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Study On Properties Of High Strength Silica Fume Concrete Withpolypropylene Fibre

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ABSTRACT:Now a day's high strength and high performance concrete are being widely used all over the world. Most applications of high strength concrete have been in high rise buildings, long span bridges and in some special applications in structures. In developed countries, using high strength concrete in structures today would result in both technical and economic advantage. In high strength concrete, it is necessary to reduce the water/cement ratio and which in general increases the cement content. To overcome low workability problem, different kinds of mineral admixtures (fly ash, rice husk ash, silica fume etc.) and chemical admixtures are used to achieve the required workability. In the present experimental investigation, the mechanical properties of high-strength concrete of grades M60, at 28 days characteristic strength with different replacement levels of cement with silica fume are considered. Standard cubes (150mm x 150mm x 150mm), standard cylinders (150mm dia x 300mm height) and standard prisms (100mm x 100mm x500mm) were considered in the investigation. all specimens were cast with and without polypropylene fiber. The mechanical properties viz., compressive strength, flexural strength and split tensile strength, of high strength concrete with various replacement of polypropylene fiber 0.5%, 1%, 1.5% and 2% and silica fume viz., 10%, 20%, and 30% , has been considered. The study revealed that the use of waste material like silica fume improved the mechanical properties of high strength concrete, which is otherwise hazardous to the environment and thus may be used as a partial replacement of cement.

Keywords— polypropylene fibre, silica fume

1. INTRODUCTION

High strength silica fume concrete is a concrete that meets special combinations of strength and uniformity requirements which cannot always be achieved routinely using conventional constituents and normal mixing and placing and curing practices. To produce high strength concrete it is generally essential to use chemical and mineral admixtures in addition to the same ingredients, which are generally used for normal concrete.

In recent times, many researches are going on for improving the properties of concrete with respect to strength, durability, and performance as a structural material. There are many materials like Fly Ash, Furnace Slag, and Silica Fume etc. One among these special concretes is the Silica Fume concrete which is new emerging as one of new generation construction material in producing high strength and performance concrete for special structures.

The interest in Silica Fume started in enforcement of air pollution control in many countries. This implies that the industry had to stop releasing Silica Fume along with other fine gases into the atmosphere. To find solution to this problem studies were initiated and after some investigations, it was found that the Silica Fume could be used as a very useful material in concrete. Silica Fume is being used in concrete for quirt some time in countries like Norway and U.S. very high strength concrete is being produced using this very fine highly reactive industrial by product. In India, imported Silica Fume is finding its use now a day.

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2. MATERIALS USED

2.1 Properties of polypropylene fibre

In this investigation, polypropylene fibers are used an average diameter of 10 μm, a length of 18mm.

Table1. Properties of polypropylene fibers

Specification	Values
Aspect ratio	1800
Tensile strength (Mpa)	$2.5x10^3$
Elasticity modulus (Mpa)	$8x10^3$
Specific gravity (g/cm^3)	8

2.2 Materials used

Ordinary Portland cement 53 grade was used for casting of all the specimens and clean dry river sand and natural aggregates will be used. The natural river sand passing through IS 4.75mm sieve the specific gravity of fine aggregate is 2.85. Then natural coarse aggregate with specific gravity of 2.67 and passing through IS 20mm sieve. Cubes of 150x150x150 mm, cylinders of 300x150 mm and prisms of 500x100x100 mm were cast cured and tested for 7 days and 28 days.

3. MIX DESIGN

Table 2.Mix Proportion ratio

Water ($litre/m^3$)	Cement (Kg/m^3)	Fine Aggregate (Kg/m^3)	Coarse aggregate (Kg/m^3)
0.32	1	1.29	2.3

4. EXPERIMENTAL RESULTS

4.1 Compressive strength

Table 3. Compressive strength (% of fiber added)

TIME PERIOD	CONVENTIONAL CONCRETE	0.50%	1%	1.50%	2%
7 DAYS	48.58	49.98	51.25	52.04	48.64
14 DAYS	56.25	57.85	59.98	60.85	54.28
21 DAYS	62.58	68.58	70.2	72.88	62.28
28 DAYS	69.95	71.25	72.48	74.56	68.8

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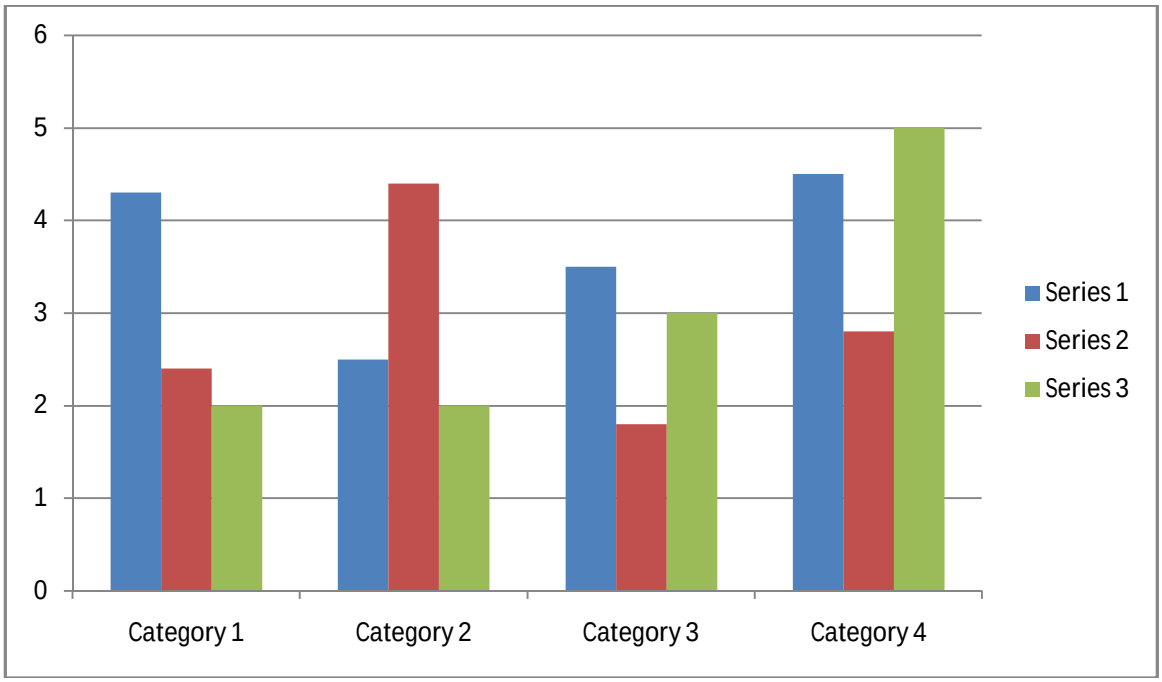

Fig 1. Compressive strength of concrete

4.2Split tensile strength

Table4. Split Tensile Strength (% of fiber added)

TIME PERIOD	CONVENTIONAL CONCRETE	0.50%	1%	1.50%	2%
7 days	3.58	4.05	4.18	4.28	3.56
14 days	4.98	5.05	5.8	5.98	4.8
21 days	5.75	6.48	6.68	7.05	5.7
28 days	7.2	7.84	8.48	8.72	7.1

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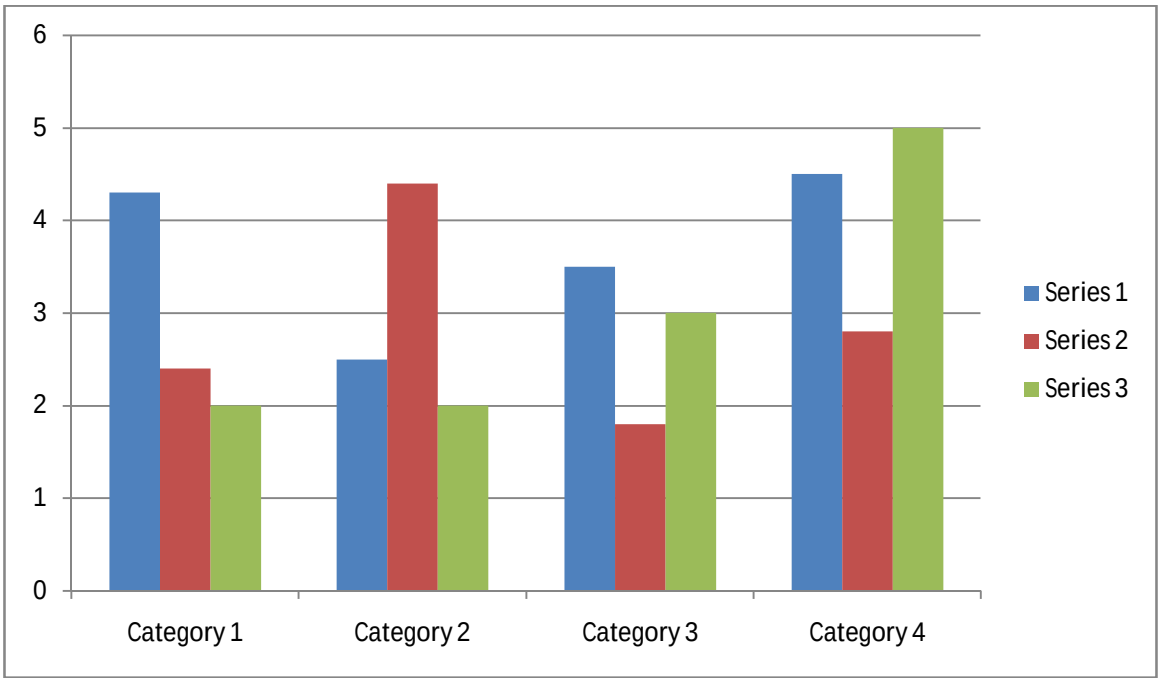

Fig 2.Split Tensile strength of concrete

4.3 Flexural strength

Table 5 Flexural Strength (% of fiber added)

TIME PERIOD	CONVENTIONAL CONCRETE	0.50%	1%	1.50%	2%
7 days	3.58	4.05	4.18	4.28	3.56
14 days	4.98	5.05	5.8	5.98	4.8
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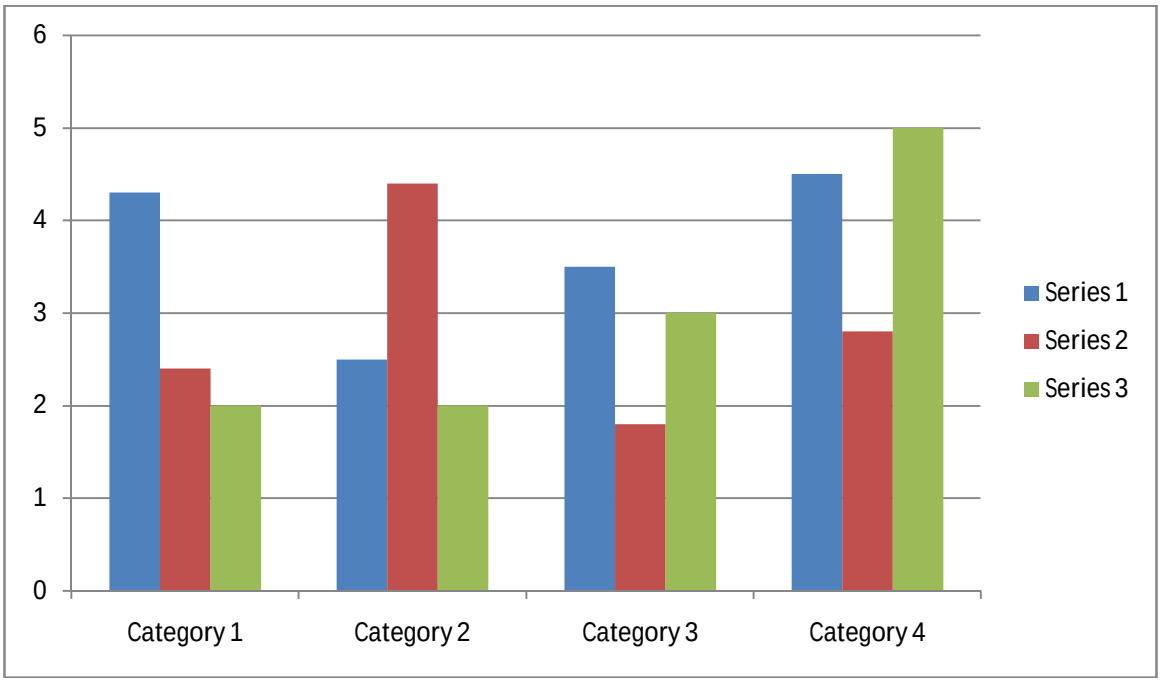

Fig 3.Flexural strength of concrete

5. CONCULSION

Compressive strength of the silica fume concrete withpolypropylene fibers has increased by 10.63%, then Conventional concrete. Split tensile strength of the Geopolymer concrete without fibers have increased by 11.58%, then Conventional concrete.

Compressive strength of the Geopolymer concrete with fibers has increased by 10.70%, then Conventional concrete.Split tensile strength of Geopolymer concrete with fibers has increased by 13.62%, then Conventional concrete.

Geopolymer concrete produces a substance that is comparable to or better than traditional cements with their properties. Low-calcium fly ash-based geopolymer concrete has excellent compressive strength and is suitable for Structural applications.

As per load deflection test, strain energy absorbed, ductility factor and, toughness index, are considerably increases in GPC with addition of polypropylene fibers. Due to geopolymer concrete the consumption of cement, emission of carbon di - oxide and greenhouse effect are reduced.

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