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The Effect of Admixtures in Concrete Containing Natural and Manufactured sand

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ABSTRACT

Scarcity of good quality Natural River sand due to depletion of resources and restriction due to environmental consideration has made concrete manufactures to look for suitable alternative fine aggregate. One such alternative is Manufactured sand. A great deal of research is currently being conducted concerning the use of plasticizers in increasing the workability and strengthening of reinforced cement concrete and plain cement concrete members. In this thesis work literature review based on workability and compressive strength of concrete as experimental investigations are studied and need of the study is included. The cubes of size 150*150*150 are tested for workability and compressive strength using slump cone test apparatus and compression testing machine. Effect on workability and compressive strength are studied from experimental data obtained for 7 days, 14 days and 28 days. Finally, it has been concluded that use of plasticizers as admixtures results in improvement in workability and finally an increase in compressive strength of concrete. It can be used in concrete as viable alternative to natural sand. This paper puts forward the applications of manufactured sand as an attempt towards sustainable development in India. It will help to find viable solution to the declining availability of natural sand to make eco-balance.

Keyword: - Chemical admixtures, manufactured sand, workability, compressive strength.

1. INTRODUCTION

Concrete is the most widely used man-made construction material in the world. It is obtained by mixing cementations material, water & aggregates in required proportions. The main components of concrete are; cement, coarse aggregate, fine aggregate, water and admixtures. Sand is the one of main constituents of concrete making about 35% of volume of concrete used in construction industry. Digging sand, from river bed in excess quantity is hazardous to environment. The deep pits dug in the river bed, affects the ground water level. Erosion of nearby land is also due to excessive sand lifting. Also, good quality sand may have to be transported from long distance, which adds to the cost of construction. Manufactured sand as replaced materials to natural sand has become beneficial and is common in the world. Manufactured sand is manufactured by crushing larger stones of quarry to particular size of sand. Its chemical & physical properties such as color, size & shape, surface texture up particles depend upon types of stone & its source. Use of manufactured sand has become a good substitute for natural sand and it has become essential keeping in view of technical, commercial & environmental requirements. Proper quality control while using manufactured sand or manufactured sand can result in better results. Admixture is defined as a material, other than cement, water and aggregates, which is used as an ingredient of concrete and is added to the batch immediately before or during mixing.

This paper presents the results of experimental work conducted on performance of concrete made with manufactured sand as fine aggregate. The natural sand was replaced with manufactured sand. The effect of concrete of Manufactured sand (M-sand) has been discussed.

2. OBJECTIVE

The followings are the objectives of the study, which include:

- To study the influence of natural sand and manufactured sand on the compressive strength of concrete with addition of admixture.
- To compare the properties of addition admixture in concrete with manufactured sand and normal concrete.
- To offer a viable solution of manufactured sand to the decreasing availability of natural sand in construction.

3. EXPERIMENTAL PROGRAM

3.1 Materials Used

Cement: In this experiment work, Ambuja Cements Pvt. Ltd OPC-43 cement used agreeing to Indian Standard 8112-1989. The properties of cement are, i) Specific gravity= 3.08, ii) Fineness= 4%, iii) Normal consistency= 28%, iv) Initial Setting Time= 90min, v) Final Setting Time= 9hr 30min

Natural Sand: The sand will be collected in local available sources. The used sand in this project belongs to the Zone-II as per Indian Standard 383-1970 codal provision.

Manufactured sand: Manufactured sand is a fine crushed aggregate produced under controlled conditions from a suitable sound source rock. It is designed for use in concrete, asphalt and other specific products. M-Sand is replaced is fully replacement of river sand. The properties of natural sand and M-sand is shown in table1

Table -1 Properties of Natural sand and Manufactured sand

S.NO	Property	Natural Sand	Manufactured Sand
1	Specific Gravity	2.6	2.9
2	Fineness Modulus	2.78	2.97
3	Bulk Density KN/m^3	1.65	1.72

Coarse Aggregate Crushed angular aggregate with maximum grain size of 20mm and downgraded was used and having bulk density 2770kg/m3. The specific gravity and fineness modulus was found to be 2.88 and 2.75 respectively.

Water: Fresh potable water, which is free from organic substance.

Super Plasticizer: Super plasticizer used in this investigation is Conplast SP430 which is Sulphonated Napthalene Polymers based one and supplied as a brown liquid instantly dispersible in water.

3.2 Procedure

Mix Design was done by Indian Standard Recommended Method (IS 10262 - 1982), The mix ratio is prepared for M30 grade concrete for both conventional sand and also M-Sand. Natural sand is completely replaced by M-sand. The Cube size of (150 x 150 x 150) mm Specimen is prepared for compressive strength. The specimens are tested for 7 days, 14 days and 28 days for M30 with percentage of super plasticizers 1.5%. The mix proportions adopted and quantities of material are presented in Table 2.

Table -2: Concrete Mix Proportions For One m3 at w/c ratio 0.40

Material	Cement	Sand	Coarse Aggregates	Water
Quantity	350kg	637kg	1137kg	140lts
Proportion	1	1.82	3.25	0.40

Compressive Strength Measurements The concrete cubes of size 150 mm×150mm×150mm were casted using 1:1.82: 3.25 mix with a W/C ratio of 0.4 with manufactured sand. During casting the cubes were filled by three layers and each layer is compacted by tamping rod by giving 35 stocks. After 24 hours the specimens were remolded and subjected to curing for 7, 14 and 28 days in portable water. It also stated in IS 516-1959 that the load was applied without shock and increased continuously at the rate of approximately 140 Kg/sq cm/ min until the resistance of specimen to the increasing loads breaks down and no greater load can be sustained. The maximum load applied to the specimen was then recorded as per IS: 516-1959.

Compressive strength (MPa) = Failure load / cross sectional area.

Fig -1: Compression Testing Machine for Cubes

4. RESULTS

After curing, the specimens were tested for compressive strength using compression testing machine of 1000KN capacity.

Table -2: Compressive Strength of Concrete

Sample Type 1	Compressive Strength of Concrete (N/mm^2)		
	7 days	14 days	28 days
S1	18.35	22.52	27.41
S2	19.62	24.25	29.20
S3	21.20	26.80	31.50

Sample Type 2	Compressive Strength of Concrete (N/mm^2)		
	7 days	14 days	28 days
MS1	19.20	23.80	28.50
MS2	22.40	27.20	31.40
MS3	24.00	29.50	33.80

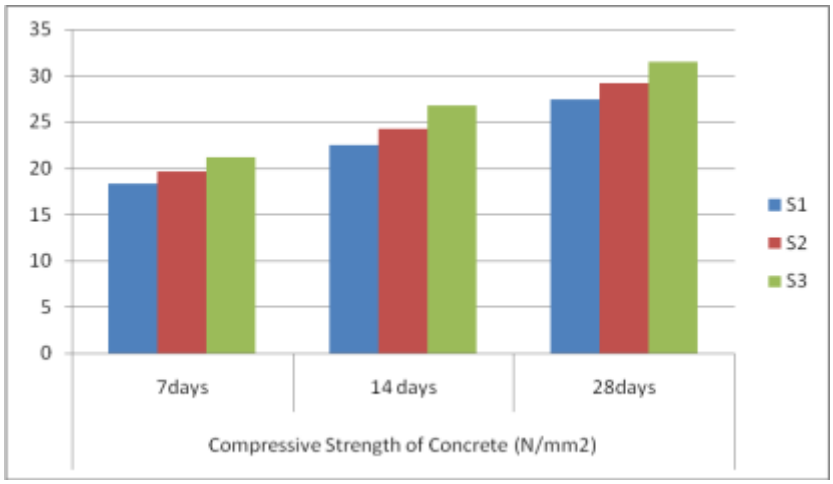

Chart 1 -: Compressive Strength of Concrete

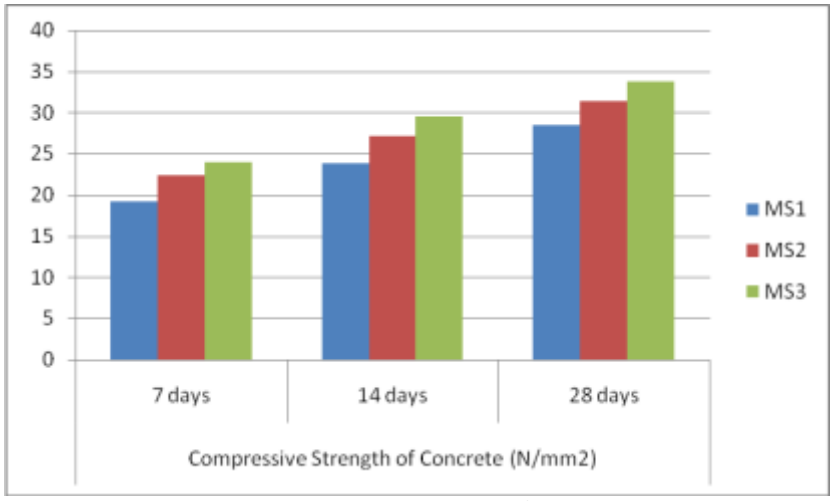

Chart 2 -: Compressive Strength of Concrete

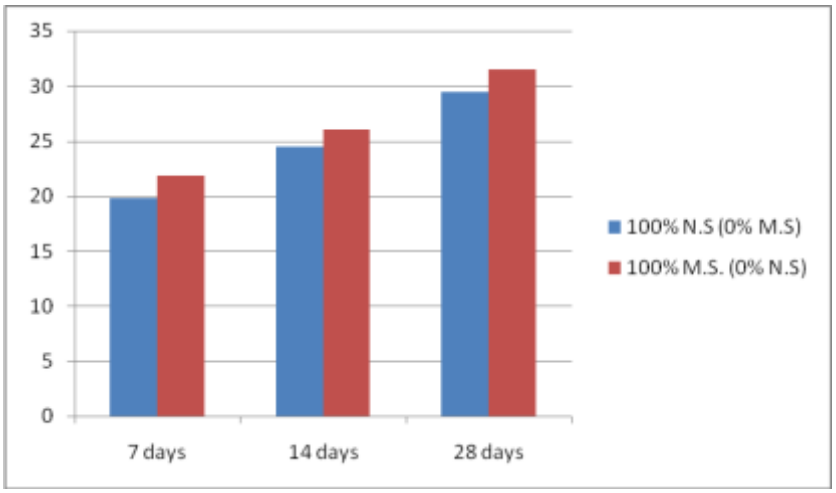

Chart 3 -: Comparison of Compressive Strength of Concrete

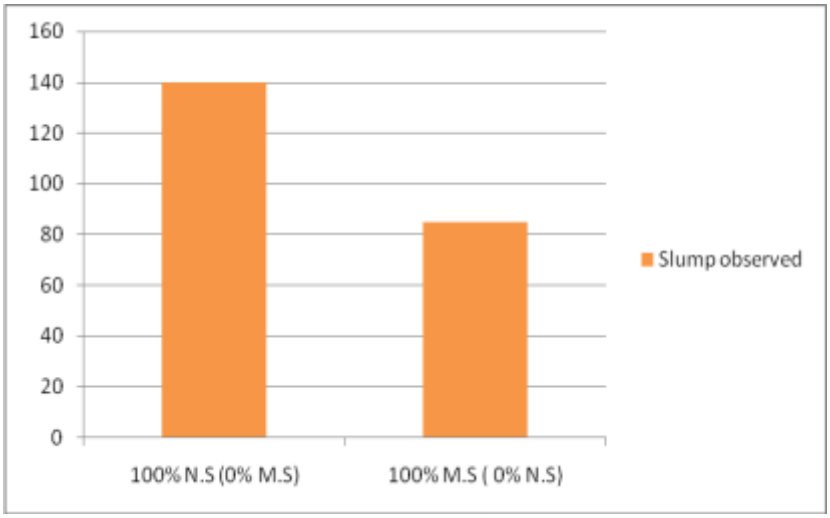

Chart 4 -: Workability of Concrete

5. CONCLUSIONS

This paper was conducted to study the effects of admixtures on properties of concrete in M30. The properties investigated were workability (slump), and compressive strength. However, the conclusion, which follow are drawn based on experimental results and observations presented earlier in the paper.

- Concrete modified with M-sand perform comparatively better than normal concrete with admixtures like superplasticizer.
- The workability of concrete can be increased by addition of superplasticizer. The Slump loss observed in M sand is more than normal concrete, but it can maintained by adding optimum level of water and admixture.
- M-sand with admixture attained high compressive strength compared to natural sand.
- The compressive strength of concrete with M sand was higher than normal concrete when superplasticizer was added. The increment in compressive strength for specimen was 8.5% more than normal concrete
- Considering, the acute shortage of river sand, 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.

From the above experimental results it is proved that, manufactured sand can be used as replacement for the natural sand, and the compressive strength are increased as the percentage of manufactured sand is increased.

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