Experimental Study on Strength of Concrete by using METAKAOLIN

Shashikant Dewangan
Research Scholar
Department of Civil Engineering
RKDF Institute of Science & Technology , Bhopal

Nidhi Gupta
Head of Dept.
Department of Civil Engineering
RKDF Institute of Science & Technology , Bhopal

Abstract

concrete is that pourable mix of cement, water, sand, and gravel that hardens into a super-strong building material. supplementary cementing materials (SCM) have become an integral part of concrete mix design. these may be naturally occurring materials, industrial wastes or, by products or the ones requiring less energy to manufacture. some of the commonly used SCM are fly ash, silica fume (SF), GGBS, rice husk ash and metakaolin (MK), etc. metakaolin is obtained by the calcination of kaolinite. it is being used very commonly as pozzolanic material and has exhibited considerable influence in enhancing the mechanical and durability properties of concrete. in this paper, experimental study was carried out on M 50 grade of concrete. in this concrete cement was replaced by metakolin. in various percentages such as 5%, 10%, 15%, 20%, 25% concrete specimens containing metakaolin were studied for their compressive strength.

Keywords: Metakaolin, compressive strength, grade of concrete

I. INTRODUCTION

Concrete is probably the most extensively used construction material in the world. It is an artificial material in which the aggregates are bonded together by the cement when mixed with water. With the advancement of technology and increased field of application of concrete and mortars, the strength, workability, durability and other characteristics of the ordinary concrete can be made suitable for any situation. For this, definite proportions of cement, water, fine aggregate, coarse aggregate, mineral admixtures and chemical admixtures are required. The demand for Portland cement is increasing dramatically in developing countries. Portland cement production is one of the major reasons for CO2 emissions into atmosphere. Metakaolin when used as a partial replacement substance for cement in concrete, it reacts with Ca(OH)2 one of the by-products of hydration reaction of cement and results in additional C-S-H gel which results in increased strength. Metakaolin is obtained by thermal activation of kaolin clay. This activation will cause a substantial loss of water in its constitution causing a rearrangement of its structure. To obtain an adequate thermal activation, the temperature range should be established between 600 to 750ºC. The principal reasons for the use of clay-based pozzolans in mortar and concrete have been due to availability of materials and durability enhancement. In addition, it depends on the calcining temperature and clay type. It is also possible to obtain enhancement in strength, particularly during the strength of curing. The very early strength enhancement is due to a combination of the filler effect and acceleration of cement hydration. **1**Dinakar et al. investigated the effect of using local calcined kaolin or MK obtained commercially as pozzolan on the development of high strength and permeability/durability characteristics of concrete designed for a very low w/b ratio of 0.3. investigated the effect of partial replacement of cement by metakaolin on the properties of concrete. SuPPlementary cementing materials (SCMs) have been widely used all over the world in concrete due to their economic and environmental benefits. Hence, they have drawn much attention in recent years. Investigated the porosity and pore size distribution of high performance cement paste blended with metakaolin and compared them with silica fume (SF) or fly ash (FA) blended cement pastes. This present study was concerned with the MK-blended cement pastes at lower w/b ratios. The cement pastes prepared were MK blended pastes with MK contents of 5, 10, and 20%, SF-blended pastes with SF contents of 5 and 10%, an FA blended paste with a FA content of 20%, and a control PC paste without any pozzolanic replacement. The w/b ratio for all the pastes was 0.3.

II. MATERIAL

1) Cement
2) Sand
3) Aggregate
4) Metakaolin

III. RESULT

Table – 1
mix proportions & compressive strength of Metakaolin & OP concrete M50 grade

Grade of Concrete	*S. No*	*Type of Mix*	*Cement (kg/m3) (Cement %)*	*Metakaolin (kg/m3) (Metakaolin %)*	*Water (l/m3)*	*Fine aggregate (kg/m3)*	*Coarse aggregate (kg/m3)*	*Compressive strength (MPa) 28 days*
M50	*1*	*Normal*	*470 (100)*	*0.00 (0)*	*155*	*451*	*1240*	*61.4*
	2	*MK (05)*	*446.50 (95)*	*23.50 (5)*	*155*	*451*	*1240*	*65.78*
	3	*MK (10)*	*423.0 (90)*	*47.0 (10)*	*155*	*451*	*1240*	*68.9*
	4	*MK (15)*	*399.50 (85)*	*70.50 (15)*	*155*	*451*	*1240*	*66.8*
	5	*MK (20)*	*376.0 (80)*	*94.0 (20)*	*155*	*451*	*1240*	*64.92*
	6	*MK (25)*	*352.5 (75)*	*117.50 (25)*	*155*	*451*	*1240*	*56.36*

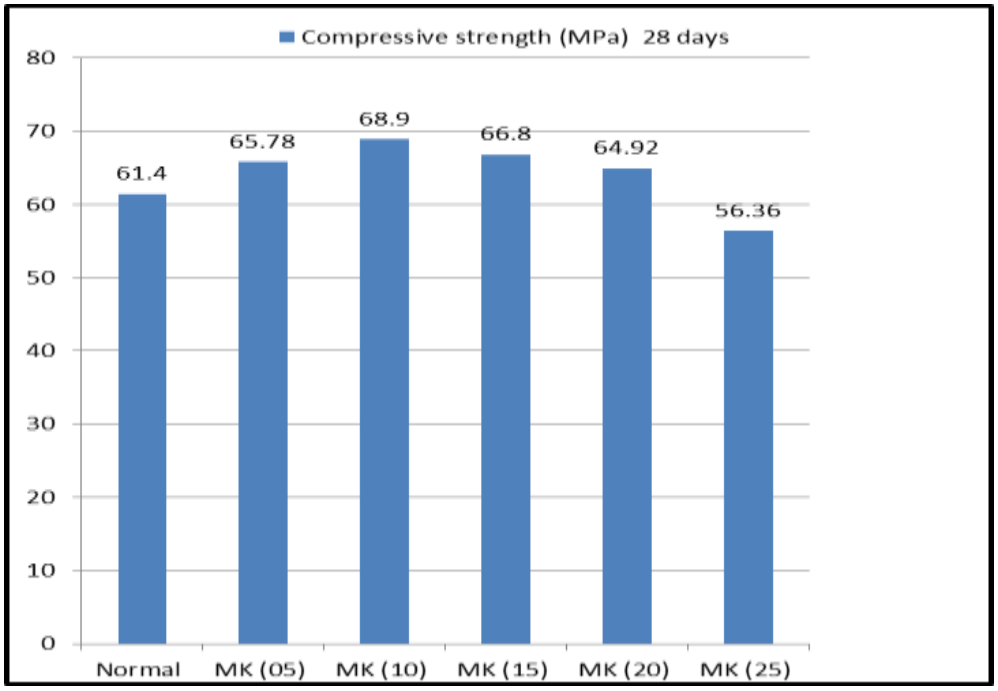

Fig. 1: proportions & compressive strength of Metakaolin & OP concrete M50 grade

IV. CONCLUSION

The compressive strength for M 50 grade is in Metakaolin concrete consisted of 90% OPC and 10% Metakaolin

REFERENCES

[1] Charles. H., Henage & Doberty. T.J.: "Analysis of reinforced fibrous concrete", Journal of ASCE, Structural Division, Vol-2, No.ST.1, Jan. 1976, PP.177-188.
[2] Ghosh, S.et al., "Tensile strength of steel fibre reinforced concrete", Journal of the Institution of Engineers (India), Vol.69, January 1989, PP. 222-227.
[3] Gopalaratnam, V.S., & Shah, S.P., "Properties of steel fibre reinforced concrete subjected to impact loading", ACI Journal January-February 1986, PP. 117-126 .
[4] H.Nakagawa, Suenaga T., and S. Akihama., "Mechanical properties of various types of fibre reinforced cement and concrete: International conference held on Sept. 18-20, University of wales college of Cardiff; Ed. By R.N.Swamy and B.Barr, Elsevier- aPPlied science, London, 1989, PP.523-532.
[5] Jack synder & David Lankard: "Factors affecting the flexural strength of SFRC", Journal of ACI, Vol.69, No. 2, Feb-1972.
[6] Kukreja C.B, Kaushik S.K., Kanchi M.B., and Jain O.P., "Flexural characteristics of steel fibre reinforced concrete", Concrete Journal, July (1980), PP.184-188.
[7] Kukreja, C.B. and Chawla, Sanjeev., "Flexural characteristics of steel fibre reinforced concrete", Indian Concrete Journal, March 1989, PP. 246-252.
[8] Rachel J.Detwiler and P.Kumar Mehta, "chemical and Physical effects of silica fume on the mechanical behaviours of concrete", ACI Materials Journal, Vol-86, No-6, 1989, PP-609-614.
[9] Saluja, S.K. et al., "Compressive strength of fibrous concrete", the Indian Concrete Journal, February 1992, PP.99-102.
[10] V.Ramakrishnan, G.Y.Wu, and G.Hosalli, "Flexural behaviour and toughness of fibre reinforced concrete", Transportation Research Record, No.1226, 1989a, PP.69 – 77.