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# "Experimental Study of Cement and Fly Ash with Poly Propylene Fiber"

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**Abstract -** *Concrete is the most widely used construction material. It is difficult to point out another material of construction, which is as versatile as concrete. It is the material of choice where strength, performance, durability, impermeability, fire resistance and abrasion resistance are required. Concrete is seemingly simple but actually complex material. Crack formation in reinforced concrete structures will takes place due to low tensile strength of concrete. Wider cracks may not only destroy the aesthetics of structure, but also expose steel reinforcement to the environment leading to corrosion. Cracking in reinforced concrete members also causes a significant increase in deflection. This is a result of the reduction in bending stiffness at cracked section. Reinforced concrete structures with high yield strength deformed bars and designed using limit state method was found to have larger crack widths.*

*To overcome this difficulty of cracking and to enhance other physical parameters of concrete now a day concrete is reinforced with various fibres. The objective of the project is to analyse the maximum strength of concrete with fly ash and polypropylene fibre*

***KeyWords*:Cement, Aggregate, Fly Ash, Sand, pollypropeline fiber**

## 1. INTRODUCTION

**1.1 Cement:** Cement consists of four major compounds Tricalcium Silicate ($C_3S$), Dicalcium Silicate ($C_2S$), Tricalcium Aluminates ($C_3A$) & Tetra calcium Aluminoferrite ($C_4AF$). After reviewing all above requirements, Ultratech Portland Pozzolona Cement (PPC) is used

**1.2 Fine Aggregate (Sand):**Concrete is an assemblage of individual pieces of aggregate bound together by cementing material, its properties are based primarily on the quality of cement paste. This strength is dependant also on the bond between the cement paste and aggregate.. Source of fine aggregate :- Sarankheda River

**1.3 Coarse Aggregate**: Locally available crushed stone aggregates are used. The test results are as follows-.Source of Aggregate :- Vilholi**.**

**1.4 Water:**As per IS-456:2000 water used for mixing and curing shall be clean and free from injurious amounts of oils, alkalis, salts, sugars, organic materials or other substances that may deleterious to concrete or steel. In the present work, available tap water is used for concreting**.** For mixing of concrete distill water was used.

## 2. Methodology of the work

**Mix design:** In the present work, Indian Standard method (IS: 10262 - 1982) is used for mix desig**n.**

| Material | Proportion by Weight | Weight in Kg/m³ |
|---|---|---|
| Cement | 1 | 413.33 |
| FA | 1.546 | 639.10 |
| CA | 2.802 | 1158.03 |
| W/C | 0.45 | 0.45 |

**Quantity of Materials per Cubic Meter of Concrete Grade M25.**

**CASTING SCHEDULE** Mould Size = 15 cm x 15 cm x 15 cm. **Casting Schedule**

| Flyash (%) | 3 Days | 7 Days | 28 Days | Total |
|---|---|---|---|---|
| 0.0% | 3 | 3 | 3 | 9 |
| 10% | 3 | 3 | 3 | 9 |
| 20% | 3 | 3 | 3 | 9 |
| 30% | 3 | 3 | 3 | 9 |
| 40% | 3 | 3 | 3 | 9 |
| | | | **TOTAL** | **45** |

## 3. Data Analysis

**TEST CONDUCTED:-** Compressive Strength Test.

**Compressive Strength Test Setup:** The test is carried out on the cube specimen 150mm X 150mm X 150mm. Cast iron moulds are used to cast the cubes having leak proof metal base plate.

For the compression test, the cubes were placed in machine in such a way that the load was applied on the faces perpendicular to the direction of cast. The top surface of machine is fixed and load is applied on the bottom surface of specimen

$f_c$= P / A

Where, P = Load at failure, kN

A = Cross sectional area of cube

**CASTING:** Cube of 150*150*150mm was been casted in an mould.

**CURING:** After moulding the test specimens are stored in laboratory at a place free from vibration under damp matting, sacks or other similar materials for 24 ± 0.5 hours from the time of addition of water to the other ingredients

**Advantages of Fly Ash:-**

1) ECONOMY

2) DURABILITY

3) LONG TERM STRENGTH DEVELOPMENT

**Disadvantages of Fly Ash:-**

1) LONGER SETTING TIMES

2) COLOR VARIABILITY

The structural effects of fly ash may be more critical, but cosmetic concerns also affect its use in concrete. It is more difficult to control the color of concrete containing fly ash than mixtures with Portland cement only.

| SR. NO | MARK | CEMENT | FLYASH | CRUSHING LOAD | COMP. STRENGTH |
|---|---|---|---|---|---|
| 1 | C1 | 100 | 00 | 913.5 | 40.6 |
| 2 | C2 | 90 | 10 | 617.17 | 27.43 |

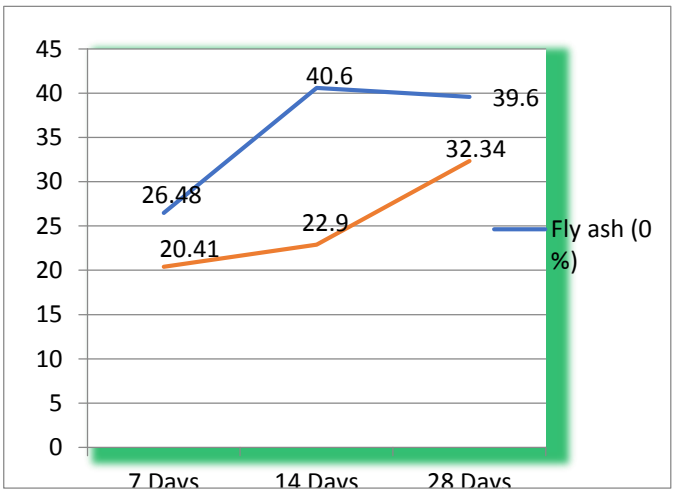
| | | | | | |
|---|---|---|---|---|---|
| | | | | 5 | |
| 3 | C3 | 80 | 20 | 701.55 | 31.18 |
| 4 | C4 | 70 | 30 | 561.15 | 24.94 |
| 5 | C5 | 60 | 40 | 220.5 | 9.8 |

**Table 2 Compression Test Results for 14 Days**

**CONCLUSION :-**From the above graph we conclude that after the combination of flyash and cement with increment of 10% with flyash and decrement of 10% with cement, the maximum compression strength obtain is **40.06** MPA at 100% cement and 0% flyash.

| SR.NO | MARK | CEMENT | FLYASH | CRUSHING LOAD | COMP. STRENGTH |
|---|---|---|---|---|---|
| 1 | C1 | 100 | 00 | 913.5 | 39.6 |
| 2 | C2 | 90 | 10 | 617.175 | 35.95 |
| 3 | C3 | 80 | 20 | 701.55 | 37.9 |
| 4 | C4 | 70 | 30 | 561.15 | 32.24 |
| 5 | C5 | 60 | 40 | 220.5 | 12.59 |

**CONCLUSION :-**As per graph 4.3, it is observe that 30 % fly ash mixed concrete got 32.34 Mpa which is greater than targeted strength i.e. **31.6** Mpa.




Graph Comparison of 0 % fly ash mixed concrete and 30 % fly ash mix concrete

**CONCLUSION:-** From the results obtained above for 28 days, Strength for percentage vary of 30% fly ash and 70% cement is 32.34MPA which approves or satisfy the targeted strength of 31.6 MPA. So for further experiment with polypropylene fibers we have choose the percentage vary of 30% fly ash & 70% cement. Graph shows that fly ash mixed concrete increase its strength slowly up to 14 days as compare to concrete which not contain fly ash.

Further we took the percentage vary of **30% flyash and 70% cement** as it has obtained the targeted strength. In further experiment, compression test on cube for 7days, 14days & 28days and varying percentage of POLYPROPELLINE fiber reinforced concrete are carried out. The experimental results and discussion for various tests is described below:

**TEST:**

**Compression Test Results for 7 Days**

| SR.NO | MARK | % Weight of fiber | CRUSHING LOAD | COMP. STRENGTH |
|---|---|---|---|---|
| 1 | C1 | 0.1 | 913.5 | 23.66 |
| 2 | C2 | 0.2 | 617.175 | 23.76 |
| 3 | C3 | 0.3 | 701.55 | 26.26 |
| 4 | C4 | 0.4 | 561.15 | 22.13 |

**CONCLUSION:-**

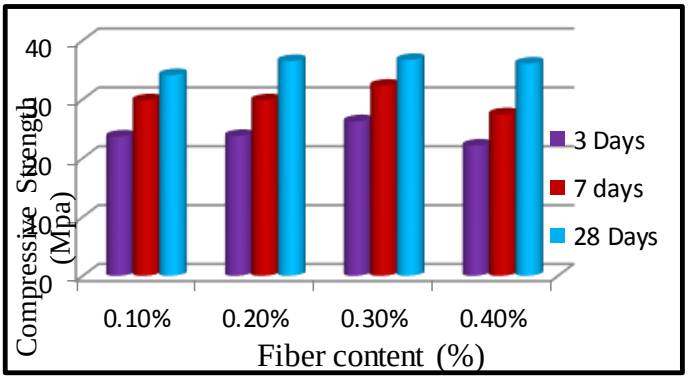
From the above graph we conclude that the maximum compression strength obtained at 7 Days with addition of polypropelline fiber with increment of 0.1% of 70% cement and 30% flyash is 26.26 MPA at 0.3% polypropelline.

**Compression Test Results for 14 Days**

| SR. NO | MARK | % Weight of fiber | CRUSHING LOAD | COMP. STRENGTH |
|---|---|---|---|---|
| 1 | C1 | 0.1 | 670.72 | 29.81 |
| 2 | C2 | 0.2 | 670.86 | 29.816 |
| 3 | C3 | 0.3 | 731.25 | 32.5 |
| 4 | C4 | 0.4 | 617.4 | 27.44 |

**CONCLUSION :-** From the above graph we conclude that the maximum compression strength obtained at 14 Days with addition of polypropelline fiber with increment of 0.1% of 70% cement and 30% flyash is 32.24 MPA at 0.3% polypropelline

## 4. Results and Discussions




Graph shows the comparison of compression strength of 0.1%,0.2%,0.3%,0.4% polypropelline fiber with 3 days 7 days and 28 days.

From the results it is observed that, compressive strength of concrete without fiber is recorded as 32.34 N/mm$^2$ and maximum compressive strength is recorded as 36.63 N/mm$^2$ for 0.3% of polypropylene fiber content for 28 days curing. The results show that the compressive strength of PFRC increases with increase in percentage of fiber up to 0.1 %. The fiber percentage more than 0.2 % increases heterogeneity of concrete matrix since there are physical difficulties in providing homogeneous distribution of polypropylene fibers.

In the presence of water Portland cement hydrates to form new solids that become the foundation of hardened cement paste in concrete like calcium hydroxide and calcium-silicate-hydrate. The calcium-silicate-hydrate (C-S-H) gel is the most important cementing component of concrete. It is responsible for the engineering properties of concrete including setting, hardening and strength development.

## 5. Conclusion

Graph shows the comparison of compression strength of 0.1%,0.2%,0.3%,0.4% polypropelline fiber with 3 days 7 days and 28 days.From the results it is observed that, compressive strength of concrete without fiber is recorded as 32.34 N/mm$^2$ and maximum compressive strength is recorded as 36.63 N/mm$^2$ for 0.3% of polypropylene fiber content for 28 days curing. The results show that the compressive strength of PFRC increases with increase in percentage of fiber up to 0.1 %. The fiber percentage more than 0.2 % increases heterogeneity of concrete matrix since there are physical difficulties in providing homogeneous distribution of polypropylene fibers.

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