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Comparative Study on Strength of Concrete by Replacing Fine Aggregate with Sea Sand

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Abstract:
Initial goal of this project is to remove the salt content from the by hot water treatment and chemical treatment and determine the performance of concrete by using sea sand as fine aggregate. And to get the most economic material that can be replaced for fine aggregate in construction. Finally finding out compressive strength of sea sand which is replaced with fine aggregate in concrete. Generally salt content present in the sea sand will cause the reinforcement to get corroded which is used in the structure. So that it affects the load carrying capacity of the reinforcement and makes the structure less durable. For removing the salt content from the sea sand there was no specific method of treatment for sea sand. Subsequently there was a need to experimentally make a treatment technique for own. For the most part sea sand can be washed with typical water, yet it is sufficient that water wash can't expel the 100% salt substance from sea sand. So it should be treated by acid or different chemicals. In the present project sea sand was treated with Acetic acid. Test outcome will be obtained from the conductivity test.Cubes were cast for M_{25}, M_{30}, M_{35} and tested for compressive strength after 7 days and 28 days. The Sea sand is replaced in percentages of 10%, 20%, 30%, 40%, 50% and 100%.

Keywords: sea sand, acetic acid, Hotwate

1. INTRODUCTION

At present situation demanding of river sand in construction is very high. In most of the constructions river sand is used as the fine aggregates as the demand increases scarcity of sand also increases this lead to illegal snatching of sand from the river bed. Therefore, it has been very difficult to find out the alternative material for river sand which is having same advantages like easy availability, eco-friendly, cheap. So there is an alternative for river sand which is sea sand can be used for the construction purpose. In our country construction is the very big aspect which is growing very fast and construction of good infrastructure will indicate the development of the country. From past thirty years there is delay in the construction field it may be due to many factors such as shortage of materials, availability of labours, environmental condition, lack of modern equipment facilities, storage problems, etc. And there is such a huge demand for construction materials in those fine aggregates plays a major role. If we replace river sand with sea sand in making of concrete the salt content present in the sea sand defects the structure. Reinforcement in the structure will get corroded and which will fail to transfer the load. So we have to make sure to remove the salt content present in the sea sand for that we have to carry out the different experiments with chemicals to make sure to remove the salt content in sea sand and should check the conductivity reading after each set of acid wash. Nowadays there have been using M-sand or manufactured sand which is also found alternative for the river sand and M-sand is obtained by crushing of rocks in the quarries. This sand has the same properties of river sand which can be used in the construction. M-sand will be cubical in shape and generally the size of the sand will be below 4.75mm. At the end after satisfying the entire requirement when it comes to construction using M-sand the cost is very high and it will become uneconomical compared to river sand. By taking note of all the points we should use sea sand as replacement for river sand as totally or partially.

2. LITERATURE REVIEW

[1] ManikantaKopuri
In this work generally river sand is replaced by sea sand and also two types of cements are used to change in strength parameter with varying percentage of cement content and sea sand content. Here sand was tests were conducted as per code. Here they conducted compression strength, split tensile strength and flexural strength for an M30 grade of a concrete. They concluded that compression strength by using OPC at an 20% of sea sand is used as an substitution of stream sand is 3.16% greater than conversional concrete. Similarly for a PSC at an age of 28days is 19.5% greater than normal concrete. Split tensile strength for an OPC and 20percent substitution of ocean sand as a fine aggregate is 6.98%. Similarly for PSC strength is about 7.88% greater than no replaced concrete. Flexural strength of concrete for a use of OPC and 20% of sea sand is 12.9% and for PSC is 22.2%.

[2] Iyappan. A. P
In persent task Sea sand were gathered from kalpakkam shoreline. It is added to prepare a concrete substitution of river sand in variation of 0, 20, 40, 60% to know the compressive and split tensile test on concrete. Mix proportion (M40) was done according to IS 10262:2009 and in this mix, 75% of coarse aggregate is of 20mm and remaining 25% of 12mm are used. Steel filaments (1% by add up to volume of cement) were added to the solid chambers. The test outcome demonstrates that, compressive strength and split tensile test was decreased for the ocean sand extents 20 present, 40and 60% when contrasted and chamber. The cubes have most

astounding compressive strength of 51.7 N/mm^2. Ocean sand extent 20 per cent has high compressive quality 47.55 N/mm^2 when contrasted with ocean sand extent 40 and 60%. The ocean sand extent 40% has compressive quality 45.24 N/mm^2 and ocean sand extent 60percent has most reduced compressive quality 40.80 N/mm^2.

[3] S. Priyadharshini

Here they done the project on the use of a sea sand in the improvement field with the removing of salt content present in the sea sand. Once treatment has been done on sea sand using that sand various test has been conducted on sea sand and fully mix is done for purified sea sand to fulfil required strength at 28 days. The usage of ordinary river sand with ocean sand will conquers the fulfilment of required strength in the necessity of the stream sand in the development. The pure sea sand has higher amount of salt content than the untreated ocean sand. Hence, it is showed that the amount of corrosion is decreased. This proved that removal of salt substance from the ocean sand is required for get the workability and strength of concrete.

3. MATERIAL AND METHODS

3.1 CEMENT

In this work 53 grade ultra tech cement is used. There are two distinct necessities that any concrete must meet: (1) it must build up the proper strength and (2) it must display proper rheological conduct among the compound constituents of cement.

3.2 AGGREGATES

Aggregate is word used for portray any latent material, normally rock subsidiary, usually in between an 50mm to 75µ utilized as filler in concrete mix (make concrete). It is classified into coarseaggregate and fine aggregate.

The properties of fine aggregate are:

As per Indian standards sand is divided into four zones based on the sieveanalysis of steam sand as zone. 1 is an coarser and that of falling on a zone 4 were finer.

3.3 SEA SAND

In this project river sand is replaced by sea sand. And sea sand is replaced with different percentages. Sea sand is belongs to zone IV.

3.5WATER

Water is an imperative element of. It frames quality giving an cement gel, nature of water required to be looked deliberately. A prevalent measuring stick for the reasonableness of water for preparing of an concrete is that, on the off chance that water is fit for drinking it is fit for making concrete however not valid for all conditions. Water is required for reason for hydration and for getting appropriate functionality.

4. METHODOLOGY

4.1 Conductivity test on sea sand

In this project, sea sand used throughout the project is collected from Thannirbavi Beach, Mangalore.

4.2.1 Trial 1

At first conductivity test has been conducted for a trail sample consisting of sea sand and hot water has been used. The reason for using hot water is to remove the salt content which is present in the sea sand. Sample 1: it is consisting of 40^{0}C of water + sea sand.

Sample 2: it is consisting of 50^{0}C of hot water +sea sand.

Sample 3: it is consisting of 60^{0}C of water+ ocean sand.

Sample 4: it is consisting of 100^{0}C of water and sea sand is added beaker.

Now sea sand has been washed twice, so that small amount of salt content is removed, which is present at the surface. Now sea sand obtained after water wash is taken into small beaker and added the hot water of 40^{0}C and then sample has been stirred well using glass rod. After stirring the sample, the solution is transferred to another beaker through filter paper. Now conductivity test is conducted by immersing the probe into a new beaker consisting of filtered solution. Similarly conductivity test is conducted for time intervals of 10min, 20min, and 30min. After that conductivity test has been conducted and noted down the readings. Now similarly hot water of 50^{0}C, 60^{0}C, 100^{0}C is collected in the different beakers. Now sea sand after water wash is poured into the above beakers and stirred well. Now the sample is transferred through filter paper and collected the solutions in the new beaker. Conductivity test is conducted for time intervals of 10min, 20min, and 30min.

RESULTS

From Trial 1:

- It has been observed that hot water washed sample has removed salt content maximum in 60^{0}C than normal Water wash.

From Trail 2:

- It is observed that most of the salt is removed at 3% concentration of acetic acid.
- In this trial we are concluded that 3% concentration of acetic acid can remove the salt content from the sea sand.
- In this trial we are fixed the acetic acid concentration.

5. RESULTS HOT WATER WASH

5.1 Compressive strength results for M25 grade concrete

Compression test are conducted on concrete cubes (different % of sea sand) for M25 grade is showed in Table .5.1 and Fig 5.1.

Table.5.1. Compressive strength results for M25 on different percentage of sea sand

Mix designation	Percentage of sea sand replacement	Compressive strength n/mm^2	
		7 days	28 days
M 25	0%	20.1	34.31
	10%	12.6	22.91
	20%	14.4	25.38
	30%	13.83	24.05
	40%	12.38	21.5
	50%	11.65	20.28
	100%	10.21	17.16

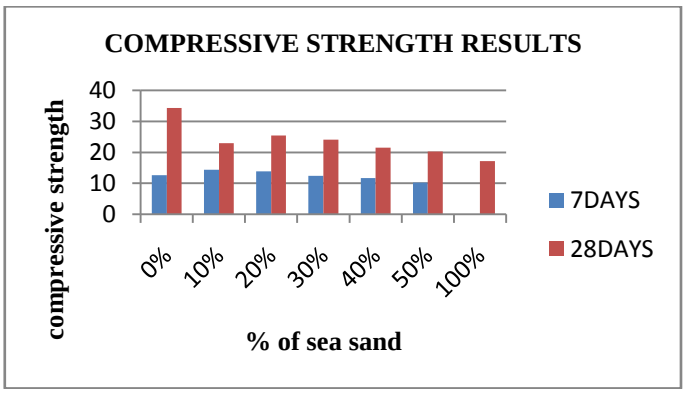

Figure.5.1. Variation in compressive strength at 7 days & 28th day of M25 with various % of sea sand respectively.

5.2Compressive strength results for M30 grade concrete
Compression test are conducted on concrete cubes (different % of sea sand) for M30 grade. After curing period cubes are tested and is in Table. 5.2and graphical variation are shown in Fig 5.2.

Table.5.2. Compressive strength results for M30 on different percentage of sea sand

Mix designation	Percentage of sea sand replacement	Compressive strength n/mm^2	
		7 days	28 days
M 30	0%	23.11	43.32
	10%	15.41	26.74
	20%	17.57	29.47
	30%	15.97	25.26
	40%	14.56	24.13
	50%	13.12	22.96
	100%	10.01	18.65

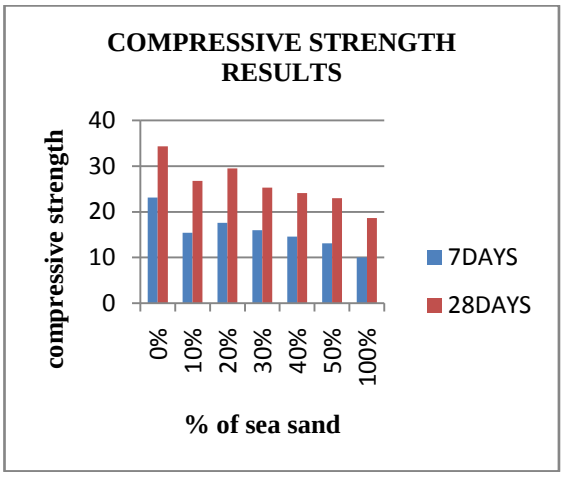

Figure.5.2. Variation in compressive strength at 7 days & 28th day of M30 with various % of sea sand respectively.

5.3 Compressive strength results for M35 grade concrete
Compression test are conducted on concrete cubes (different % of sea sand) for M25 grade. Test for compression were tabulated in table 5.3 and graphical variation are shown in Fig 5.3.

Table.5.3: Compressive strength results for M35 on different percentage of sea sand

Mix designation	Percentage of sea sand replacement	Compressive strength N/mm^2	
		7 days	28 days
M 35	0%	31.23	49.62
	10%	17.43	27.26
	20%	15.95	26.12
	30%	14.87	24.96
	40%	13.21	23.42
	50%	12.37	21.83
	100%	9.86	18.37

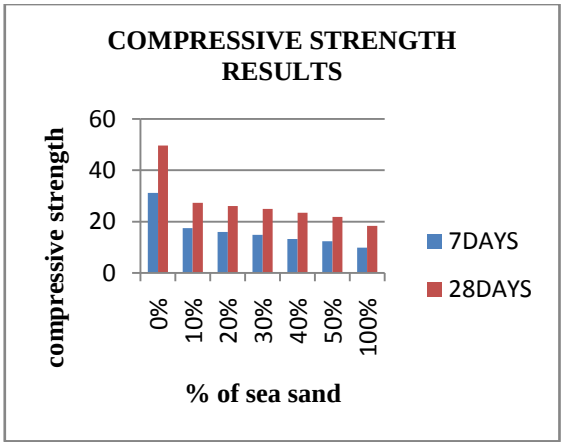

Figure.5.3. Variation in compressive strength at 7 days & 28th day of M30 with various % of sea sand respectively.

6. RESULTS OF BOTH HOT WATER AND ACID WASH

6.1 Compressive strength results for M25 grade concrete
Compression test are conducted on concrete cubes (different % of sea sand) for M25 grade. Test outcome are shown at a Table 6.1 and graphical variation are shown in Fig 6.1.

Table.6.1. Compressive strength results for M30 grade concrete (Acid wash)

Mix design ation	Percentage of sea sand replacement	Compressive strength N/mm^2	
		7 days	28 days
M 25	0%	20.1	34.31
	10%	20.36	31.46
	20%	21.24	32.98
	30%	22.74	33.52
	40%	21.02	30.98
	50%	19.84	29.43
	100%	17.34	24.45

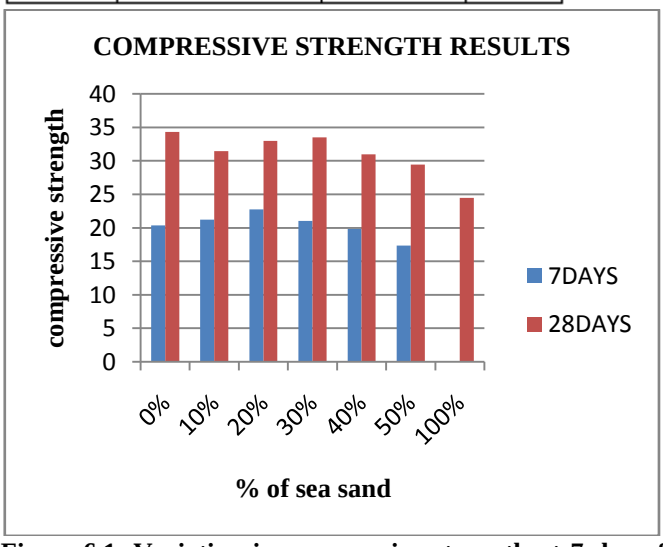

Figure.6.1. Variation in compressive strength at 7 days & 28th day of M25 with various % of sea sand respectively (Acid wash).

6.2 Compressive strength results for M30 grade concrete
Compression test are conducted on concrete cubes (different % of sea sand) for M30 grade and its strength are tabulated at Table 6.2 and graphical variation are shown in Fig 6.2.

Table.6.2. Compressive strength results for M30 concrete (Acid wash).

Mix designation	Percentage of sea sand replacement	Compressive strength n/mm^2	
		7 days	28 days
M 30	0%	23.11	43.32
	10%	24.56	36.72
	20%	25.92	37.11
	30%	26.82	38.93
	40%	24.13	32.84
	50%	21.17	29.23
	100%	18.34	26.12

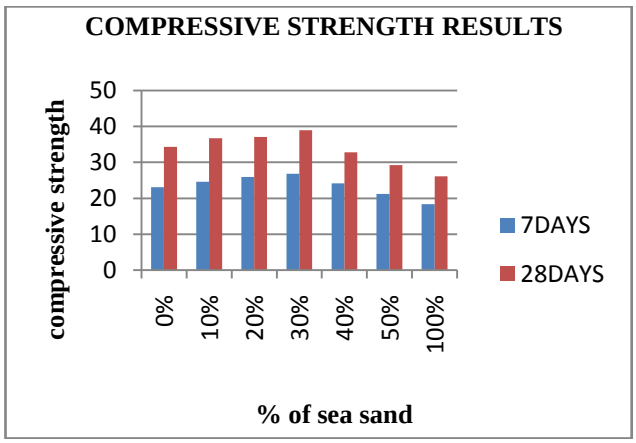

Figure.6.2. Variation in compressive strength at 7 days & 28th day of M30 with various % of sea sand respectively (Acid wash).

6.3 Compressive strength results for M35 grade concrete

Compression test are conducted on concrete cubes (different % of sea sand) for M25 grade. After curing period of 7 & 28 days cubes were tested and its output are shown in Table 6.3 and graphical variation are shown in Fig 6.3.

Table.6.3. Compressive strength results for M35 on concrete (Acid wash).

Mix design ation	Percentage of sea sand replacement	Compressive strength N/mm^2	
		7 days	28 days
M 35	0%	31.23	49.62
	10%	28.86	39.26
	20%	29.43	44.6
	30%	27.3	37.7
	40%	25.42	35.83
	50%	22.97	34.37
	100%	19.89	30.02

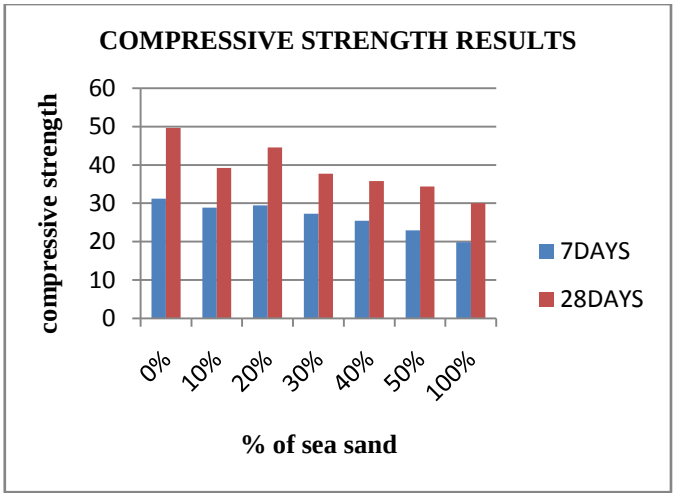

Figure.6.3. Variation in compressive strength at 7 days & 28th day of M35 with various % of sea sand respectively (Acid wash).

7. CONCLUSION

The ocean sand without any treatment is not suites for concrete preparation purpose due salt content present in it and therefore this will leads to corrode the reinforcement in a structural member.

Chemical treatment

Chemical treatment is concludes that most of the salt content is removed when sea sand is washed with hot water at an temperature of 60^{o}C and then treated with acid wash at an concentration of 3% of acetic acid at a time interval of 3 hours.

Hardened concrete

Hot water wash

It is observed that, compressive strength is gradually decreased for all grades of concrete used for all percentages of replacement for river sand by sea sand as fine aggregate. It concludes that hot water wash is not suitable for construction due to gradually decreasing in compressive strength.

Chemical treatment

It also observed that, for M25 and M30 grades compressive strength increased up to 30% replacement of steam sand by ocean sand as a fine aggregate. And for M35 grade of concrete strength is increased up to 20% replacement of river sand. And hence combination of both treated sea sand and river sand (30% replacement of sea sand) can be used in concrete in construction purpose for non-structural members for M25 and M30 grade of concrete and similarly 20% replacement for M35 grade of concrete. This is mainly due to the presence of salt substance present in the treated ocean sand in structural member and its durability is unknown and it is not yet studied

8. ACKNOWLEDGEMENT

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