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"Practicability Of Jute Fiber With Optimum Replacement Of Natural Sand With Artificial Sand In Concrete"

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ABSTRACT

The huge quantity of concrete is consumed by construction industry all over the world. In India, the conventional concrete is produced by using natural sand obtained from riverbed as fine aggregate; but now as the use of concrete has increased all over the world simultaneously use of natural sand has also increased as the consumption of sand has increased the required good quality of sand is not available also poses the environmental problem and hence government restrictions on sand quarrying resulted in scarcity and significant increase in its cost.
In 2017-18 an attempt has been made before to discuss the properties such as workability, split tensile strength and compressive strength of concrete prepared by replacing natural sand with artificial sand at difference replacement levels (65%). The development of cracks and their measurement is also studied. The result have shown that the natural sand can be replaced with a artificial sand up to a maximum replacement level of 65% in order to produce concrete of satisfactory workability, compressive strength and cracks of lesser areas studied.

Key words: concrete, jute fiber, strength, testing ingredient

INTROUCTION

The huge quantity of concrete is consumed by construction industries all over the world. In India, the conventional concrete is produced by using natural sand, cement, coarse aggregate and water. One major challenge facing the civil engineering community is also to execute project in harmony with nature using the concept of sustainable development involving the use of high performance, environment friendly materials produced at reasonable cost. In the context of concrete, which is predominant building material, it is necessary to identify less expensive substitutes.

Now a day's sand is not readily available, it should be transported by long distance. Those resources are also exhausting very rapidly. With a natural sand deposit the world over drying up, there is an acute need for a product that matches the properties of natural sand in concrete. in the last 15 years, it has become clear that the availability of good quality of natural sand is decreasing. So it is need of the time to find out some substitute to natural river sand.
Hence replacing the natural sand with the artificial sand of 65% & natural sand 35% along with the jute fiber, but one must have complete knowledge of concrete making, as there is not much difference in good concrete as far as the concrete is concerned. Concrete is specified as good concrete when it gives required strength; this strength is acquired when the ingredient are mix in proportion. According to the strength acquired by the concrete mix design is classified as M25.

LITERATURE REVIEW

Talk about artificial sand:

- **S.A. Daimi** "the mixes with the artificial sand with dust as fine aggregate gives consistently higher strength than the mixes with the natural sand. The sharp edges of the particles in artificial sand provide better bond with the cement than the rounded part of the natural sand." Published: International journal of earth science andgineering.

- **G. Sreenvisa** "Considering, the acute shortage of river sand, huge short coming on quality of river sand, high cost, greater impact on road damages and environmental effects. The construction industry shall start using the manufactured sand to full extent as alternative, reduce the impacts on

environment by not using the river sand. Published: NBMCV in April 2012

- **Vinayak R. Supekar & popat D. Kumbhar.** "Replacement of natural sand by 60% artificial sand results in producing the concrete of satisfactory workability and strength properties. It is also possible to minimize the area of the surface cracks of concrete. However, more than 60% replacement of natural sand by artificial sand cause reduction in compressive strength of concrete mix with increase in the area of cracks. "published: International journal of Engineering Research & Technology (IJERT) Vo. 1 Issue 7, September -2012 ISSN: 2278-0181 www.ijert.

➢ AIM OF THE JOB:

This project is executed with the aim "practicability of jute fiber with Optimum Replacement of Natural Sand with Artificial Sand in concrete"
This aim is undertaken to check the compressive strength, workability of the concrete after replacing the natural sand by artificial sand along with fibers so as to find the good % of fibers & competitive for the natural sand.

➢ OBJECTIVE:

a) To check the feasibility of fibers in reinforced concrete.
b) To discover a good and competitive replacement for natural sand.
c) To do the comparative study about properties and characteristics of natural sand.
d) To design the concrete mix proportion of M20 for the 65% of artificial 35% sand.
e) To achieve the specified characteristic compressive strength of 7 days and 28 days period by natural sand replacement (of casted cube)
f) To achieve the level of aspect ratio of jute fibers to be used in concrete.

INGREDIENTOF CONCRETE

1. **Cement**:
Cement (BIRLA GOLD –OPC 53) grade grades have been used for mix proportion for M25 grade concrete.

2. **Sand:**
Natural black colored locally available sand at wardha region is used for the study

3. **Artificial sand:**
Available of artificial sand at wardha region used.

4. **Coarse aggregate:**
20mm & 10mm mix coarse aggregate available at wardha region is used for study.

5. **Water:**
tap water of PH value 7.5 is used for study.

6. **Fibers:**
Jute fiber of diameter of 0.01mm used.

TESTING OF MATERIAL

Cement:
For examining the suitability of cement, the following laboratory tests are performed.

a) Sieve test
b) Standard consistency test

Normal consistency of cement is defined as that consistency which will permit the Vicat's plunger to penetrate the cement paste after mixing with water.

The found result is 35%

Natural Sand:
For examining the suitability of sand, the following properties of sand are tested:

a) Fineness modulus
b) Specific gravity
c) Bulking of sand

a) Fineness modulus

It is the number, which gives an idea about the fineness or coarseness of sand, or gives an idea of the mean size of particles in the entire body of the sand.
The found result is 2.99

b) Specific gravity

It is the ratio of dry weight of sand to the weight of equal volume of water.

$$\text{Specific gravity} = \frac{(w2-w1)}{(w2-w1)-(w3-w4)}$$

The found result is 2.59

c) Bulking of sand

Bulking of sand means, increase in volume due to presence of moisture.

Percentage of bulking of sand is 15%

Artificial Sand
For examining the suitability of artificial sand, the following properties of sand are tested.

a) Fineness modulus
b) Specific gravity
c) Impact value

a) Fineness modulus:

It is the number, which gives an idea about the fineness or coarseness of artificial sand, or gives an idea of the mean size of particles in the entire body of the artificial sand.

The found result is 4.16

a) Specific gravity:

It is the ratio of dry weight of sand to the weight of equal volume of water.

$$\text{Specific gravity} = \frac{(w2-w1)}{(w2-w1)-(w3-w4)}$$

The found result is 2.85

b) Impact value:

The artificial sand impact value gives a relative measure of the resistance of an artificial sand to sudden shock or impact. The impact value of artificial sand is generally used as an alternative to its crushing strength.

$$\text{Impact value} = \frac{w2}{w1}x100$$

The average impact value is 57.88%

Coarse Aggregate:

For examining the suitability of coarse aggregate, the following properties of coarse aggregate are tested:

a) Specific gravity
b) Impact value

A) **Specific gravity**:

It is the ratio of dry weight of coarse aggregate to the weight of equal volume of water.

$$\text{Specific gravity} = \frac{(w2-w1)}{(w2-w1)-(w3-w4)}$$

The found result is 2.88

B) Impact value:

The coarse aggregate impact value gives a relative measure of the resistance of a coarse aggregate is generally used as an alternate to its crushing strength.

$$\text{Impact value} = \frac{w2}{w1}x100$$

Average impact value is 31.02%

Fiber:

Natural reinforcing material can be obtained at low cost and low levels of energy using local manpower and technology. Utilization of natural fiber as a form of concrete reinforcement is of particular interest to less developed region where conventional construction materials are readily available or too expensive.

In the late 1960's research on the engineering properties of natural fibers, and concrete made with this fiber undertaken; the result was these fibers can be used successfully to make the thin sheets for walls and roofs.

The fiber is a filament or thread like piece of any material. Fiber is a small piece of reinforcing material possessing certain characteristics properties. It is a long and thin material, can be circular or flat.

Fiber is described by a parameter called "aspect ratio". It is the ratio of fiber to its diameter or least lateral diameter in the case of flat fiber. It ranges from 30 to 150. Generally 1% of fiber is used in concrete.

Calculation of fine aggregate:

$$V = (w+\frac{c}{Sc}+\frac{fa}{pxsfa})x\frac{1}{1000}$$

fa = 612.70 kg/m^3

Calculation of coarse aggregate

$$Ca = (\frac{1-p}{p}) \times fa \times (\frac{fa}{fsf})$$

Ca = 1265.27 kg/m^3

Calculated Quantity:

Cement	Sand	Aggregate	Water
372	612.70	1265.27	0.5
1	1.65	3.40	0.5

Quantity for one cube:

$$\frac{2400}{1+1.65+3.40+0.5}x\ (0.15x0.15x0.15)$$

= 1.25 kg/m^3

Cement = 1.25 x 20 = 25 kg
Sand = 25 x 1.65 = 41.25 kg
Aggregate = 25 x 3.40 = 85 kg
Water = 25 x 0.5 = 12.5 lit

Test no. 1: 100% Natural Sand

Cement = 1.25 kg
Natural Sand = 1.25 x 1.65 = 2.06 kg
Artificial Sand = 00
Aggregate = 1.25 x 3.40 = 4.25 kg
Water = 1.25 x 0.5 = 0.625 lit
Fiber = 00

Test no. 2: 75% Natural Sand & 25% Artificial Sand

Cement = 1.25 kg
Natural Sand = 1.545 kg
Artificial Sand = 0.515 kg
Aggregate = 4.25 kg
Water = 0.625 lit
Fiber = 0.1% = 1.25 gm (wt. of cement)

Test no. 3: 65% Natural Sand & 35% Artificial Sand

Cement = 1.25 kg
Natural Sand = 1.339 kg
Artificial Sand = 0.721 kg
Aggregate = 4.25 kg
Water = 0.625 lit
Fiber = 0.15% = 1.875 gm (wt. of cement)
= 0.2% = 2.5gm (wt. of cement)
= 0.25% = 3.125 gm (wt. of cement)

Test no. 4: 100% Artificial Sand
Cement = 1.25 kg
Natural Sand = 00
Artificial Sand = 1.25 x 1.65 = 2.06 kg
Aggregate = 1.25 x 3.40 = 4.25 kg
Water = 1.25 x 0.5 = 0.625 lit
Fiber = 00

Test no. 5: 75% Artificial Sand & 25% Natural Sand
Cement = 1.25 kg
Natural Sand = 0.515 kg
Artificial Sand = 1.545 kg
Aggregate = 4.25 kg
Water = 0.625 lit
Fiber = 0.1% = 1.25 gm (wt. of cement)

Test no. 6: 65% Artificial Sand & 35% Natural Sand
Cement = 1.25 kg
Natural Sand = 0.721 kg
Artificial Sand = 1.339 kg
Aggregate = 4.25 kg
Water = 0.625 lit
Fiber = 0.15% =1.875 gm (wt. of cement)
= 0.2% = 2.5gm (wt. of cement)
= 0.25% = 3.125 gm (wt. of cement)

Result:
Various tests which were carried out on concrete to check its durability, workability & strength are as follows:-

Result of compressive strength of different % of fiber (test-1)

Sr. No.	% Of Natural Sand	%Of Artificial Sand	Aspect Ratio Of Fiber %	Compressive Strength N/mm^2	
				7 Days	28 Days
1	100	00	00	16.54	29.58
2	75	25	0.1	16.74	28.30
3	65	35	0.15	17.43	28.44
4	65	35	0.2	19.60	30.21
5	65	35	0.25	18.90	29.10

Result of compressive strength of different % of fiber (test-2)
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Sr. No.	% Of Artificial Sand	%Of Natural Sand	Aspect Ratio Of Fiber %	Compressive Strength N/mm^2	
				7 Days	28 Days
1	100	00	00	13.64	20.38
2	75	25	0.1	14.44	22.40
3	65	35	0.15	14.43	25.04
4	65	35	0.2	15.20	24.11
5	65	35	0.25	16.70	23.05

Comparison between percentage of fiber & compressive strength of concrete
Test-1

PERCENTAGE OF FIBER	COMPRESSIVE STRENGTH OF CONCRETE AFTER 28 DAYS
00	29.58
0.1	28.30
0.15	28.44
0.2	30.21
0.25	29.10

Comparison between percentage of fiber & compressive strength of concrete
Test-2

PERCENTAGE OF FIBER	COMPRESSIVE STRENGTH OF CONCRETE AFTER 28 DAYS
00	20.38
0.1	22.40
0.15	25.04

0.2	24.11
0.25	23.05

Conclusion:

From result no.1different aspect ratio of jute fibers vs. compressive strength of concrete for M25 grade. We observed that as aspect ratio of fiber increases up to a certain limit the strength of concrete increases of fiber for the optimum replacement of artificial sand to natural sand. Hence, aspect ratio of fiber of 0.2% of the weight of cement got the maximum strength of M25 grades concrete.

From result no.2 different aspect ratio of jute fibers vs. compressive strength of concrete for M25 grade. We observed that as aspect ratio of fiber increases up to a certain limit the strength of concrete increases of fiber for the optimum replacement of artificial sand to natural sand. Hence, aspect ratio of fiber of 0.15% of the weight of cement got the maximum strength of M25 grades concrete.

Recommendation:

Result has show that, for the optimum replacement of fibers of different aspect ratio artificial sand to natural sand up to the level 65% maximum strength of concrete can be achieved i.e. 30.21 N/MM^2 at aspect ratio of fiber of 0.2% of the weight of cement got the maximum strength of M25 grade concrete. Hence, the jute fiber of 0.2% of weight cement with aspect ratio of 2500 for achieving the maximum strength of concrete.
Result has show that, for the optimum replacement of fibers of different aspect ratio artificial sand to natural sand up to the level 65% maximum strength of concrete can be achieved i.e.25.04 N/MM^2 at aspect ratio of fiber of 0.15% of the weight of cement got the maximum strength of M25 grade concrete. But it is not most suitable for heavy construction therefore it can be used as bed concrete.

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CONCLUSION

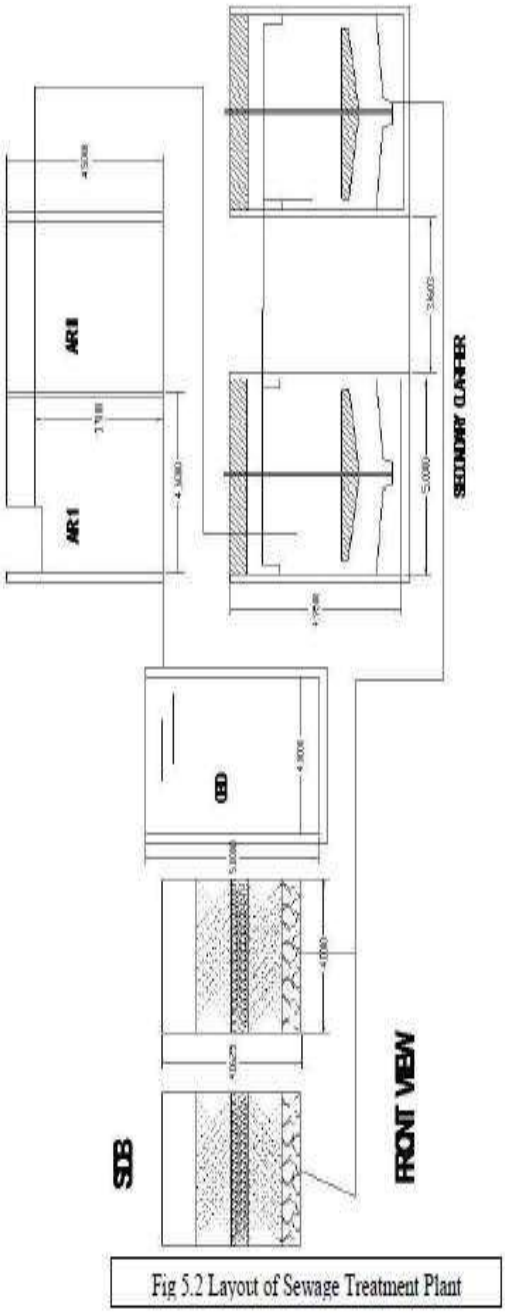

Fig 5.2 Layout of Sewage Treatment Plant

The average ranges of physical, chemical and biological characteristics of waste water quality are experimented and found out.

- The Ph range from 7.8 to 8.01. The Turbidity ranged from 10 to 120 NTU.
- The value of Turbidity was found to be within the permissible limit.
- The Chloride and Alkalinity were in the range of 3.5 to 120 mg/l and 15 to 80 mg/l respectively.
- The Total Iron content was in the range of 0 to 3 mg/l.
- The Zinc content was in the limits of 0.1 to 2 mg/l.
- Copper content ranged from 0 to 0.2 mg/l.
- Potassium was present in the limits of 2 to 12 mg/l.
- The parameters studied resemble the waste water quality.
- Total amount of waste water treated =0.051mld.
- Dimension of the collection pit is calculated to be 4m in diameter and 5m depth of the cylindrical tank.
- A bar screen of width 1.7m is provided.
- Dimension of the aeration tank is $4.5x4.5x3.7m^3$
- Dimensions of Sludge Drying Bed are 4.5mx4.5mx1m of two numbers.