken Jute fiber since it is a natural fiber it possess several benefits like Low value, Easily available and Eco-Friendly and they also offer High strength and toughness once combine in cement composites.

Fibre reinforced concrete

FRC is concrete containing fibrous material that will increases its structural integrity. so we are able to outline fibre concrete as a material of cement concrete or mortar and discontinuous seperate and uniformly spread fibre. Fibre is a discrete material having some characteristic properties. Fibre material can be anything. But not all will be effective and economical. Some fibres that are commonly used are steel ,glass, carbon, natural jute etc.

Jute fibre is one of the most commonly used fibre. Use of steel fibre is a developed process but steel fibre undergo

corrosion easily. Generally round fibres are used. Jute is an important bast fibre with a number of advantages. Jute has low density, harmlessness and good dimensional stability. Jute textile is a low cost eco-friendly product and is abundantly available, easy to transport and has moisture retention capacity. It is widely being used as method for plant mulching and road pavement construction. On combustion, jute does not release toxic gases. Jute fibre is 100 percent bio-degradable and reusable and therefore environmentally friendly with moisture content of 12.6%

Glass fibre reinforced concretes are mainly employed in exterior building façade panels and as architectural precast concrete. This material is incredibly sensible in creating shapes on the front of any building and it is less dense than steel

Use of carbon fibre is not well developed process. But it has considerable strength and Youngs modulus. Also investigates have shown that use of carbon makes the concrete very durable. Study on carbon fibre is limited. Mainly used for cladding purpose. Natural fibres are low cost and abundant.

Addition of tyre

Tyres are composed of materials which do not decompose under environmental conditions and cause serious contaminations. Burning is a choice for their decomposition, the gases exhausted from the tyre burning results in harmful pollutions. Use of tyre pieces in concrete composite makes significant improvement in flexural, tensile and compressive properties of concrete. Also using tyre pieces as a partial replacement of aggregate solves environmental problem. Addition of tyre in cement concrete reduces cost and also it reduces its weight.

Materials used

The basic materials for mixing Concrete are

Cement,

Sand,

Aggregate and

Tire rubber

Naturally occurring Jute Fiber are to be taken

2. LITERATURE REVIEW

The audit of writing is relating to a portion of the imperative articles and review recorded by different specialist in their journals and references from IS codes.

1. **Vipul kumar (Aug 2015)** This project can bring out a solution for waste management problem. On adding natural jute fibre to the concrete mix the outcome is workability of fibre reinforced concrete decreases because of the water absorbing property of jute fibre.Conducted an experimental study on M30 concrete. Mix design is carried out as per Indian standard 456-2000. And fiber cement ratio is taken as 0.5% , 1% , 1.5% and fiber length was taken as 5mm-10mm Observed decrement in slump values from 0.5% to 1.5% due to the water absorption capacity of fiber. Compressive test on cubes were carried out. The compressive strength of experimental cubes comes out to be higher than that of plain concrete with an average value of 46N/mm2.Observed that the difference in Initial setting and final setting time of mix increased with increased ratio of fiber – cement .The standard consistency or water cement ratio increases with an increase fiber cement ratio.

2. Tushar R More1, Pradip D Jadhao1 and S M Dumne (2015) Conducted an experimental study on M53 concrete. The rubber aggregates used are prepared mechanically by cutting the tyres to maximum nominal size equal to 4.75.Four different concrete mixes of same concrete grade are prepared with constant 10% silica fume replaced to cement and by partial replacement of fine aggregates of 3, 6, 9 and 12% with rubber aggregates by an equal volume of rubber aggregates to form rubberized concrete. And concrete of same grade is prepared with no replacement of fine aggregate and silica fume. Then checked the compaction factor, flexural strength split tensile strength at 7th and 28th days for various concrete mixes. the results for workability, flexural strength, splitting tensile strength tests are conducted using M25 with 0, 3, 6, 9 and 12% replacement of rubber aggregates to natural aggregates for further discussion and interpretation. Observed the decrease in compaction factor due to increase in percentage of rubber aggregates in all sample of concrete mix. Also found the effect of size and shape of rubber aggregate on compaction factor. During test of flexural strength, it is observed that

nature of crack formation in rubberized concrete different from normal concrete. Observed an increment of compressive strength from 3 to 6% and decrement of compressive strength from 6 to12%

3. **Pooja Warke and Shrinkhala Dewangan,(May 2016)** Conducted an experimental study on M20 concrete. Various tests for properties of aggregate and properties of cement carried out. Add jute fibers to the concrete mix as 0.2%,0.3%,0.4% volume of concrete. Final strength was analysed after 7 days and 28days of curing. Admixtures such as Sikkament, Sikkament are used to improve the behavior of concrete under a variety of conditions. The addition of jute fibers increased compressive strength higher with the 0.2% fiber-cement ratio and little decreases compressive strength with 0.3% fiber-cement ratio and 0.4% fiber cement ratio of compressive strength little decreases as compared to 0.3% of fiber-cement ratio.

4. Rahul R. Kshatriya, Vikas L. Kumavat (2016) Conducted an experimental study on M53 concrete and compared with M40 concrete..First determine the mix proportion of M40 concrete. Jute fiber is treated with alkali, polymer mix. All the specimens were demolded after 24 h of casting and water cured for 7 days respectively. At the specified date they were removed from water, surface dried and tested. Each test result represented the mean of at least three specimens. All the specimens were demolded after 24 h of casting and water cured for 7 days respectively. At the specified date they were removed from water, surface dried and tested. Each test result represented the mean of at least three specimens. observed that when the raw jute is added in concrete by 1% weight of cement then the compressive strength of concrete cube increased by 17.5% and by adding modified jute compressive strength increase by 26.5%.observed that when the raw jute is added in concrete by 1% weight of cement then the split tensile strength of concrete cylinder increased by 7% and by adding modified jute split tensile strength increase by 6%.observed that when the raw jute is added in concrete by 1% weight of cement then the flexural strength of concrete cube increased by 1% and by adding modified jute flexural strength increase by 4%.

IS Codes

IS 10262:2009 It is applicable to ordinary and standard concrete grades. Concrete mix need to be proportioned for higher target mean compressive strength f‟ck. Standard deviation is calculated for each test sample and acceptable record for calculation of standard deviation shall be not less than 30. Mix design is calculated as the preliminary free water-cement ratio corresponds to the target strength at 28 days selected from water cement ratio given in IS 456-2000.quantity of maximum mixing water per unit volume of concrete is determined from table 2.Amount of cementitious material is calculated in accordance with the water cement ratio and the quantity of water per unit volume of concrete design should be based on 28 day characteristic strength.

3. PROPERTIES OFMATERIAL USED

Cement

In this project OPC 25 and 30 grade-MAHA cement was used. The properties of cement used were given in table below.

SL.NO	PROPERTIES	VALUES OBTAINED
1	Specific gravity	3.23
2	fineness	7%
3	Initial setting time	35 minutes
4	consistency	32%

Fine aggregates

River sand passing through 4.75mm is used

SL.NO	PROPERTIES	VALUES OBTAINED
1.	Specific gravity	2.65
2	Fineness modulus	3.20

Coarse aggregates

The materials whose particles are of size are retained on IS sieve NO.480(4.75mm)is termed as coarse aggregates.

SL.NO	PROPERTIES	VALUES OBTAINED
1	Specific gravity	2.58
2	Fineness modulus	7.14

Water

Water chemically combines with cement to form hydration product, calcium silicate hydrate gel. The strength of cement concrete comes mainly from the binding action of hydrated cement paste gel. The addition of water should be restricted to that required for chemical reaction with cement, as excess water would end up only in the formation of undesirable voids in hardened cement paste in concrete.

Jute fibre

Jute fiber has high strength, good elasticity and excellent abrasion resistance. Jute fibre is collected and it is chopped into 20mm length.

Length of jute fibre 20mm

Diameter of jute fibre 4mm

Color of jute fibre yellow brown

Tyre

Tyres are composed of materials which do not decompose under environmental conditions and cause serious contaminations. Burning is a choice for their decomposition, the gases exhausted from the tyre burning results in harmful pollutions. Use of tyre pieces in concrete composite makes significant improvement in flexural, tensile and compressive properties of concrete. Waste tyre rubber pieces having 30mm size selected, Tyre pieces provide good elasticity.

4. RESULT AND DISCUSSION

1. Slum test result

sl.no	specimen	Water cement ratio	slump height (mm)
1	CS	0.5	90
2	CT1	0.45	40
3	CT2	0.45	60
4	CT3	0.45	40
5	CJ1	0.5	30
6	CJ2	0.5	40
7	CJ3	0.5	30

2. Compaction Factor Results.

Sl.no	specimen	Water Cement ratio	Compaction factor
1	CT1	0.45	0.786
2	CT2	0.45	0.78
3	CT3	0.45	0.7910
4	CJ1	0.5	0.812
5	CJ2	0.5	0.8
6	CJ3	0.5	0.8

3. compressive strength test value of M30 plain concrete at 28 days.

sl.no	specimen	compressive strength (N/mm2)
1	CN1	30.22
2	CN2	31.5
3	CN3	30.67

4. Compression Test Value Of M30 Concrete cubes On Addition Of Jute Fiber

sl.no	specimen	average compressive strength (N/mm2)
1	CJ1	38.4
2	CJ2	35.7
3	CJ3	37

5. Density Of M25 Concrete Cube On Partial Replacement OfAggregate By Tyre Rubber

Sl.no	**Specimen**	**Mean density (Kg/m3)**
1	**CT1**	**2339.7**
2	**CT2**	**2322.9**
3	**CT3**	**2245.86**

6. Compressive Strength Of M25 Plain Concrete

sample	Compressive strength (N/mm2)	Mean compressive strength (N/mm2)
1	25.11	25.48
2	25.78	
3	25.56	

7. compression test on m25 concrete cube on partial replacement of aggregate by tyre

sl.no	specimen	percentage of tyre	average compressive strength (N/mm2)
1	CT1	10	24
2	CT2	20	27.11
3	CT3	30	24.88

8. flexural strength of 25 concrete beam

sl.no	specimen	percentage of tyre	average flexural strength (N/mm2)
1	CTO	0	4.785
2	CT1	10	3.36
3	CT2	20	5.55
4	CT3	30	3.99

5. CONCLUSION

Utilizing the waste tyre rubber as partial substitute for coarse aggregate in concrete reduces problem of disposing the waste and it shows increase in the strength of concrete. Compressive strength tests and flexural strength tests are performed on the casted specimens, which proved that the strength of the specimens are increased .

Also compressive strength tests were conducted on concrete specimens with 0.5%, 1%, 1.5% jute with respect to concrete and comparisons had done. It is observed that there is considerable change in the behavior of concrete due to the addition of tyre rubber and jute.

The findings of this project can be concluded as follows:

- The jute fibers used in this project has shown considerable improvement in all the properties of concrete (M30) when compared to standard M30n concrete.
- Compressive strength of concrete added with jute fibers is improved by 23 %.
- By estimation of cost it have been seen that for concrete reinforced with jute the cost has been increased in every % since because jute is extra addition.
- The M25 concrete specimen used in this project have shown a small increment in compressive strength and flexural strength.
- Compressive strength of concrete replaced with tyre chips is improved by 8%.
- Flexural strength of concrete replaced with tyre chips is improved by 6.3%.

By estimation of cost, it have been seen that for concrete replaced with tyre chips the cost has been decreased in every % because tyre is a waste material

- Construction using tyre chips can be considered as a alternate method for waste tyre management.
- The light unit weight qualities of rubberized concrete may be suitable for architectural application, false facades, stone baking, and interior construction, In building as an earthquake shock wave absorber, where vibration damping is required

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