Experimental Analysis of Concrete with Bi-Blended material

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***Abstract:* To provide low-cost construction materials for usage in poor nations, the utilization of additional cementitious elements is essential. The numerous qualities of concrete, including workability, durability, strength, resistance to fractures, and permeability, can be enhanced by the inclusion of some pozzolanic elements. A by-product of the reduction of high-purity quartz with coal, coke, and wood chips in an electric arc furnace to create silicon metal or silicon alloys is silica fume. It is well known that silica fume enhances the durability and mechanical properties of concrete. The main physical consequence of silica fume in concrete is filler, which due to its fineness may fit into the space between cement grains similarly to how sand does.**

***Keywords:* Concrete beam, Metakaolin, Silica Fume**

I. INTRODUCTION

Metakaolin is a different type of pozzolanic material that is produced from specific kaolins after being refined and calcined under the circumstances. It may thus show to be a promising material for producing high-performance concrete because it is quite effective for raising strength and minimizing setting time in concrete, which improves concrete quality (Li and Ding 2003). It is a very effective pozzolana that, through a pozzolanic reaction, quickly creates calcium silicate and calcium aluminosilicate hydrates from the excess calcium hydroxide left over after OPC hydration (Luc Courard et al. 2003).

A by-product of the reduction of high-quality quartz with coal, coke, and wood chips in an electric arc furnace to create silicon metal or silicon alloys is silica fume. It is well known that silica fume enhances the durability and mechanical properties of concrete. The main physical function of silica fume in concrete is that it acts as a filler. Sand fills the space between coarse aggregate particles, and cement grains fill the space between sand grains.

In this work, tests are carried out to check the mechanical properties of concrete with various combinations of Metakaolin and Silica fume. The replacement ratios are 5,10,15&20percentages of Metakaolin by weight of cement and 5,10 &15percentages of Silica fume by weight of cement.

II. MATERIAL USED

Properties	OPC 53grade	Metakaolin	Silica Fume
Specific gravity	3.15	2.61	2.82
Specific area cm^2/gm	3250	$1.5x10^5$-3 $x10^5$	$1.5x10^5$-$1.8x10^5$

The above-mentioned coarse aggregate, fine aggregate, and binder were used in the mix design for M20 grade concrete (target strength = 26.6 MPa) for the current experiment. Materials were distributed in the following weight ratio: 1:1.4:2.9:0.5. (Cement: Fine aggregate: Coarse aggregate: Water). 150 mm cubes were cast for reference and other mixes with different silica fume and metakaolin concentration, as shown in Table, to examine the effect of including silica fume and metakaolin combination (as part replacement of cement).

III. RESULT

Table:1 Conventional Concrete

No. of days curing	Compressive Strength (MPa)	Tensile Strength (MPa)
3	11.480	1.295
7	16.568	2.637
28	28.630	3.931

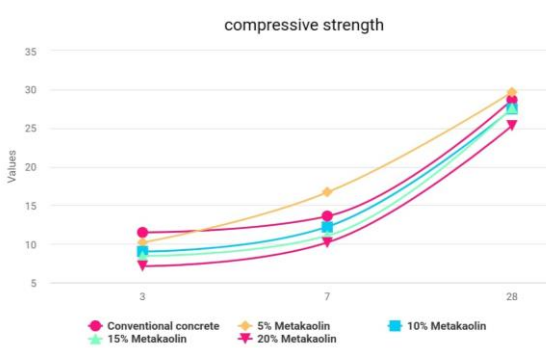
Table:2 Replacement of Metakaolin to the weight of cement

% Replacement	No. of days curing	Compressive Strength (MPa)	Tensile Strength (MPa)
5	3	10.173	2.226
	7	13.660	2.822
	28	29.630	3.978
10	3	9.010	1.943
	7	12.208	2.776
	28	27.468	3.654
15	3	8.429	1.850
	7	11.045	2.128
	28	27.613	2.683
20	3	7.121	1.526
	7	10.170	1.850
	28	25.288	2.128

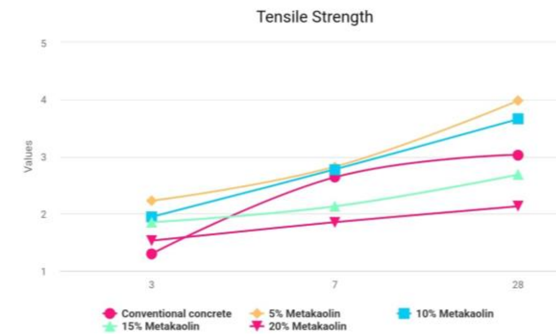
Table:3 Fixing the optimum ratio of Metakaolin and changing the ratio of Silica Fume

% Replacement		No. of days curing	Compressive Strength (MPa)	Tensile Strength (MPa)
Metakaolin	Silica Fume			
5	5	3	12.935	2.914
		7	15.456	2.877
		28	31.802	3.697
	10	3	16.870	3.165
		7	19.078	3.852
		28	33.252	4.452
	15	3	16.202	2.354
		7	18.247	2.636
		28	29.522	3.654

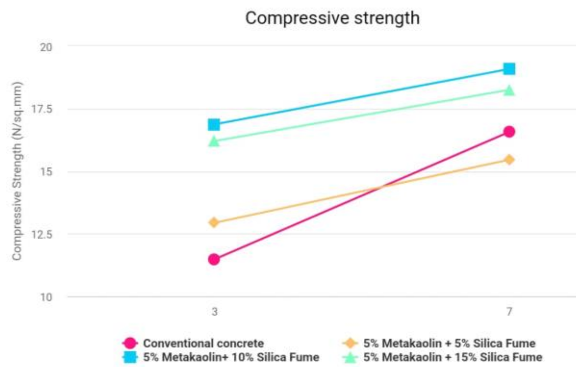
IV. COMPARISON GRAPH



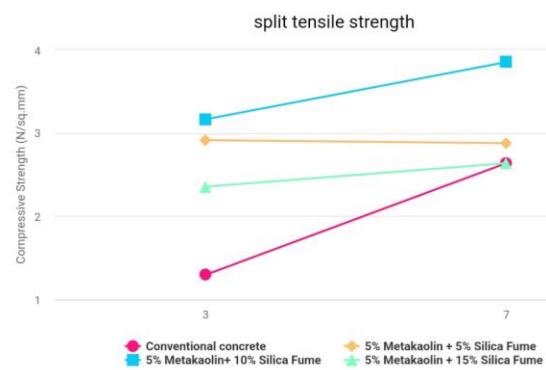
Conventional Concrete vs Metakaolin (Compressive Strength MPa)



Conventional Concrete vs Metakaolin (Tensile Strength MPa)



Conventional Concrete vs Metakaolin and Silica Fume (Compressive Strength MPa)



Conventional Concrete vs Metakaolin and Silica Fume (Tensile Strength MPa)

V. CONCLUSION

Its concluded from the above result that by finding and fixing the optimum percentage of metakaolin and changing the percentage of Silica Fume by weight of cement. The Compressive Strength and Tensile Strength are found to be optimum at 5%Metakaolin and 10%Silica Fume

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