STUDY AND BEHAVIOR OF CONCRETE STRUCTURAL ELEMENTS USING NANOMATERIALS AS STRENGTH SUPPLIMENTS

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Abstract— *In this present study by using nano particles (nano-silica and titanium dioxide) which leads to densifying of the micro and nanostructure resulting in improved mechanical properties. The addition of Sio2 and Tio2 with several weights with represents to cement improves excellent mechanical properties of concrete. In these we had added 0.1, 0.125, 0.25, 0.5, 0.75 and 0.1 percentage of Sio2 and Tio2. Nano-silica addition to cement based material can also control the degradation of the fundamentals C-S-H (Calcium- Silicate-Hydrate) reaction of concrete caused by calcium leaching in water as well as block water penetration and therefore lead to improvements in durability.*

Keywords— nano-silica, degradation of thefundamentals, block water penetration

1. INTRODUCTION

1)This Indian Standard was adopted by the Indian Standards Institution on 30 July 1982, after the draft finalized by the Cement and Concrete 9Sectional Committee had been approved by the Civil Engineering Division Council.

2) Considerable need has been felt for formulating standard recommendations for guidelines on proportioning of concrete mixes. The need has been further emphasized by the importance given to design mix concrete according to IS: 456-1978. Having recognized this need, Cement and Concrete Sectional Committee decided to evolve a standard recommended guideline for concrete mix design.

Literature Review:

Abhiyan et., al 2013 has worked on "An Overview on Application o Nanotechnology in Construction Industry" Abstract:-Important feats in the construction industry were the invention of concrete in ancient Rome, the mass production of steel from the mid-19th century and the mass-production of glass panes that changed from luxury to strength, likely others have similarly small to large changes with time. The paper focuses on questions like: What is nanotechnology? What can nanotechnology mean for the construction industry? Are there presently any commercialized products in construction that make use of nanotechnology? Construction can be defined as a process of converting the basic civil engineering raw materials to the final civil engineering product. Hence if the performance of the basic civil engineering raw materials is enhanced anyhow, the productivity will get increased as to work with those modified materials and the performance of the final civil engineering product will also be improved. Thus, the information presented in this paper is categorized into following main or basic raw materials: Cement, steel, paints, glass and fire protection materials, along with various definitions and basic concept of Nanotechnology.

Zhi Ge and Zhili Gao (2008) are worked on "Applications of Nanotechnology and Nano materials in Construction" Nanotechnology is one of the most active research areas with both novel science and useful applications that has gradually established itself in the past two decades. Expenditure on nanotechnology research is significant; however, the research is continuously moving forward motivated by immediate profitable return generated by high value commercial products. The Architecture, Engineering, and Construction (A/E/C) industry might accommodate broad applications of nanotechnology and Nano materials. It has been demonstrated that nanotechnology generated products have many unique characteristics, and can significantly fix current construction problems, and may change the requirement and organization of construction process.

2. NANO PARTICLES

The Nano materials can improve vital characteristics of construction materials such as strength, durability, and lightness, endow useful properties (e.g., heat-insulating, self-cleaning, and antifogging), and function as key sensing components to monitor construction safety and structural health.

The particle packing in concrete can be improved by using Nano-silica which leads to densifying of the micro and nanostructure resulting in improved mechanical properties. Nano-silica addition to cement based materials can also control the degradation of the fundamental C-S-H (calcium-silicate-hydrate) reaction of concrete caused by calcium leaching in water as well as block water penetration and therefore lead to improvements in durability.

3. RISKS OF USING NANO PARTICLES IN CONSTRUCTION

In building construction nano materials are widely used from self-cleaning windows to flexible solar panels to Wi-Fi blocking paint. The self-healing concrete, materials to block ultraviolet and infrared radiation, smog-eating coatings and light-emitting walls and ceilings are the new nano materials in construction. Nanotechnology is a promise for making the "smart home" a reality. Nanotech-enabled sensors can monitor temperature, humidity, and airborne toxins which needs nanotech based improved batteries.

4. EFFECT OF NANOPARTICLES ON HEALTH AND ENVIRONMENT:

Nanoparticles may also enter the body if building water supplies are filtered through commercially available nano filters. Airborne and waterborne nanoparticles enter from building ventilation and wastewater systems.

5. CONCRETE RESEARCH LOOKS FOR MATERIALS AND PROCESSES TO:

- Reduce material costs and energy costs
- Obtain high initial and final resistance
- Improve density and compressive strength
- Improve workability, pump ability and finishing
- Improve durability and reduce permeability
- Reduce shrinkage cracks, dusting problems
- Chemical resistance, e.g. sulphate resistance

6. RESULTS:

Mix Design Parameters:

S.No	MIX PROPORTION	W/C	NANO SiO_2 (%)	NANO TiO_2 (%)	NO.OF CUBES
1	1:1.5:2.7	0.48	0.10	0.10	12
2	1:1.5:2.7	0.48	0.13	0.13	12
3	1:1.5:2.7	0.48	0.25	0.25	12
4	1:1.5:2.7	0.48	0.50	0.50	12
5	1:1.5:2.7	0.48	0.75	0.75	12
6	1:1.5:2.7	0.48	1	1	12

TEST FOR DETERMINATION OF SPECIFIC GRAVITY:

Trail No	Empty Weight of Bottle (W1)	Weight of Bottle + Dry aggregates (W2)	Weight of bottle + aggregates + water (W3)	Weight of bottle + water	Specific gravity
1	660	1080	1738	1442	3
2	660	1090	1738	1442	3.2
3	660	1095	1730	1442	3.4
				Avg.	**3.2**

Compressive strength of concrete with the application of Nano particles:

S.No	SIO_2 Average Compressive Strength in N/mm^2					
%	0.1	0.125	0.25	0.5	0.75	1
Days	28	28	28	28	28	28
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	--	--	--	--	--	--
4	54.01	53.06	50.9	50	52.01	40
5	56.01	54.01	50.9	50	50.01	40.01
6	52.01	53.06	50.9	50	50.01	40.01
AVG	**54.0**	**53.4**	**50.9**	**50**	**50.6**	**40.01**

S.No	TIO_2 Average Compressive Strength in N/mm^2					
%	0.1	0.125	0.25	0.5	0.75	1
Days	28	28	28	28	28	28
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	--	--	--	--	--	--
4	54.0	53.0	52.1	53.06	56.01	59.06
5	50.0	54.0	52.01	53.06	54.00	59
6	56.0	53.0	52.01	53.06	54.01	59.06
AVG	53.3	53.3	52.0	53.06	54.6	59.0

7. CONCLUSIONS:

For Sio2:

- 7- Days compressive strength is gradually increasing up to 0.75% later decrease in strength are observed.
- After adding 1% of Sio2 there is not much change in strength of concrete.
- 28- Days compressive strength is also increasing up to 0.75% later decreases for 1% addition of Sio2.
- The maximum percentage of 0.75% the 28-day compressive strength is observed as 50.7N/mm2
- Optimum content of Sio2 is restricted as 0.75%.

For Tio2:

- 7- Days compressive strength is alternate increase and decrease were observed.
- Up to 0.25% of Tio2 there is not much change in 28-day strength of concrete.
- 28- Days compressive strength is increasing after 0.25% of Tio2 and is observed as 59N/mm2

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