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EXPERIMENTAL INVESTIGATION ON CRIMPED STEELFIBER CONCRETE AS PARTIAL REPLACEMENT OF ZEOLITE POWDER WITH CEMENT

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ABSTRACT

In building, aggregate is a hard, chemically inert particle material (often sand and gravel) that is cemented together with cement and water to form structural materials. The effects of partially substituting cement for zeolite powder on the characteristics of concrete were investigated experimentally. Zeolite powder replaces cement to varying degrees, including 0%, 5%, 15%, 20%, 25%, and 30%. Concrete is mixed with 1%, 2%, 3%, and 4% of crimped steel fibres. Zeolite is being used to partially replace cement in concrete in order to lower CO2 generation. Natural pozzolanic substance includes zeolite powder. Zeolite will absorb hazardous gases and provide excellent compressive strength, making concrete using zeolite as a partial replacement material. It is environmentally friendly since it will absorb hazardous gases and provide high compressive strength and split tensile strength for 7 and 28days.

***KEYWORDS**: Zeolite powder, Crimped steel fibre, Compressive strength, Split tensile strength.*

1. INTRODUCTION

A composite material consisting of fine and coarse aggregate combined by a cement paste which is fluid at first and eventually hardens (cures). Concrete is the most often used building material and the second most used material in the world after water. A fluid slurry that is simple to pour and shape is created when aggregate, dry Portland cement, and water are combined. A process known as concrete hydration causes the cement and water to react, hardening the mixture over the course of many hours to create a durable stone-like substance with a variety of uses. This period of time enables concrete to be prepared in a number of tooled procedures in addition to being cast in forms. To enhance the wet mix's physical characteristics, slow down or speed up the curing process, or alter the final product in some other way, additives (such pozzolans or superplasticizers) are frequently added to the mixture.

Crimped A type of metal reinforcement is steel fibre. The term "steel fibre for reinforcing concrete" refers to short, discrete lengths of steel fibres with different cross-sections and an aspect ratio (ratio of length (20) to diameter (100)) that are small enough to be randomly incorporated into a mixture of unhardened concrete using customary mixing techniques. Concrete's physical characteristics can be qualitatively altered by adding a particular proportion of steel fibre, considerably enhancing the material's tenacity, durability, and resistance to cracking, impact, fatigue, and bending, among other features.

One metal oxide that has a strong solid acidity is zeolite.For use in concrete as a partial replacement for cement; zeolite is also available in powder form. It is capable of absorbing carbon dioxide from the atmosphere and exhibits strong pozzolanic reactivity.

2. OBJECTIVES:

1. To optimize the usage of zeolite powder in concrete.
2. This experiment examines in which Crimped Steel Fibre behaves in concrete.

3. MATERIALS

3.1 Cement:

In the presence of water, cement exhibits cohesive and adhesive capabilities. Hydraulic cements are the name for such cements. These largely consist of silicates and aluminates of lime made from clay and limestone.

3.2 Aggregate:

Since aggregates make up around 80% of the volume of concrete, their characteristics have a significant impact on how the material behaves.

3.3 Water:

The potable water which was used for the manufacture of concrete.

3.4 Zeolite powder:

Zeolite has been used as an antibacterial agent, to prevent concrete from cracking, to increase concrete strength, to control humidity, and as a fluidizing agent for carriers.

3.5 Crimped steel fibres:

Either carbon steel or stainless steel is utilised to make the crimped steel fibres. Metals can be converted into wire owing to their ductility by being drawn through dies that getting smaller and smaller. They are quite stiff materials, and this rigidity forces High Strength Fibre Reinforced Concrete to have certain mechanical qualities.

4. EXPERIMENTAL RESULTS

4.1 Compressive strength

Concrete's compressive strength must be determined because it is the standard by which to determine the material's quality.

Table 1: Compressive strength of concrete with Zeolite powder as partial replacement of cement in concrete

S.No.	% Zeolite powder	Compressive Strength, N/mm^2	
		7 Days	28 Days
1	0	27.72	40.06
2	5	30.53	43.68
3	10	32.48	47.15
4	15	35.72	50.67
5	20	32.75	49.11
6	25	32.06	46.21
7	30	31.46	45.02

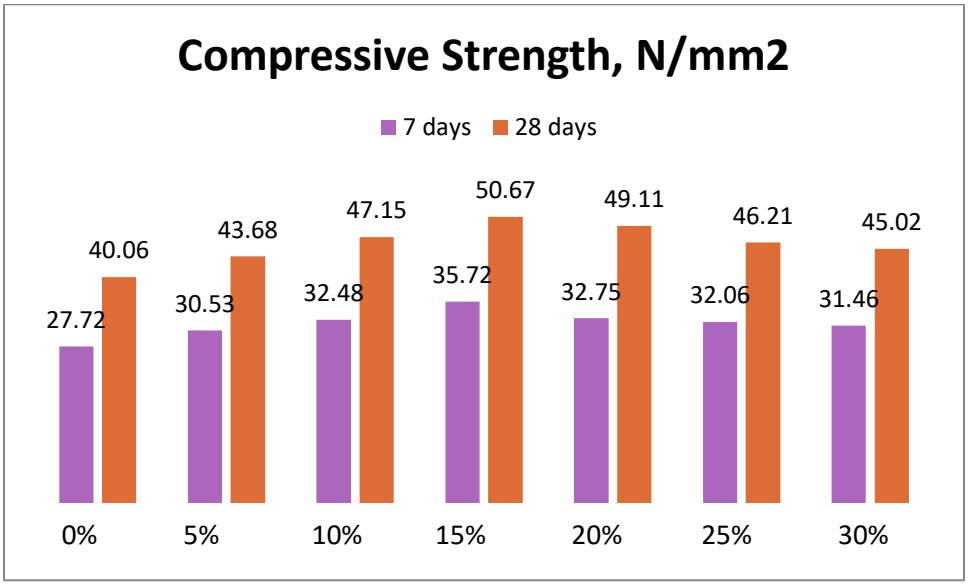

Figure 1: Compressive strength of zeolite powder

Table 2: Compressive strength of concrete with crimped steel fibre concrete

S.No.	% Crimped steel fibre	Compressive Strength, N/mm^2	
		7 Days	28 Days
1	0	27.72	40.06
2	1	28.32	40.48
3	2	28.55	41.08
4	3	29.86	42.73
5	4	28.39	41.26

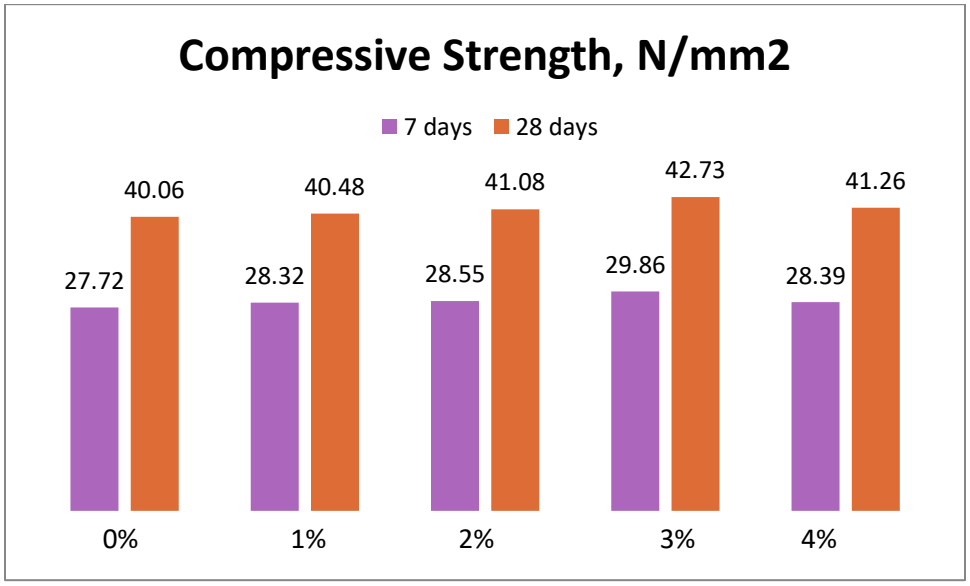

Figure 2: Compressive strength of Crimped Steel fiber

Table 3: Combined compressive strength of concrete with 15%Zeolite powder and 3% Crimped steel fibers

S.No.	ZP +CSF	Compressive Strength, N/mm^2	
		7 days	28 days
1	0%	27.72	40.06
2	15% ZP +3%CSF	36.04	51.64

4.2 Split tensile strength results

The split tensile strength conducted in compressive strength machine for the cast and cured specimens and the

results are furnished in Table.

Table 4: Split tensile strength of concrete with Zeolite powder as partial replacement of cement in concrete

S.No.	% Zeolite powder	Split tensile Strength, N/mm^2	
		7 Days	28 Days
1	0	2.76	3.95
2	5	2.99	4.28
3	10	3.25	4.66
4	15	3.54	5.05
5	20	3.28	4.85
6	25	3.17	4.61
7	30	2.95	4.26

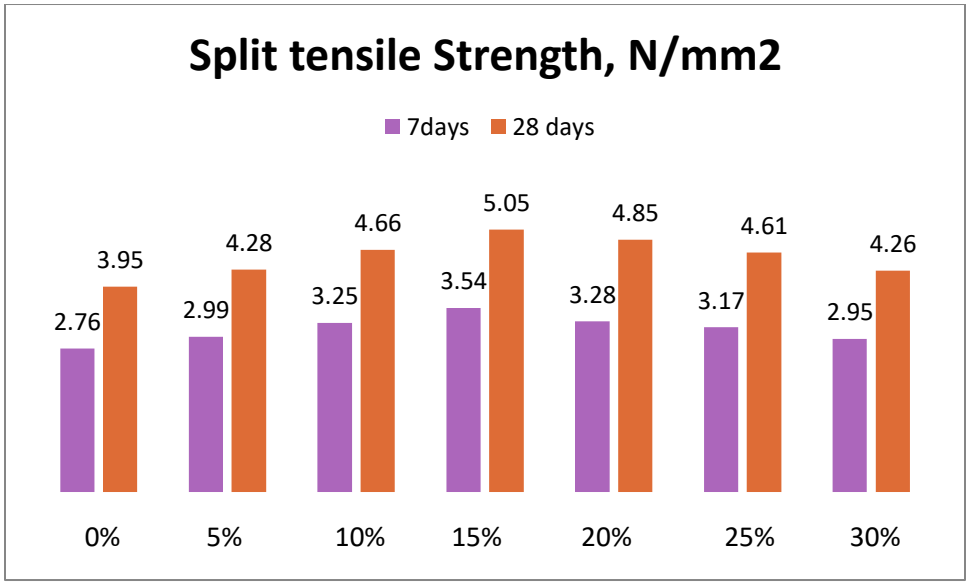

Figure 3: Split tensile strength of zeolite powder

Table 5: Split tensile Strength of concrete with crimped steel fibre concrete

S.No.	% Crimped steel fibre	Split tensile Strength, N/mm^2	
		7 Days	28 Days
1	0	2.71	3.95
2	1	2.84	4.01
3	2	2.87	4.07
4	3	3.06	4.26
5	4	2.82	4.08

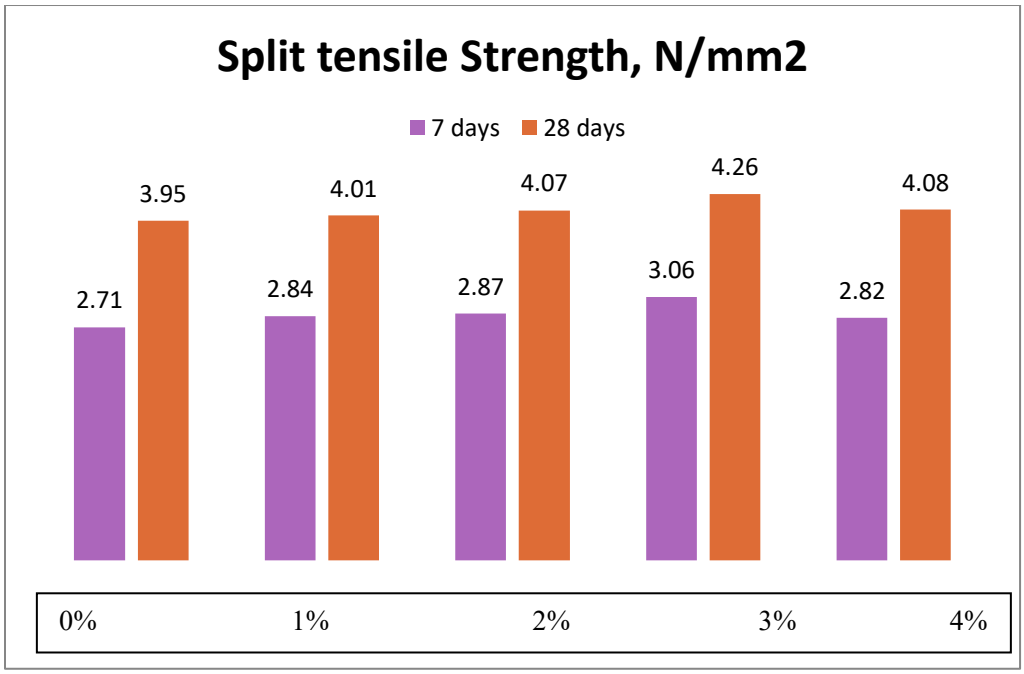

Figure 4: Split tensile strength of Crimped Steel fiber

Table 6: Combined Split tensile strength of concrete with 15% Zeolite powder and 3% Crimped steel fibers

S.No.	ZP +CSF	Split tensile Strength, N/mm^2	
		7 days	28 days
1	0%	2.71	3.95
2	15% ZP +3%CSF	3.65	5.22

5. CONCLUSION:

1. The Normal Concrete Compressive strength result for 7 and 28 days is 27.72 N/mm^2 and 40.06N/mm^2.
2. At 15% replacement of cement by zeolite powder the achieved compressive strength of concrete is 35.72N/mm^2 for 7days and 50.67N/mm^2 for 28days.
3. At 3% crimped steel fibre concrete the achieved compressive strength of concrete is 29.86 N/mm^2 for 7days and 42.73 N/mm^2 for 28days.
4. Combined replacement of compressive strength of concrete with 15% of zeolite powder and 3% of crimped steel fibre at 7 and 28 days are 36.04 and 51.64 N/mm^2.
5. The Normal Concrete Split tensile strength result for 7 and 28 days is 2.71 N/mm^2 and 3.95N/mm^2.
6. At 15% replacement of cement by zeolite powder the achieved Split tensile strength of concrete is 3.54 N/mm^2 for 7days and 5.05 N/mm^2 for 28days.

7. At 3% crimped steel fibre concrete the achieved compressive strength of concrete is 3.06 N/mm^2 for 7days and 4.26 N/mm^2 for 28days.
8. Combined replacement of compressive strength of concrete with 15% of zeolite powder and 3% of crimped steel fibre at 7 and 28 days are 3.65 and 5.22 N/mm^2.

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