Cracking Behaviour of Hardened Concrete By Using Nano Silica, Banana Fibers And Zone-Iv Sand As Replacements

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Abstract- *This Dissertation is the combined effect of incorporation of Nano-Silica (NS) and banana fibers (BF)on ordinary grade of cement concrete . An experimental investigation has been carried out by replacing the cement with nano silica of 0.3%, 0.6% and 1% b.w.c., and Banana Fiber has used as volume substitution by 1%, 3%, 5%. The FESEM micrographs support the results and show that the microstructure of the hardened concrete is improved on addition of nano silicawe investigated that ,the used banana fibres are having 40mm length were used. Compressive strength and split tensile strength are determined by using various combinations of NS and BF. Nano-Silica, are having tiny particles, and they leads to can modify the properties by altering the micro-structure of the concrete. Superior improvement is being noticed in the strength properties of concrete when Nano silica is used these nano particles improve C-S- H gel properties up to a extent,The addition of NS to the concrete we implemented zone –iv sand as the fine aggregate will improve the properties strength as well as durability to a great extent. The usage these present materials are increase the bonding between particles and reduce cracking up to a greater extent.*

Keywords- banana fibres, nanosilica, cracking behaviour, Sand zone-iv

I. RESEARCH FRAME WORK

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II. SCOPE OF WORK

The present study incorporates mix design based on the guidelines as per Indian Standard code IS 10262-2009. The nano-silica used is imported from a supplier. The use of any kind of admixture is strictly prohibited in the mix design. The water content has been kept constant to facilitate a better comparison for different samples. The compressive strength measurements are carried out for 7-day and 28-day and the FESEM analysis has been done for 28-day only. The size of the nanosilica was identified using Particle Size Analyser.

III. OBJECTIVE OF THE EXPERIMENTAL PROGRAM

The main objective of this project is to determine experimental investigation on behaviour of Nano-Silica concrete in association with Banana fiber reinforcement.

1. To evaluate the compressive strength, split tensile strength of the Nano-Silica concrete by using Musaacuminate (banana) fibre in different proportions at different ages.
2. The comparison is made between Banana Fibre reinforced Nano-Silica concrete and normal concretewith different percentages at different ages.
3. To evaluate the optimum percentage of Musaacuminate (banana) fibres.

IV. REVIEW OF LITERATURE

Khalil et al 2006 studied fine structure of plant fibers like Banana and pineapple fibers using SEM .The chemical composition of fiber was analyzed according to TAPPI method. Above studies helpful in reducing environmental and health hazards associated with disposal of plant waste.Pothan

et al 2003 studied influence of banana fiber on the visco-elastic properties of polyester.

H. Li et. al. (2004) experimentally investigated the mechanical properties of nano-Fe2O3 and nanoSiO2 cement mortars and found that the 7 and 28 day strength was much higher than for plain concrete. The microstructure analysis shows that the nanoparticles filled up the pores and the reduced amount of Ca(OH)2 due to the pozzolanic reaction. Tao Ji (2005) experimentally studied the effect of Nano SiO2 on the water permeability and microstructure of concrete. The findings show that incorporation of Nano SiO2 can improve the resistance to water of concrete and the microstructure becomes more uniform and compact compared to normal concrete.

Materials used :

a) cement
b) sand
c) coarse aggreagate
d) nano silica
e) banana fibres
f) super plasticizers
g) H_20

MIX DESIGN :

Cement required = 0.024x433 = 10.4 kg
Fine aggregate required = 0.024x614 = 14.7 kg
Coarse aggregate required = 0.024x1192 = 28.6 kg
Water required = 0.024x186 = 4.5 kg

Preparation of Test Specimens:

After taking the quantities of materials we are supposed to prepare the specimens for interpretation of results .according to the Indian standards and procedures

UPV Test Results:

1. UPV Test for control specimen for 7 day

7-DAY TEST RESULT			
Sample No.	Weight (kg)	Velocity (m/s)	Time (µs)
1	8.10	4678	32.2
2	8.34	4702	31.9
3	8.36	4777	31.4

2. UPV Test for specimen with nano-silica 0.3% b.w.c for 7 day

7-DAY TEST RESULT			
Sample No.	Weight (kg)	Velocity (m/s)	Time (µs)
1	8.18	4491	33.4
2	8.22	4491	33.4
3	8.24	4386	34.2

3. UPV Test for specimen with nano-silica 0.6% b.w.c for 7 day

7-DAY TEST RESULT			
Sample No.	Weight (kg)	Velocity (m/s)	Time (µs)
1	8.26	4630	32.4
2	8.08	4630	32.4
3	7.98	4702	31.9

4. UPV Test for specimen with nano-silica 1% b.w.c for 7 day

7-DAY TEST RESULT			
Sample No.	Weight (kg)	Velocity (m/s)	Time (µs)
1	8.24	4491	33.4
2	8.14	4360	34.4
3	8.30	4559	32.9

5. UPV Test for control specimen for 28 day

28-DAY TEST RESULT			
Sample No.	Weight (kg)	Velocity (m/s)	Time (µs)
1	8.42	4808	31.2
2	8.36	4854	30.9
3	8.14	4777	31.4

6. UPV Test for specimen with nano-silica 0.3% b.w.c for 28 day

28-DAY TEST RESULT			
Sample No.	**Weight (kg)**	**Velocity (m/s)**	Time (µs)
1	8.06	4673	**32.1**
2	8.32	4732	**31.7**
3	**8.22**	**4854**	**30.9**

7. UPV Test for specimen with nano-silica 0.6% b.w.c for 28 day

28-DAY TEST RESULT			
Sample No.	**Weight (kg)**	**Velocity (m/s)**	Time (µs)
1	8.18	4702	**31.9**
2	8.24	4777	**31.4**
3	**8.22**	**4777**	**31.4**

8. UPV Test for specimen with nano-silica 1% b.w.c for 28 day

28-DAY TEST RESULT			
Sample No.	**Weight (kg)**	**Velocity (m/s)**	Time (µs)
1	8.30	4658	**32.2**
2	8.30	4702	**31.9**
3	**8.28**	**4808**	**31.2**

1. Compressive Strength of control specimen for 7 day

7-DAY TEST RESULT			
Sample No.	**Weight (kg)**	**Load (tonne)**	Compressive Strength (MPa)
1	8.10	52	**22.67 ***
2	8.34	68	**29.65**
3	8.36	61	**26.59**
Mean			**26.30**

2. Compressive Strength of specimen with nano-silica 0.3% b.w.c for 7 day

7-DAY TEST RESULT			
Sample No.	**Weight (kg)**	**Load (tonne)**	Compressive Strength (MPa)
1	8.18	67	**29.21**
2	8.22	71	**30.95**
3	8.24	52	**22.67**
Mean			**27.61**

3. Compressive Strength of specimen with nano-silica 0.6% b.w.c for 7 day

7-DAY TEST RESULT			
Sample No.	**Weight (kg)**	**Load (tonne)**	Compressive Strength (MPa)
1	8.26	66	**28.77**
2	8.08	72	**31.39**
3	7.98	76	**33.14**
Mean			**31.1**

4. Compressive Strength of specimen with nano-silica 1% b.w.c for 7 day

7-DAY TEST RESULT			
Sample No.	**Weight (kg)**	**Load (tonne)**	Compressive Strength (MPa)
1	8.24	77	**33.57**
2	8.14	79	**34.44**
3	8.30	82	**35.75**
Mean			**34.59**

5. Compressive Strength of control specimen for 28 day

28-DAY TEST RESULT			
Sample No.	**Weight (kg)**	**Load (tonne)**	Compressive Strength (MPa)
1	8.42	84	**36.62**
2	8.36	84	**36.62**
3	8.14	75	**32.70**
Mean			**35.31**

6. Compressive Strength of specimen with nano-silica 0.3% b.w.c for 28 day

28-DAY TEST RESULT			
Sample No.	**Weight (kg)**	**Load (tonne)**	Compressive Strength (MPa)
1	8.06	66	**28.78**
2	8.32	88	**38.37**
3	8.22	88	**38.37**
Mean			**35.17**

7. Compressive Strength of specimen with nano-silica 0.6% b.w.c for 28 day

28-DAY TEST RESULT			
Sample No.	**Weight (kg)**	**Load (tonne)**	Compressive Strength (MPa)
1	8.18	83	**36.19**
2	8.24	80	**34.88**
3	8.22	88	**38.37**
Mean			**36.48**

8. Compressive Strength of specimen with nano-silica 1% b.w.c for 28 day

28-DAY TEST RESULT			
Sample No.	**Weight (kg)**	**Load (tonne)**	Compressive Strength (MPa)
1	8.30	88	**38.37**
2	8.30	93	**40.55**
3	8.28	93	**40.55**
Mean			**39.82**

7-DAY RESULTS	STRENGTH (MPa)	INCREASE IN STRENGTH (%)
CONTROL	26.30	-
NS 0.3% b.w.c	27.61	**4.98**
NS 0.6% b.w.c	31.10	**18.25**
NS 1% b.w.c	**34.59**	**31.52**

Comparison of compressive strength for 28 day

28-DAY RESULTS	STRENGTH (MPa)	INCREASE IN STRENGTH (%)
CONTROL	35.31	-
NS 0.3% b.w.c	35.17	**-0.39**
NS 0.6% b.w.c	36.48	**3.31**
NS 1% b.w.c	**39.82**	**12.77**

V. CONCLUSIONS

Results have been analyzed taking into consideration the strength characteristics of Nano-Silica concrete reinforced withthe banana fibre of M25 grade

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1. The experimental tests revealed that the strength properties of concrete improved with the addition of banana fibres to the Nano-Silica concrete.
2. The addition of Banana Fibres considerably increased the strength characteristics of Nano-Silica concrete, mainly compressive strength and tensile strength.
3. The cracking resistance of the concrete has also improved to a greater extent.
4. When compared to normal concrete, the compressive strength of Banana Fibre reinforced Nano-Silica concrete of M30 grade has improved.
5. The compressive strength of concrete has increased gradually up to 3+3% addition of NS+BS and has shown gradual decrement in the compressive strength beyond that percentage.
6. the split tensile strength results are satisfactory in every curing manner
7. All the used materials very cheap, eco friendly in nature & gives compact structure when we mixed fresh concretes
8. The implementation admixtures are not necessary for these type of mixes
9. M-25 grade is a ordinary and standard concrete but these replacements are gives extraordinary outcomes in the programme
10. But some limitations are for this replacement we can do more trial and errors for beyond M25