

## **STUDY ON POLYPROPYLENE REINFORCED CONCRETE USING FLY ASH**

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### **ABSTRACT**

The study deals with the strength properties of concrete containing polypropylene and class C fly ash in different proportions. Adding fly ash in ratios 50%,55%,60% with replacing of cement. Polypropylene is used in dosage of 0.9%. According to IS code concrete is to be mixed in design mix of M<sub>35</sub>. Series of cubes will be casted and carried out to find compressive strength at the age of 3days, 7days, and 28 days.

**KEYWORDS :** polypropylene, class C fly ash, compressive strength, M<sub>35</sub>

### **INTRODUCTION**

Polypropylene (PP) is a versatile and widely used polymer, Polypropylene (PP) resins are a general class of thermoplastics produced from propylene gas. Propylene gas is derived from the cracking of natural gas feedstock's or petroleum by-products. Under broad ranges of pressures and temperatures, propylene generally polymerizes to form very long polymer chains. Polypropylene (PP) fibers belong to the newest generation of large-scale, manufactured chemical fibers, having the fourth largest volume in production after polyesters, polyamides and acrylics.

The ash which is extracted from flue gases through Electrostatic Precipitator in dry form. This ash is fine material & possesses good pozzolanic property. Fly ash is commonly used in concrete in replacements ranging from 0 to 30% by mass of the total cementitious material. Research has shown that using 50% or greater replacement of fly ash can have wide range of benefits. Fly ash is a by-product and less expensive than Portland cement, it is also known to improve workability and reduce internal temperature. The improved workability is result of the ball bearing action of the spherical fly ash particles. Fly ash improves grading in the mixture by smoothing out the fine particle distribution. Also, fly ash has shown to reduce the amount of water required.

### **MATERIAL TESTING**

Engineering properties of materials is playing a very important role in the process of grouting because of result may depend on that. Materials involved in this process are Polypropylene, Fly ash and concrete materials. High in calcium dry fly ash obtained from the Neyveli Lignite Corporation (NLC) was used as the base material

#### **Preliminary tests on:**

In this investigation the test attempt are done in laboratory to find the engineering properties of the materials.

#### **1. Cement:**

In the present investigation 53 Grade Ordinary Portland Cement (OPC) conforming to IS 1489(part 1): 1991 where used in this work. It's having Fineness 95%, Normal consistency Normal consistency, Initial Setting Time 30 Minutes, Specific gravity of cement 3.15

### **2.Fine Aggregate:**

Specific gravity of fine aggregate 2.73, sand is coming under Zone III find out with the help of sieve analysis.

### **3.Coarse Aggregate:**

The aggregate most of which are retained on the on the 4.75mm IS sieve and contain only so much of fine material as is permitted by the specification are termed coarse aggregate. Crushing Value of coarse aggregate 11.09%, Impact value 21.44%, Devals value 1.2% , Los angels value 19.4%, Specific gravity of coarse aggregate 2.85

## **METHODOLOGY**

Strength mainly depends on water - cement or water - cementitious material ratio [w/c or w/(c+p) ]. For a given set of materials and conditions, concrete strength is determined by the net quantity of water used per unit quantity of cement or total cementitious materials. Design for the M<sub>35</sub> (35N/mm<sup>2</sup>) grade concrete was done based on I.S code method. Mix Design [AS PER IS: 10262 – 2009].

Compression test is the most common test conducted on hardened. concrete, partly because it is an easy test to perform, and partly because most of the desirable characteristic properties of the concrete qualitatively related to its compressive strength. The compressive test is carried out on the cube specimen is of the size 150mm x 150mm x 150mm. In order to determine the compressive strength, a total number of 27 cubes were casted. After 24 hours of casting, the specimens were de-moulded and cured under normal temperature. At the end of curing period, the specimens were tested in a compression testing machine as per IS: 516-1959. compressive strength ( $f_{ck}$ ) is calculated from the expression  $f_{ck} = P/A$  Where,

$f_{ck}$  = compressive strength (MPa)

P = applied load (Kilo Newton)

A = cross section area (mm<sup>2</sup>)

## **RESULTS**

Compressive strength of cube with 50%, 55%, 60% of fly ash in M35 grade concrete are tabulate below.

**Table 1:50% replacement of FLY ASH @ 3 days Curing**

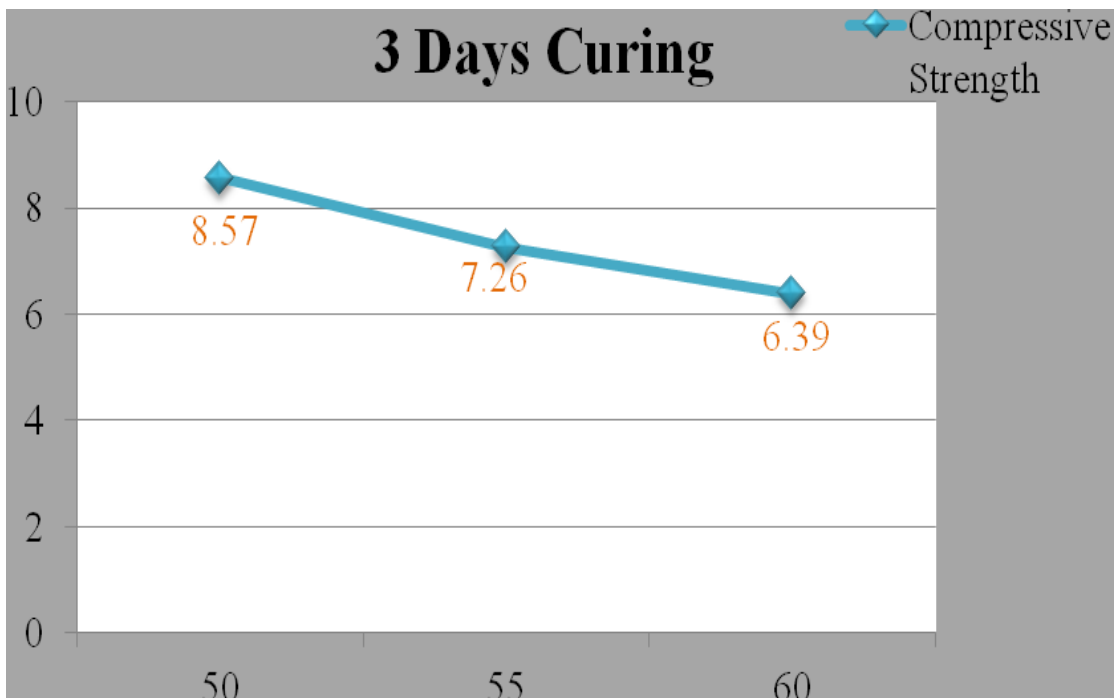
<b>SL.NO</b>	<b>WEIGHT OF SPECIMEN IN (KG)</b>	<b>APPLIED LOAD (P)(Kn)</b>	<b>C/S AREA MM<sup>2</sup></b>	<b>STRESS N/MM<sup>2</sup></b>
1	8.170	20	22500	8.72
2	8.154	20	22500	8.72
3	8.130	19	22500	8.28
AVERAGE COMPRESSIVE STRENGTH = 8.57 N/MM <sup>2</sup>				

**Table 2: 55% replacement of FLY ASH @ 3days Curing**

<b>SL.NO</b>	<b>WEIGHT OF SPECIMEN IN (KG)</b>	<b>APPLIED LOAD (P)(KN)</b>	<b>C/S AREA MM<sup>2</sup></b>	<b>STRESS N/MM<sup>2</sup></b>
1	8.106	18	22500	7.84
2	8.050	16	22500	6.97
3	8.180	16	22500	6.97
AVERAGE COMPRESSIVE STRENGTH = 7.26 N/mm <sup>2</sup>				

**Table 3: 60% replacement of FLY ASH @ 3 days Curing**

SL.NO	WEIGHT OF SPECIMEN IN (KG)	APPLIED LOAD (P)(KN)	C/S AREA MM <sup>2</sup>	STRESS N/MM <sup>2</sup>
1	7.742	17	22500	7.41
2	7.436	13	22500	5.66
3	7.626	14	22500	6.10
Average compressive strength of cubes after 3 days curing = 6.39 N/mm <sup>2</sup>				



**Table 4: 50% replacement of FLY ASH @ 7 days Curing**

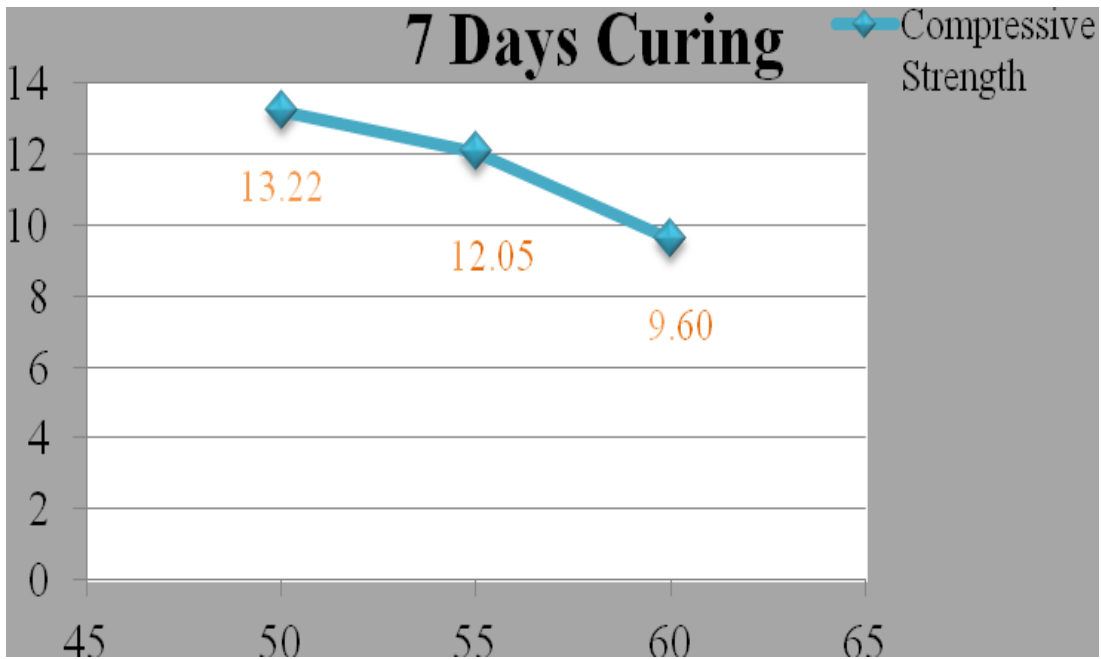
<b>SL.NO</b>	<b>WEIGHT OF SPECIMEN IN (KG)</b>	<b>APPLIED LOAD (P)(KN)</b>	<b>C/S AREA MM<sup>2</sup></b>	<b>STRESS N/MM<sup>2</sup></b>
1	8.089	32	22500	13.95
2	8.000	31	22500	13.51
3	7.821	28	22500	12.20
AVERAGE COMPRESSIVE STRENGTH = 13.22 N/MM <sup>2</sup>				

**Table 5: 55% replacement of FLY ASH @ 7days Curing**

<b>SL.NO</b>	<b>WEIGHT OF SPECIMEN IN (KG)</b>	<b>APPLIED LOAD (P)(KN)</b>	<b>C/S AREA MM<sup>2</sup></b>	<b>STRESS N/MM<sup>2</sup></b>
1	8.125	29	22500	12.64
2	7.900	26	22500	11.33
3	7.980	28	22500	12.20
AVERAGE COMPRESSIVE STRENGTH = 12.05 N/mm <sup>2</sup>				

**Table 6: 60% replacement of FLY ASH @ 7 days Curing**

<b>SL.NO</b>	<b>WEIGHT OF SPECIMEN IN (KG)</b>	<b>APPLIED LOAD (P)(KN)</b>	<b>C/S AREA MM<sup>2</sup></b>	<b>STRESS N/MM<sup>2</sup></b>
1	7.780	22	22500	9.60
2	7.650	20	22500	8.72
3	7.800	24	22500	10.46
AVERAGE COMPRESSIVE STRENGTH = 9.60 N/mm <sup>2</sup>				



**Table 7:50% replacement of FLY ASH @ 28 days Curing**

SL.NO	WEIGHT OF SPECIMEN IN (KG)	APPLIED LOAD (P)(KN)	C/S AREA MM <sup>2</sup>	STRESS N/MM <sup>2</sup>
1	8.096	52	22500	22.67
2	7.886	43	22500	18.75
3	8.200	50	22500	21.08
AVERAGE COMPRESSIVE STRENGTH = 21.08 N/MM <sup>2</sup>				

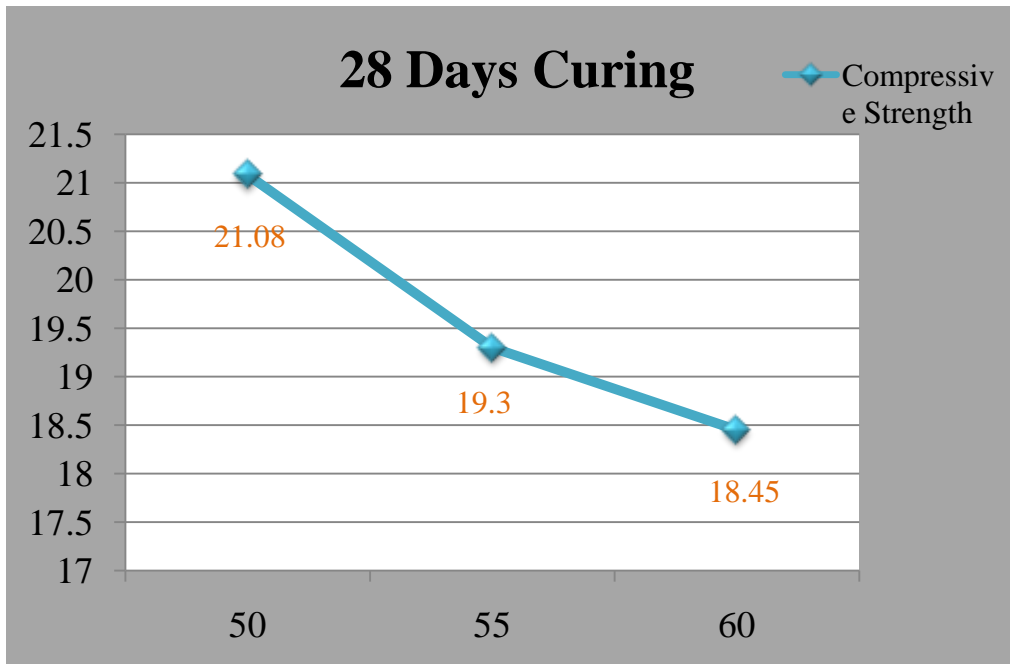
**Table 8:55% replacement of FLY ASH @ 28days Curing**

<b>SL.NO</b>	<b>WEIGHT OF SPECIMEN IN (KG)</b>	<b>APPLIED LOAD (P)(Kn)</b>	<b>C/S AREA MM<sup>2</sup></b>	<b>STRESS N/MM<sup>2</sup></b>
1	8.260	41	22500	17.80
2	8.188	42	22500	18.30
3	8.215	50	22500	21.8
AVERAGE COMPRESSIVE STRENGTH = 19.30 N/MM <sup>2</sup>				

**Table 9:60% replacement of FLY ASH @ 28 days Curing**

<b>SL.NO</b>	<b>WEIGHT OF SPECIMEN IN (KG)</b>	<b>APPLIED LOAD (P)(Kn)</b>	<b>C/S AREA MM<sup>2</sup></b>	<b>STRESS N/MM<sup>2</sup></b>
1	8.300	48	22500	20.92
2	8.218	37	22500	16.13
3	8.250	42	22500	18.31
AVERAGE COMPRESSIVE STRENGTH = 18.45 N/mm <sup>2</sup>				





## CONCLUSIONS

From the experiment result we can say that 50% replacement of Fly ash gives good strength and more than 50% (55%,60%) it shows decrease in strength. Extending of curing period fly ash starts to react and gains more strength to the concrete. With large quantities of Fly ash available in India at low cost, the use of Fly ash seems to offer the best solution to rising and high cost cement. We can conclude that, The early strength of concrete is lower and higher strength is developed when days get prolonged. At early ages fly ash exhibits very little cementing value. At later ages when liberated lime resulting from hydration of cement, reacts with fly ash and contributes considerable strength to the concrete. This method of fly ash use is used for mass concrete works where initial strength of concrete has less importance compared to the reduction of temperature rise. It can also be considered as Eco-Friendly concrete.

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