

A detailed study on the compressive strength of concrete with the use of nS

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Abstract —*this paper present the work now a day's required better Durability in certain conditions property. Nanotechnology has changed our vision, expectations and abilities to control the material world. The developments in nano-science will have a great impact on the field of construction materials. Better understanding and engineering of complex structure of cement based materials at nano-level will definitely result in a new generation of concrete, stronger and more durable, with desired stress-strain behavior. This research work addresses the measures taken to prevent or minimize the deterioration of concrete, and gives better compressibility. Nanotechnology is widely regarded as one of the twenty-first century's key technologies, and its economic importance is sharply on the rise. There exists an immense need that these measures are recognized and implemented by the construction industry to put a stop to huge money losses.*

Keywords – Concrete, Nano material, concrete cubes, compressive strength.

I. INTRODUCTION

Modern world concrete is the most frequently used material for construction and their design consumes almost the total cement production in the world. The use of large quantities of cement produces increasing CO₂ emissions, and as a consequence the green house effect. A method to reduce the cement content in concrete mixes is the use of silica fines. One of the silica fines with high potential as cement replacement and as concrete additive is nano-silica (nS) which will be the key material to change the construction industry in future era.

The developments in nano-science will have a great impact on the field of construction materials. Better understanding and engineering of complex structure of cement based materials at nano-level will definitely result in a new generation of concrete, stronger and more durable, with desired stress-strain behavior. This research work addresses the measures taken to prevent or minimize the deterioration of concrete, due to compressive load on the concrete material.

II. EXPERIMENTAL PROGRAM

For experimental program different materials with different properties used to fix out best mix proportion which can give better result. Concrete with the use of nano silica and without use of nano silica has been used to get the variety and comparison regarding result. Here mix design has been done on the basis of it concrete were cubes casted and the compressive strength of the cubes has been tested. The various material used for the mix are as mention below :

- Cement: For preparation of samples, 43 grade ordinary Portland cement is used.
- Sand : Zone 1 (As Per IS:383-1970 Specification)
- Aggregate: Aggregates will be of Gandhinagar, Dist. Gandhinagar, Gujarat (As per IS: 383-1970 Specification) used.
- Water: As a constituent of matrix, simple tap water available in laboratory is used. Water quantity is taken with reference to cement content.
- Nano Silica : <100nm, [Sigma Aldrich Company (Germany)]
- Fly Ash: GEB Power Plant, Gandhinagar (if required).

The design of concrete has been done as per IS Code and M40 concrete grade based on that various specimens casted and tested under ideal condition.

First of all concrete without nS has been casted and the compressive test on the specimen has been occurred after that various percentage of nS has been added in the design mix and for that various mixes of concrete has been casted and the compressibility test on the specimen has been occurred. As per IS : 10262 – 2009, with M40 grade of concrete has been designed and casted for the same. After that various compressibility test has been carried out on the specimen after 7, 14 and 28 days respectively and the result of that one has been compared.



Fig.1 Cement Mix



Fig.2 Concrete casted



Fig.3 Compaction of concrete



Fig.4 Testing of nominal cube



Fig.5 Nano Silica



Fig.6 Testing of cube with nS

III. TEST RESULTS

Table 1 : Normal Concrete & Concrete with nano silica (1%) at the end of 3 days

Sr. No.	3 days strength of Normal concrete (N/mm ²)	3 days strength of concrete with nS (N/mm ²)
1	21.25	34.15
2	20.75	33.20
3	21.75	34.80

Table 2 : Normal Concrete & Concrete with nano silica (1%) at the end of 7 days

Sr. No.	7 days strength of Normal concrete (in N/mm ²)	7 days strength of concrete with nS (in N/mm ²)
1	32.15	44.65
2	31.10	44.05
3	30.95	45.05

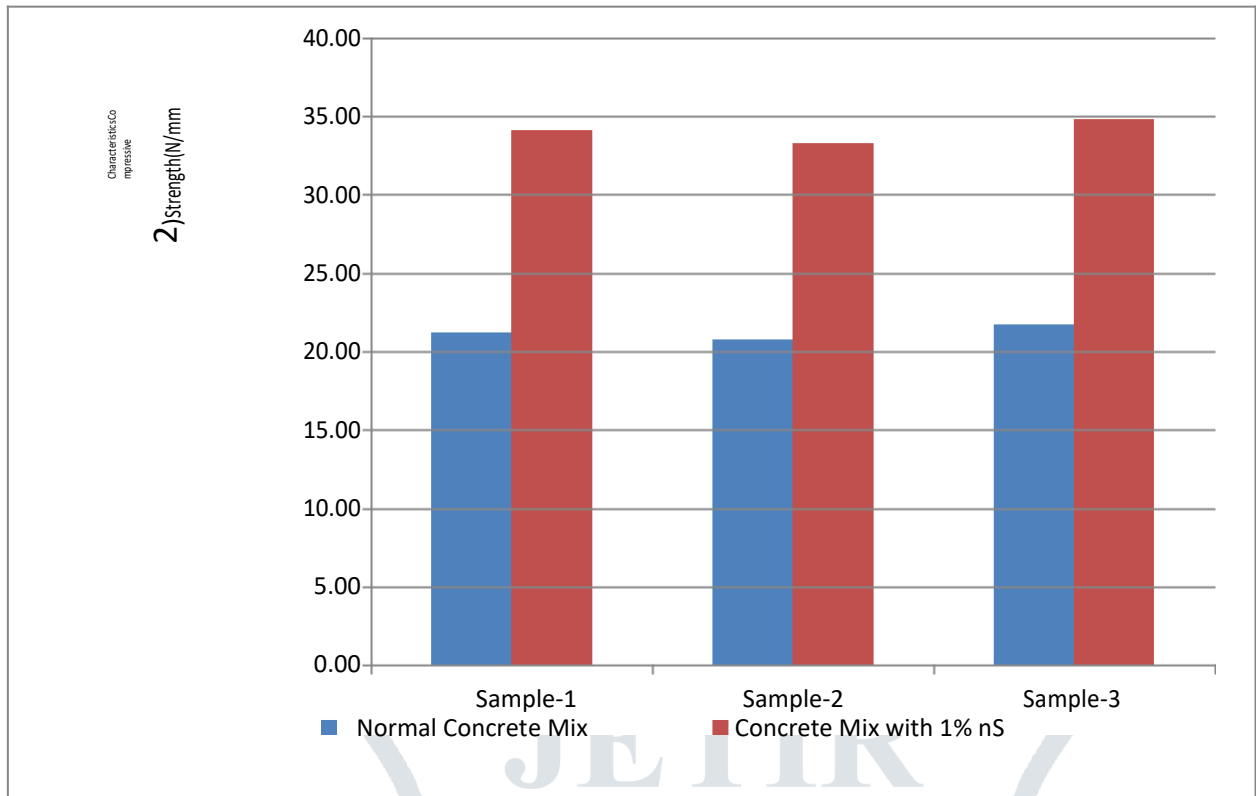


Fig.7 : Testing result in graphical form of concrete without nS at 3 days

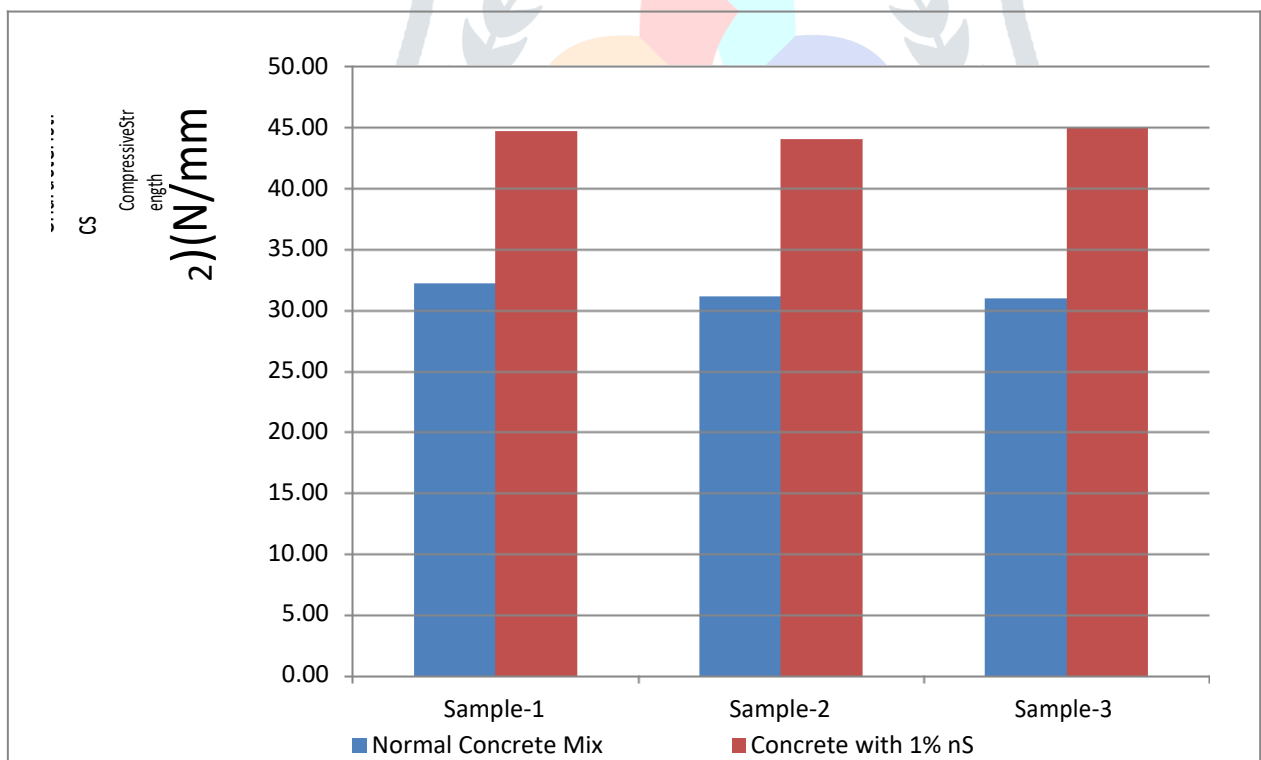


Fig.8 : Normal Concrete & Concrete with nano silica (1%) at the end of 7 days

Table 3 : Normal Concrete & Concrete with nano silica (1%) at the end of 28 days

Sr. No.	28 days strength of Normal concrete28 (in N/mm ²)	28 days strength of concrete with nS (in N/mm ²)
1	48.05	63.65
2	47.50	64.40
3	47.75	64.10

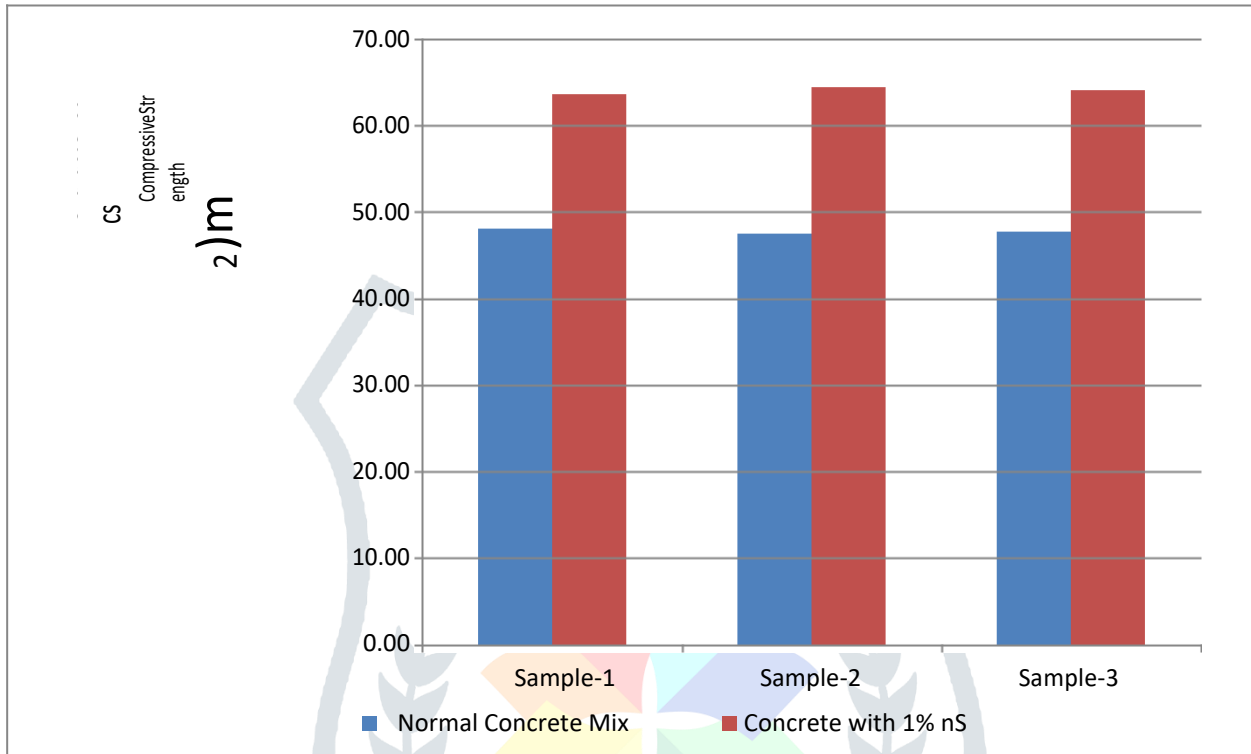


Fig.9 : Normal Concrete & Concrete with nano silica (1%) at the end of 28 days

Table 4 : Comparison of mean compressive strength of normal and concrete with nS

Duration	Number of Samples	Nominal Concrete (in N/mm ²)		Concrete with Nano silica(in N/mm ²)	
		Characteristics Strength	Mean Strength	Characteristics Strength	Mean Strength
3 Days	Sample-1	21.25	21.250	34.15	34.050
	Sample-2	20.75		33.20	
	Sample-3	21.75		34.80	
7 Days	Sample-1	32.15	31.400	44.65	44.583
	Sample-2	31.10		44.05	
	Sample-3	30.95		45.05	
28 Days	Sample-1	48.05	47.767	63.65	64.050
	Sample-2	47.50		64.40	
	Sample-3	47.75		64.10	

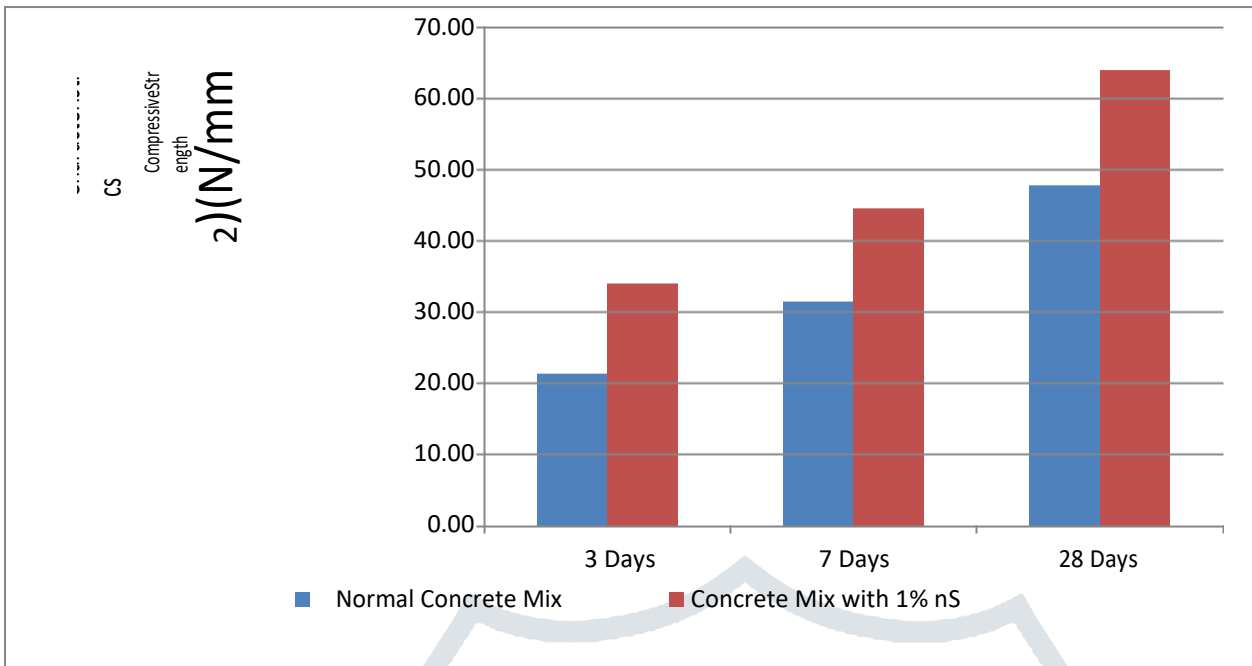


Fig.10 : comparison of mean strength Normal Concrete & Concrete with nano silica (1%) at the end of 28 days

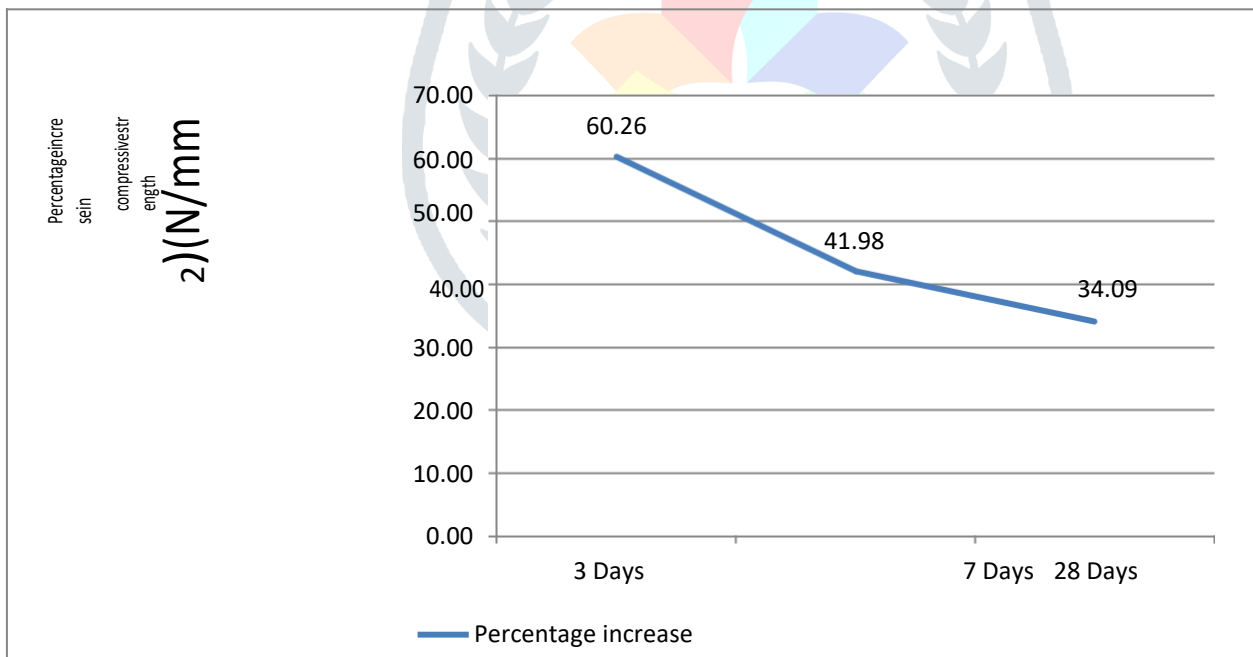


Fig.11 : percentage increase in compressive strength at the end of 28 days

CONCLUSIONS

This paper represent a compressive strength of concrete with the use of nS and without the use of nS. Form the various test results and from the graphical representation it can concluded that the nano silica gives more homogeneity and less porous concrete. Which ultimately leads to the high strength concrete. The various percentage of nS variation also affect on the strength and other properties of concrete. The nS at very less amount compare to the another ingredients material it affects the more on strength parameters.

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