

Impact of Polypropylene Woven Fibre including Admixture with Fly Ash on Compressive Strength of Grade M-30 Mix

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ABSTRACT

Fibre Reinforced Concrete can be defined as a composite material consisting of mixtures of cement, mortar or concrete and discontinuous, discrete, uniformly dispersed suitable fibres. The synthetic fibres available in the United States, polypropylene is the most widely used in ready mixed concrete. The combinations of fly ash concrete with fibre reinforcements to enhance the mechanical properties. Addition of polypropylene fibre was found to improve the durability of concrete composites containing fly ash. Admixtures are generally used to alter the properties of concrete (such as increased workability or reduced water content, acceleration or retardation of setting time, acceleration of strength development, and improved resistance to weather and chemical attacks) to make it more suitable for a particular purpose. In this paper an experimental analysis has been carried out to show the impact of Polypropylene Woven Fibre including Admixture with different quantity of Fly Ash as a partial replacement of cement on compressive strength of concrete cubes for M-30 grade of concrete mix. It is found that compressive strength has been increased by using PPWF including Admixture with 10%, 20% and 30% Fly Ash.

Keywords: Polypropylene Woven Fibre, Admixture, Fly Ash, Cement, Compressive Strength.

I. INTRODUCTION

In a fast developing country where almost each and every day construction activities takes place in a modern sense to improve the structural strength with economic value, uses of prior modern materials are required.

Concrete can bear up the severest environmental conditions; however, in several conditions it may show very low characteristics. Hence, engineers worldwide are constantly trying to improve its characteristics with the aid of modern admixtures and waste materials, usually called as alternate building materials (ABM). In this regard, basic construction materials without them nothing can be started to construct but now-a-days these all are like cement, sand and aggregates are very costly materials so they may be partially replaced by percentage wise using industrial and agricultural waste materials for economical development and for the growth of the country. PPWF is a reinforced fibre which gives durability and strength to concrete and also improves workability of concrete. Compressive strength

of cubes using Fly Ash & PPWF including Admixture has not been observed till now. In this regard an experimental study in laboratory was conducted using 5%PPWF+5%ADMIXTURE & 10%PPWF+5%ADMIXTURE with 0%, 10%, 20% and 30% Fly Ash as a partial replacement material in concrete mix design M-30 GRADE. Sumant U. Ladole (2012) Corrosion of steel reinforcement is one of the main problems facing the construction industries throughout the world. Aiswarya Sukumar and Elson John (2014) did an experimental investigation on the behavior of concrete specimens reinforced with steel fibers and subjected to compressive and flexural loading.

Shubha Khatri (2014) investigated that the compressive strength of concrete cubes for M-20 and M-40 grade concrete mix design by doing an experimental study by using Coconut Fibre and Polypropylene Woven Fibre (PPWF) including Admixture in the form of Superplasticizer as CONPLAST (G-8) 410. Bhupendra Kumar, S.S. Kuswah and Amit Viswakarma (2015) This Research paper discusses the comparative study

between Fly ash based coconut fiber concrete with plain cement concrete of M40 grade. Raphael Chacko, S Hema and M Vadivel (2016) This research describes experimental studies on the use of coconut fibre and banana fibre to enhance the strength and applications of concrete.

II. METHODOLOGY

In this paper an experimental analysis has been carried out in laboratory with respect to initial and final setting time of cement, workability of concrete by slump cone test and then by compaction factor test to find out the properties of cement and concrete. To find out the compressive strength of concrete cubes mould size is taken 150mm by 150mm and grade of concrete is M-30. Fly ash as a partial replacement material has been uses in concrete. Polypropylene woven fibre and admixture in the form of super-plasticizer by weight of cement has been added to the mix. Cubes are prepared for 7 and 28 days. Here percentage of fly ash has been used from 10%, 20% and 30% respectively for 5%PPWF, 10%PPWF including 5%admixture. First of all normal concrete mix designed concrete cubes are moulded with 0% fly ash and without PPWF & ADMIXTURE for 7 and 28 days and compressive strength has been checked. Then again concrete cubes with 0% fly ash but with 5% and 10% PPWF including Admixture have been moulded for 7 and 28 days to check the compressive strength. Then again this procedure was repeated for 10%, 20% and 30% fly ash as a partial replacement of cement.

III. EXPERIMENTAL ANALYSIS

As per above discussions observation tables are presented here. Following are values are obtained according to experimental analysis. Table 1 shows the slump and compaction factor according to water/cement ratio with different amount of fly ash and PPWF including admixture. Table 2 shows the results of compressive strength of concrete cubes for M-30 grade with normal mix i.e. 0%FA, 0%PPWF & 0%ADMIXTURE. In this table compressive strength results are shown from test are tabulated related to 0% FA with 5% and 10% PPWF including admixture. Similarly results are obtained from lab work related to 10%-30% Fly Ash as a partial replacement of cement with 5% and 10% PPWF including Admixture are tabulated below in Table 2.

Table 1. Details Of Slump And Compaction Factor As Per Mixes

S. No.	w/c Ratio	Fly Ash	PPWF + ADMIXTURE	Slump (mm)	Compaction Factor
1	0.45	10%	5%PPWF+5% Admix	120	0.90
			10%PPWF+ 5% Admix	115	0.90
			15% PPWF+ 5% Admix	112	0.89
2	0.45	20%	5%PPWF+5% Admix	110	0.85
			10%PPWF+ 5% Admix	105	0.81
			15% PPWF+ 5% Admix	100	0.80
3	0.45	30%	5%PPWF+5% Admix	95	0.79
			10%PPWF+ 5% Admix	90	0.75
			15% PPWF+ 5% Admix	85	0.71

Table 2. Compressive strength test of concrete cubes of size 150mm×150mm for 7 and 28 days curing with ppwf and admixture at different content of fly ash as a partial replacement of cement

S. No.	Fly Ash %	Polypropylene Woven Fibre %+ Admixture % (By weight of cement)	Compressive Strength of Cubes N/mm ²	
			7Days	28 Days
1	0%	0% PPWF+0% ADMIX	20.0	30.0
2	0%	5% PPWF+5% ADMIX	20.5	30.5
		10% PPWF + 5% ADMIX	22.3	32.7
3	10%	5% PPWF+5% ADMIX	23.2	33.8
		10% PPWF + 5% ADMIX	25.0	36.0
4	20 %	5% PPWF+5% ADMIX	40.2	45.0
		10% PPWF + 5% ADMIX	45.18	50.08
5	30 %	5% PPWF+5% ADMIX	51.11	55.5
		10% PPWF + 5% ADMIX	52.0	57.8

IV. RESULTS & DISCUSSIONS

After conducting experimental analysis results are plotted in excel sheet and discussions have been made.

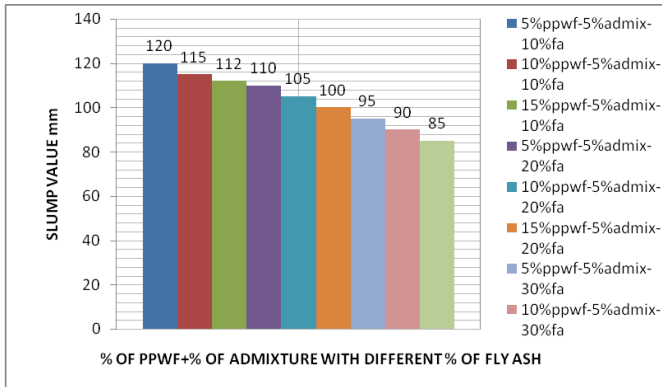


Figure 1. Workability Analysis of M-30 grade concrete mix with different percentage of PPWF-ADMIXTURE-FLY ASH

As shown in Figure 1 that by increasing the amount of fly ash from 10% to 30% slump value is decreasing continuously. In the mean time it is also shown in figure that percentage of Polypropylenes Woven Fibre including percentage of admixture by weight of cement has been mixed in concrete for M-30 grade so by increasing these amounts with different percentage of fly ash slump value is decreased. For 5% PPWF+5%ADMIX with 10% FA slump value is 120mm, for 10%PPWF+5%ADMIX with 10% FA it is 115mm and for 15% PPWF+5%ADMIX with 10% FA it is 112 mm. Similarly, for 5%PPWF+5%ADMIX with 20% FA it is 110mm, for 10%PPWF+5%ADMIX with 20% FA it is 105mm and for 15%PPWF+5%ADMIX with 20% FA it is 100mm.

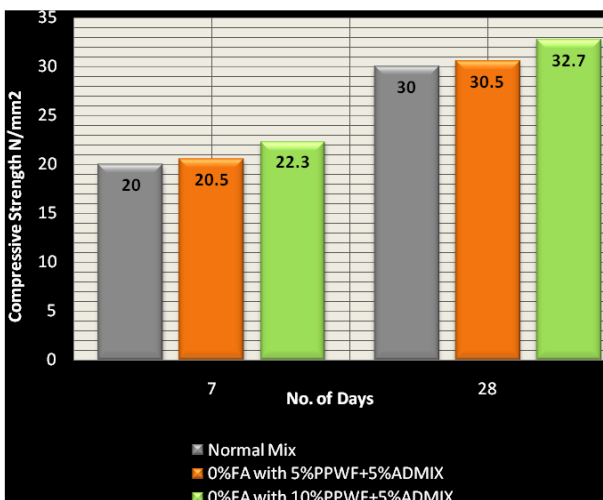


Figure 2. Compressive Strength of Concrete Cubes with: 5% & 10 % of PPWF+5%Admixture with 0 % Fly Ash for M-30 MIX Concrete

As shown in this Figure 2 that normally compressive strength of concrete cubes of size 150mm by 150mm is obtained 20 N/mm² and 30 N/mm² for M-30 grade concrete mix design for 7 and 28 days respectively. After that this mix is prepared by 0% FLY ASH replacement of cement but with 5%PPWF and 5%admixture so it gives minor changes in compressive strength like 20.5N/mm² and 30.5 N/mm² for 7 and 28 days respectively. Percentage increment is obtained as 2.43% and 1.64% respectively. While this mix is prepared by 10%PPWF and 5%admixture so percentage increment is 10.31% and 8.25% respectively for 7 and 28 days as compared to 5%PPWF+5%admixture.

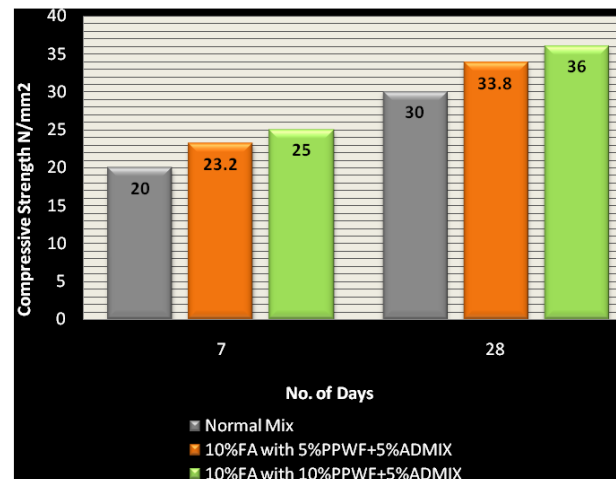


Figure 3. Compressive Strength of Concrete Cubes with: 5% & 10 % of PPWF+5%Admixture with 10 % Fly Ash for M-30 MIX Concrete

For 5%PPWF+5%admixture and 10%PPWF+5%admixture with 10% FLY ASH as a partial replacement of cement, compressive strength is increased like 23.2N/mm² and 25N/mm² for 7 days respectively. Percentage increment is also determined i.e. 13.79% and 20% respectively for 7 days. Similarly, for 5%PPWF+5%admixture and 10%PPWF+5%admixture with 10% fly ash as a partial replacement of cement, compressive strength is increased like 33.8N/mm² and 36N/mm² for 28 days respectively. Percentage increment is also determined i.e. 11.24% and 16.66% respectively for 28 days shown in Figure 3.

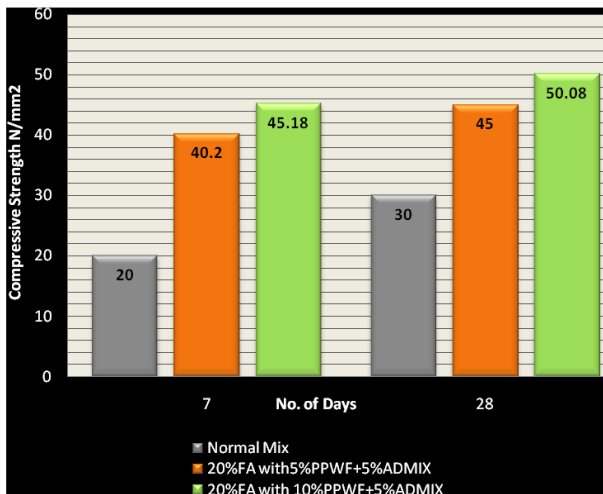


Figure 4. Compressive Strength of Concrete Cubes with: 5% & 10% of PPWF+5% Admixture with 20% Fly Ash for M-30 MIX Concrete

As shown in this Figure 4 that for 10%PPWF+5%admixture with 20% FLY ASH as a partial replacement of cement, compressive strength is increased as compared to 5%PPWF+5%admixture. Compressive strength is obtained 40.2 N/mm² and 45 N/mm² for 7 days respectively. Percentage increment is also determined i.e. 50.24% and 55.73% for 7 days. Similarly, for 5%PPWF+5%admixture and 10%PPWF+5%admixture with 20% FLY ASH as a partial replacement of cement, compressive strength is increased like 45.18N/mm² and 50.08N/mm² for 28 days respectively. Percentage increment is also determined i.e. 33.33% and 40.09% respectively for 28 days.

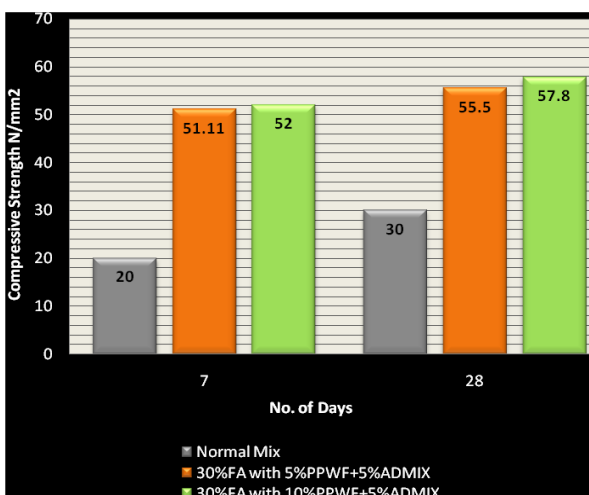


Figure 5. Compressive Strength of Concrete Cubes with: 5% & 10% of PPWF+5% Admixture with 30% Fly Ash for M-30 MIX Concrete

As shown in this figure 5 that for 10%PPWF+5%admixture with 30% FLY ASH as a partial replacement of cement, compressive strength is increased as compared to 5%PPWF+5%admixture. Compressive strength is obtained 51.11 N/mm² and 55.5 N/mm² for 7 days respectively. Percentage increment is also determined i.e. 60.86% and 61.53% for 7 days. Similarly, for 5%PPWF+5%admixture and 10%PPWF+5%admixture with 30% FLY ASH as a partial replacement of cement, compressive strength is increased like 52N/mm² and 57.8N/mm² for 28 days respectively. Percentage increment is also determined i.e. 45.94% and 48.09% respectively for 28 days respectively.

V. CONCLUSION

Workability test results are shown in Figure 1. It shows that for normal concrete mix of m-30 grade slump is very high, But when quantity of PPWF, ADMIXTURE and FLY ASH is increased by percentage weight of cement so slump is reduced continuously. For 5% PPWF+5%ADMIX with 10% FA slump value is 120mm, for 10%PPWF+5%ADMIX with 10% FA it is 115mm and for 15% PPWF+5%ADMIX with 10% FA it is 112 mm. Similarly, for 5%PPWF+5%ADMIX with 20% FA it is 110mm. For compressive strength of concrete cubes for 5%PPWF+5%ADMIX ON 0% FLY ASH percentage increment is obtained as 2.43% and 1.64% for 7 and 28 days respectively. Similarly, for 5%PPWF+5%admixture and 10%PPWF+5%admixture with 10% fly ash as a partial replacement of cement, compressive strength is obtained 33.8N/mm² and 36N/mm² for 28 days respectively. Percentage increment is also determined i.e. 11.24% and 16.66% respectively for 28 days. With 5%PPWF+5%admixture and 10%PPWF+5%admixture with 20% FLY ASH as a partial replacement of cement, compressive strength is increased like 45.18N/mm² and 50.08N/mm² for 28 days respectively. Percentage increment is also determined i.e. 33.33% and 40.09% respectively for 28 days. With 5%PPWF+5%admixture and 10%PPWF+5%admixture with 30% FLY ASH as a partial replacement of cement, compressive strength is increased like 52N/mm² and 57.8N/mm² for 28 days respectively. Percentage increment is also determined i.e. 45.94% and 48.09% respectively for 28 days respectively.

VI. REFERENCES

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