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Studies on Self Curing Concrete with Manufactured Sand

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ABSTRACT

The consumption of concrete by the construction industry is very high. Sand is essential material in concrete. Nearly 30% of sand is taken for the preparation of concrete. The fine aggregate is usually obtained from natural sources dredging of river beds or river banks. Because of deficiency of river sand the main alternative to this inconvenience is the utilization of produced sand or manufactured sand. The manufactured sand is obtained by crushing the rocks. The cost of manufactured is lower than river sand. The most advantage of manufactured sand is easily available and it has better results as compared to the river sand. In this investigation the river sand was replaced with Manufactured Sand by 50% and 100% proportions. Self curing of concrete is enhanced by polyethylene glycol which increases hydration and strength properties of concrete. It also shows the effect of Polyethylene glycol on compressive strength, split tensile strength and flexural strength by 0.3% percentage of PEG(1500) by weight of cement were studied for 50% and 100% replacement of manufactured Sand on M20, M30 and M40 grade of concrete.

KEYWORDS

Manufactured sand, self curing concrete, PEG- polyethylene glycol

INTRODUCTION

Concrete curing is the way toward controlling the rate of moisture loss from concrete amid bond hydration. Performance and durability requirements are widely achieve by proper curing of concrete. Concrete structures are normally cured by external curing. The curing period may depend on the properties required of the concrete, the ambient conditions and the purpose for which it is to be used, i.e. the relative humidity and temperature.

Self curing is a method that can be utilized to give extra dampness in concrete. Due to provision of additional moisture effective hydration of cement will takes place. Water-soluble chemicals added during the mixing can be decrease water evaporation from the concrete, making it "self-curing". Mainly polyethylene glycol, super absorbent polymers, light weight aggregates are taken has self curing agents. Here polyethylene glycol (1500) is used in the concrete to make it as a self curing.

Manufactured sand is produced from hard granite stone by crushing and it is good substitute for river sand. Because of quickly developing of development industry, the interest for sand has expanded, causing inadequacy of stream sand in most piece of the world. The manufactured sand is of cubical shape with grounded edges, washed and reviewed to as a development material. The size of the sand can be altered to meet the required grading for construction work. Here we are using manufacture sand by river sand is used to concrete mix in self curing concrete.

The Manufactured sand is easily available and has shown better results as compared to the natural sand. In this investigation the natural sand was replaced with Manufactured Sand by 50% and 100% proportion. Concrete require minimum 28 days curing to achieve good strength. In the present study, self curing is achieved by using polyethylene glycol. It also shows the effect of PEG on strength by 0.3% percentage by weight of cement, were studied for 50% and 100% replacement of Manufactured Sand on M20, M30, M40. The quality of Manufactured Sand is better than the river sand in all aspects and self-curing gives better results as compared to the standard moist curing.

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OBJECTIVES OF THE STUDY

The main objective of the present study is to experimentally investigate normal concrete and self curing concrete containing 50% and100% Manufactured sand.

- To study the strength characteristics of concrete replacing with manufactured sand.
- To study the strength characteristics of self curing concrete replacing with manufactured sand.
- To study the strength characteristics of concrete.

1) Compressive strength
2) Split tensile strength.
3) Flexural strength.

PROPERTIES OF MATERIALS

CEMENT

In this investigation 53 grade ordinary Portland cement was used. Cement is the bonding material. The cohesive & adhesive properties make it capable to unite the aggregate materials and make the compacted gathering. The specific gravity of cement was 3.15.

FINE AGGREGATE

RIVER SAND

River sand is naturally obtained granular material obtained by dredging from river beds. Sand is basically filler for the voids in concrete. Increasing the proportion of sand in the total mix increases cement demand because of the relatively very large surface zone that needs to be covered by cement paste. The properties of fine aggregate are shown in below Table1. Hence, cement demand is increased to maintain the same W/C Ratio. Locally accessible river sand having bulk density 1860 kg/m3 was used. River sand is sieved to 4.75 mm and the passed out sand is used.

Table 1. Properties of river sand

S. No:	Property	Value
1	Specific gravity	2.66
2	Water absorption	6.2%

MANUFACTURED SAND

Manufactured sand is obtained from crushing hard rock's using heavy machinery. It is finely graded and cubical in shape. Which gives greater durability and higher strength to concrete by overcoming deficiencies like segregation, bleeding, honey combing, voids and capillary and it will withstand any climatic conditions. Overall Manufactured sand is economy in construction industry. Required grade of sand for the given purpose helps the concrete more compact, thus increasing the strength of concrete.

Table 2. Properties of manufactured sand

S.No.	Property	Value
1	Specific gravity	2.70
2	Water absorption	6.7%

COARSE AGGREGATE

In this investigation, coarse aggregate is passes through 20mm sieve and retained on 16mm sieve. Well graded cubical or rounded coarse aggregates are desirable. Quality of the Aggregates should be uniform with respect to shape and grading. Specific gravity of coarse aggregate used here is 2.80.

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WATER

Water is one of the essential component in development work. Water is the one of the major constituents of preparing concrete as well as curing. The strength and durability of concrete depends on the quality and quantity of water. The water using for concrete mixing should be free from alkalis, oils, acid, organic materials etc. Generally potable water is considered for concrete mixing.

POLYETHYLENE GLYCOL

Polyethylene glycol is a consideration polymer of ethylene oxide and water with the formula H (OCH2CH2) nOH, n is the average number of repeated oxy ethylene groups from 4 to 180. Polyethylene glycol is termed in combination with numeric suffix which specify the average molecular weights PEG are prepared by polymerisation of ethylene oxide and commercially available over broad range of molecular weights from 300 g/mol tp 10,000,000 g/mol. Polyethylene glycol appears to be the water soluble mature. Polyethylene glycol is odourless, non-toxic, lubricating, non irritating and non volatile and used in pharmaceuticals.

Fig 1: Polyethylene glycol

COMPRESSIVE STRENGTH TEST

Compression is one of important property of the concrete. Concrete is strong in compression. Here 150mm cubes of a concrete were tested using a compression machine after 28 days of curing. Load is applied on the sides of cubes during compression testing such that the load was exerted perpendicularly to the direction of casting. Average value of three cubes was taken as the compressive strength.

Fig 2: cube specimen testing

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Table 3. Compressive strength @ 28 days (N/m^2)

Proportions	M20	M30	M40
M1(Normal concrete)	27.11	39.02	48.53
M2 (0.3% PEG)	28.88	40.73	50.30
M3 (50% M sand)	30.48	42.30	51.82
M4 (50% M sand +0.3% PEG)	31.55	43.55	53.24
M5 (100% M sand)	28.61	40.44	49.86
M6 (100% M sand + 0.3% PEG)	29.18	41.03	50.36

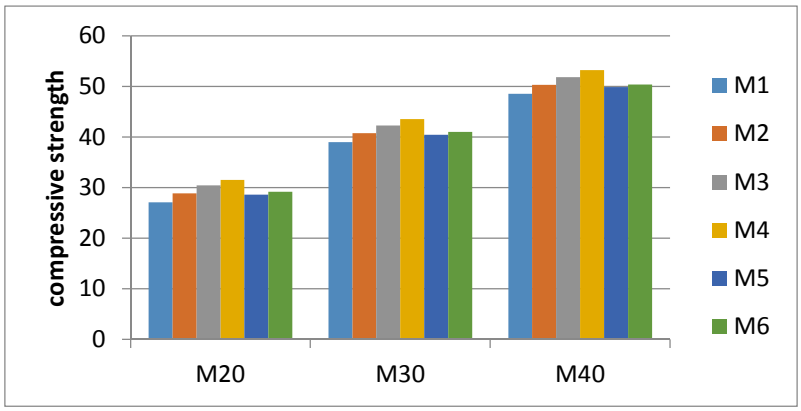

Chart 1: Compressive strength of concrete @ 28 days (N/m^2)

SPLIT TENSILE TEST

Tensile strength is one of the essential and imperative properties of the concrete. Due to the property of low tensile strength and brittle nature of concrete it cannot resist the direct tension. However the assurance of elasticity of cement is important to decide the heap at which the solid individuals may break. The splitting is a type of tension failure. Tests are carried out on 150X300 mm cylinders to attain the split tensile strength after 28 days of curing. In this test the cylinder is placed horizontally, between plates of testing machine. The load is increased until the failure occurs.

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Fig 3: cylinder specimen testing

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Table 4. Split tensile strength @ 28 days (N/m^2)

Proportions	M20	M30	M40
M1(Normal concrete)	2.45	3.39	4.35
M2 (0.3% PEG)	2.61	3.53	4.49
M3 (50% M sand)	2.82	3.72	4.69
M4 (50% M sand +0.3% PEG)	2.90	3.81	4.77
M5 (100% M sand)	2.61	3.56	4.52
M6 (100% M sand + 0.3% PEG)	2.66	3.60	4.56

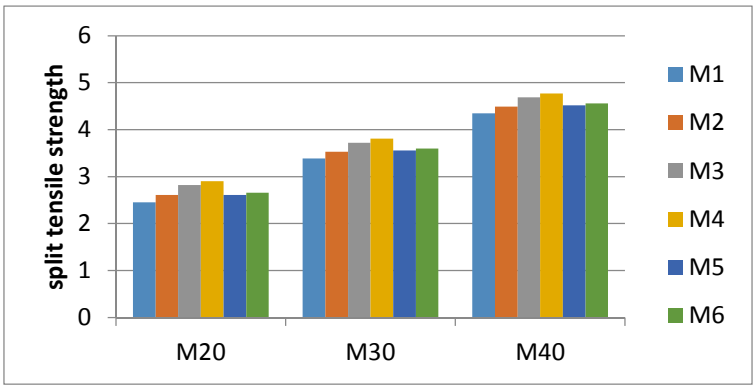

Chart 2: Split tensile strength of concrete @ 28 days (N/m^2)

FLEXURAL STRENGTH TEST

Flexural strength is the capacity of beam or slab to resist bending failure. After 28 days of curing, tests are carried on 500X100X100 mm beam to attain the flexural strength. The beams are tested in UTM by applying two point loading.

Fig 3: Beam specimen testing

Table 5: Flexural strength @ 28 days (N/m^2)

Proportion	M20	M30	M40
M1 (Normal concrete)	3.13	4.0	5.02
M4(50% M sand+0.3% PEG)	3.64	4.43	5.49

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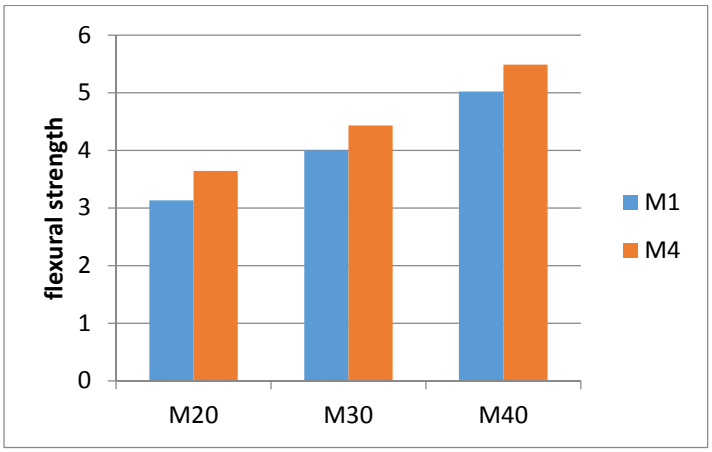

Chart 3: Flexural strength of concrete@ 28 days (N/m^2)

CONCLUSION

Based on the results obtained in this study, the following conclusions can be drawn:

The experimental investigation has been completed to analyse the residual compressive, split tensile and flexural strength of concrete for M20, M30, M40 grade of concrete with replacement of 50% and 100% manufactured sand and manufactured sand self curing concrete with 0.3% of Polyethylene glycol (1500).

- It is observed that the strength of concrete is increased by 50% and 100% replacement of manufactured sand.
- The experimental results shows that the manufactured sand replaced concrete has higher strength at 50% replacement and additionally increment in the percentage of manufactured sand, decreased the strength of concrete.
- Comparing of test results we found that self curing concrete attains higher strength at lower replacement of manufactured sand.
- Hence this research concluded that 50% manufactured sand self curing concrete obtain high strength. The superior shape, proper gradation, and smooth surface texture of manufactured sand provide greater strength.

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