



# ASSESSMENT AND INFLUENCE ON M<sub>30</sub> GRADE OF ALCCOFINATED CONCRETE INCOPERATED WITH POLYPROPYLENE FIBER

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**Abstract :** *The cement industry is one of the main producers of carbon dioxide (CO<sub>2</sub>) for production of one ton of cement approximately one ton of CO<sub>2</sub> is released into the atmosphere. To reduce the cement content different supplementary cementitious materials (SCM's) like fly ash, silica fume, alccofine, metakaolin, rice husk ash, ground granulated blast furnace slag were used. The presence of Alccofine at optimum levels in conventional concrete is expected to increase compressive strength and provide resistance to chloride attack, seawater attack and accelerated corrosion attack. The main objectives of this work focus on the compressive and flexural strengths of concrete with Alccofine and Polypropylene Fiber partially substituted for cement. This project focuses on the experimental study of concrete with different percentages of Alccofine 0%, 5%, 10%, 15% and 20% and Polypropylene Fiber 0%, 0.5%, 1.0%, 1.5% and 2.0% for 7 days, 14 days and 28 days. The design combination performed during the experiment was M<sub>30</sub> grade of concrete and compared to conventional concrete. Different percentages of Alccofine along with Polypropylene Fiber increase the strength of the initial concrete phase. Alccofine as filler reduces permeability and improves workability of fresh concrete.*

**IndexTerms -** Alccofine, Compressive Strength, Flexural Strength, Polypropylene Fiber, Workability

## 1. INTRODUCTION

Concrete is one of the predominant material used in construction industry. The concrete is cast in any desirable shape. The concrete is used in various forms in structures depending on the load carrying capacity. For flexural and axial loading steel reinforcement is induced in concrete. The scarcity of material mainly cements results in deficiency of concrete. There are several replacement induced for cement like fly ash, bottom ash, GGBS, Metaoklin etc. These materials are tested in the laboratory through partial and full replacement of cement towards strength and other properties of concrete with conventional concrete. The replacement shows some advantageous qualities while compared to cement. Alccofine is a product obtained through controlled granulation. It is a slag, consist of high glass content with ultra fine particle size. The water demand is reduced but workability is maintained up to 70% replacement and shows good performance in concrete. Alccofine can also be utilized as a good water redundant to improve the strength parameters and other properties of concrete. Alccofine is used as cement replacement mainly for two reason, to stabilize the scarcity of cement and improve the properties of concrete in their life cycle. Therefore, utilization of Alccofine together with fly ash provides better results to mechanical properties of concrete. Alccofine 1203 is a slag based supplementary cementitious materials having ultra-fineness with optimized particle size distribution. Due to its unique chemistry and ultra fine particle size Alccofine 1203 provides reduced water demand for a given workability, even up to 70% replacement level as per requirement of concrete performance and it is manufactured by Ambuja Cements Ltd.. The use of secondary material or industrial waste in construction field for production of concrete contributes to reducing the consumption of natural resources. Various by- product and secondary material such as copper slag, fly ash, silica fumes, and Polypropylene Fiber are considered as waste material. They have been intensively used in construction industries for partial replacement of cement.

## 2. RESEARCH METHODOLOGY

In the current exploration work concrete has been mostly supplanted by Alccofine-1203 and Polypropylene Fiber in M30 Grade of Concrete. The substitution levels are 0%, 5%, 10% 15% and 20% by weight of cement as well as Polypropylene Fiber 0%,0.5%,1.5% and 2.0% by volume of cement in it The properties researched are functionality, compressive quality, flexural quality. The examples of standard shapes (150mm×150×mm×150mm), and standard shafts (150mm×150mm×700mm) were projected from various blends having various substitutions levels of Alccofine powder and Polypropylene Fiber.

### 3. MATERIAL & THEIR PROPERTIES

#### 3.1 Cement

An OPC 43 grade Ultra Tech Cement was used in this study. The physical properties were found using respective IS codes. The properties are given in table below:-

**Table1: - Properties of Cement**

S.NO	SPECIFICATION	VALUES
1	Specific Gravity	3.13
2	Standard Consistency	32%
3	Initial Setting Time	30 min
4	Final Setting Time	600 min

#### 3.2 Fine Aggregate

The sand used in this research work acquired from natural river passing through 4.75mm I.S.

**Table2:- Properties of Fine Aggregate**

S.NO	SPECIFICATION	VALUES
1	Specific Gravity	2.63
2	Fineness Modulus	2.93
3	Bulk Density(Kg/m <sup>3</sup> )	1645
4	Water Absorption(%)	0.94

#### 3.3 Coarse Aggregate

In this research work locally available crushed aggregate of sizes 20mm and 10mm were used. The aggregates were tested and following results were obtained, shown in Table 3

**Table: 3-Properties of Coarse aggregate**

S.NO	SPECIFICATION	VALUES
1	Specific Gravity	2.66
2	Fineness Modulus	6.75
3	Bulk Density(Kg/m <sup>3</sup> )	1585
4	Water Absorption(%)	0.64
5	Impact value	21.10
6	Abrasion Value	24.97

#### 3.4 Alccofine

Alccofine 1203 is the new generation micro fine material of particle size much finer than other materials like cement, fly ash etc. The Alccofine is manufactured by Ambuja Cements Ltd was used in this experiment as a mineral admixture. The products alccofine 1203 is a supplementary cementitious material suitably replaces silica fume used in high performance concrete. It is obtained from the materials of the iron ore industry. The chemical composition of the alccofine shows higher percentage of the alumina content and silica content. It has unique characteristics to enhance the performance of concrete in fresh and hardened stages. It can be used as practical substitute for silica fume.

Table: 4- Properties of Alccofine

S.NO	SPECIFICATION	VALUES
1	CaO	61-64 %
2	SO	2-2.4 %
3	SiO <sub>2</sub>	21-23 %
4	AlO	5-5.6 %
5	FeO	3.8-4.4 %
6	MgO	0.8-1.4

### 3.5 Polypropylene Fiber-

Polypropylene Fiber is 100% synthetic fiber. It is formed by 85% of polypropylene. It is a bi-product of petroleum. Polypropylene fibers use in this research of 12 mm long and 18 micrometer in diameter size and Specific gravity is 0.91.

Table:5- Properties of Polypropylene Fiber

S. NO.	SPECIFICATION	VALUES
1	Tenacity(gm/den)	3.5 to 5.5
2	Bulk Density(g/cc)	0.91
3	Melting Point( <sup>0</sup> C)	170
4	Moisture regain(%)	0%
5	Elongation at break(%)	10 – 45
6	Softening Point( <sup>0</sup> C)	140
7	Thermal Conductivity	6.0

### 3.6 Water

Potable water available from nature sources free from deleterious materials was used for mixing as well as for curing of all the mixes tried in this investigation.

## 4. MIXDESIGN

The mix design was done using IS: 10262-2019 and IS: 456--2000. The calculated proportion for 1m<sup>3</sup> is given below:-

Table: 6 - Mix Proportion

Mix	PROPORTION BY WEIGHT (kg/m <sup>3</sup> )					
	Replacement Of Cement(%)	Cement	Sand	Coarse Aggregate	Polypropylene Fiber(%)	Alccofine (%)
M1	00	447	769	1044	00	00
M2	5	424	769	1044	0.5	5
M3	10	402	769	1044	1.0	10
M4	15	380	769	1044	1.5	15
M5	20	360	769	1044	2.0	20

## 5. RESULTS

### 5.1 Compressive Strength-

Cube specimen of concrete were prepared incorporated with 0%, 5%, 10%, 15% and 20% of Alccofine and 0%, 0.5%, 1%, 1.5% and 2.0% of Polypropylene Fiber of size 150x150x150 mm, cured and tested for 7, 14 and 28 days as per IS: 516-1959. The testing results were obtained are shown in Table 7 and graphical represented shown in Figure 1. From the above test results, it can be concluded that the highest compressive strength was achieved by replacement 15% of Cement with 15% of Alccofine and 1.5% of Polypropylene Fiber in it for the control mix after 28 days of curing.

**Table -7 Compressive Strength Test**

Samples	Replacement of Cement(%)			Compressive Strength (N/mm <sup>2</sup> )		
	Cement	Polypropyl ene Fiber	Alccofine	7 Days	14 Days	28 Days
M1	100	0.0	00	27.8	32.3	39.6
M2	95	0.5	5	32.2	36.2	41.4
M3	90	1.0	10	34.5	38.5	43.8
M4	85	1.5	15	36.7	39.8	45.30
M5	80	2.0	20	35.6	38.2	44.50

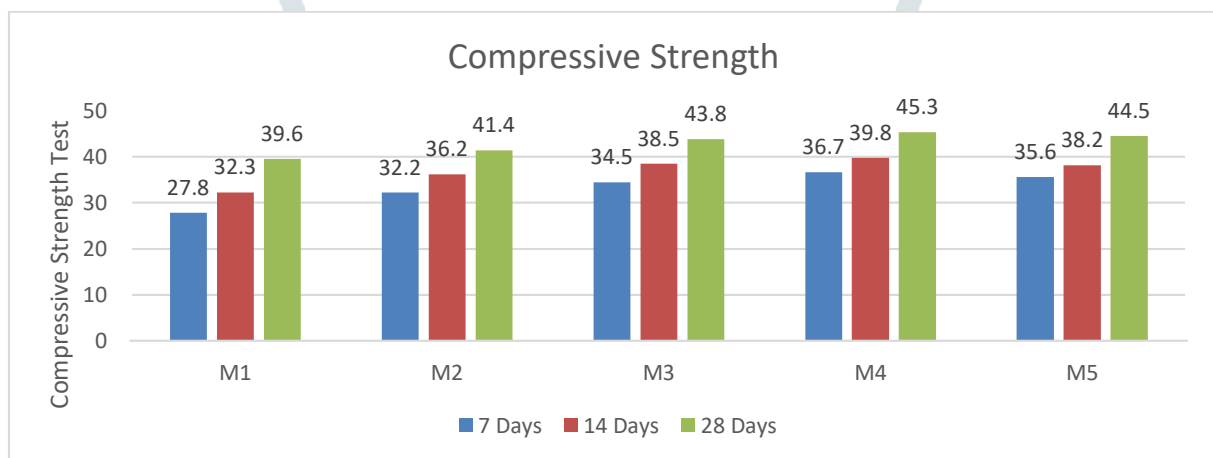


Fig 1. Compressive Strength Test

### 5.2 Flexural Strength

Standard beam of size 15cm x 15cm x 70cm were casted, cured, tested of concrete were prepared incorporated with 0%, 5%, 10%, 15% and 20% of Alccofine and 0%, 0.5%, 1%, 1.5% and 2.0% of Polypropylene Fiber of size 150x150x700 mm, cured and tested for 7, 14 and 28 days as per IS: 516-1959. The testing results were obtained are shown in Table 8 and graphical represented shown in Figure 2. From the above test results, it can be concluded that the highest Flexural strength was achieved by replacement 15% of Cement with 15% of Alccofine and 1.5% of Polypropylene Fiber in it for the control mix after 28 days of curing..

**Table-8 Flexural Strength Of Concrete**

Samples	Replacement of Cement(%)			Flexural Strength (N/mm <sup>2</sup> )		
	Cement	Polypropylene Fiber	Alccofine	7 DAYS	14 DAYS	28 DAYS
M1	100	00	00	3.1	3.5	4.3
M2	95	0.5	5	3.5	3.8	4.5
M3	90	1.0	10	4.1	4.5	5.2
M4	85	1.5	15	4.8	5.5	6.1
M5	80	2.0	20	4.6	5.2	5.8

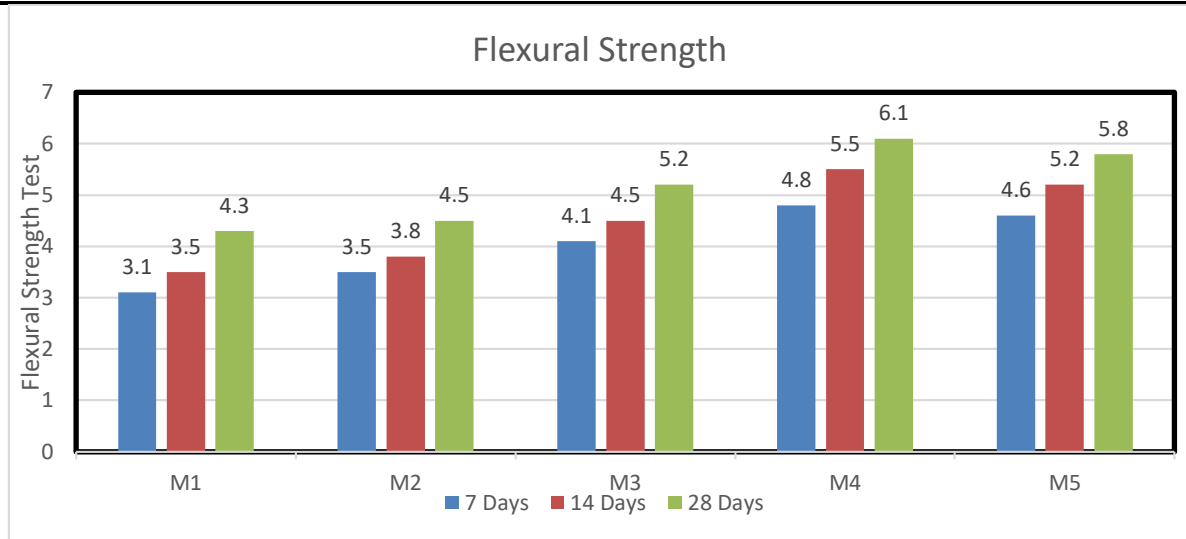


Fig 2. Flexural Strength Test

## CONCLUSION

From the experimental investigation carried out for present dissertation work, following salient conclusion can be drawn.

- This case study clearly shows that Compressive strength and the flexural strength of the Alccofinated Concrete incorporated with Polypropylene Fiber concrete were increased as compared to Conventional Concrete.
- It improves the strength and durability properties of concrete.
- It results in fast setting of concrete
- It leads to the formation of calcium silicate hydrate thereby enhancing strength of the concrete.
- The compressive strength of the concrete get increased when the cement is partially replaced with alccofine up to 15% and Polypropylene upto 1.5% gradually decreases by increasing the percentage of alccofine.
- Optimum level of replacement of cement by alccofine is found to be 15%.
- It reduces the permeability of concrete is significantly.

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