

A REVIEW ON STRENGTH AND DURABILITY OF MORTAR USING METAKAOLIN AND GGBS AS A PARTIAL REPLACEMENT OF CEMENT

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ABSTRACT: In this Evaluation the cement mortar with compound of Ordinary Portland Cement (OPC), Ground Granulated Blast Furnace Slag (GGBS) and Metakaolin (MK) replacement levels. In this present research the cement has been partially replaced with Metakaolin (5%) in conjunction with GGBS (0%, 5%, 10%, 15% and 20%) in cement mortar. So this result is confess a individual compressive strength (at ages of 3, 7, 14, 28, 56 days) of cement mortar. Compressive Strength increased upto 50% by using Metakaolin & GGBS. Further, it has been observed that GGBS can utilize upto 20% together with 5% of MK. Cement mortar with the combinations of GGBS and Metakaolin communicate stronger development in strength and durability.

Keywords: Cement, Metakaolin, GGBS, Strength, Durability.

INTRODUCTION

By replaced cement with Metakaolin and GGBS increase in strength and durability in cement mortar. GGBS, Metakaoline are some of the pozzolanic materials(SCM), which can be used in the cement mortar for the partial replacement of cement. GGBS is one of the SCM. Metakaolin can be used as mortar constituent, replacing part of the cement content since it has pozzolanic properties. Cement and mortar cube were cast in 70.6* 70.6 *70.6 mm moulds. The cement mortar cube were cast for 1:3 proportions with water cement ratio of 0.5. After 24 h curing at 95% humidity, the cement mortar cube were demoulded and cured for 3, 7, 14, 28, 56 days. So all the strength values reported were an average of three specimens. In hardened state satisfactory compressive strength and an adequate durability is required.

LITERATURE REVIEW

A.H.L Swaroop, K.Venkateswararao, Prof. P. Kodandaramarao[1] have studied that concrete has been replaced with 20% of cement by fly ash and 20% by GGBS. The concrete mix and cube test for 7, 28, 60 days by using 1% of H₂SO₄ and result of fly ash and GGBS concrete has been replaced with 20% of cement are more than differentiate to CAC at end of 28 days and 60 days for normal water curing. So it gives good result for durability criteria.

Priyanka A. Jadhava and Dilip K. Kulkarni[2] have investigated that the partial replacement of natural sand by manufactured on the compressive strength of cement mortar proportion 1:2, 1:3 and 1:6 with w/c as 0.5. Compressive strength of mortar with 50% replacement of natural sand. The overall strength of mortar increases 0% and 50% replacement of natural sand.

A.V.S Sai Kumar, Krishna Rao[3] have studied the partial replacement of cement with Metakaolin and GGBS on the strength of concrete. Quarry Dust(25%) was replaced without loss of standard strength of cement and 3.8%, 7%, 9.5%, 11% and 13.5% Metakaolin was replaced of

cement material. Finally they concluded that the slump values are to normal concrete as 0.99%, 2.6% and 2.9% are reduced for 2.9%, 6% and 8.5% replacement of Metakaolin. And compaction factor is also reduced for 0%, 3.5%, 6% and 8.5 and increased for 1.09% for 10% replacement of cement with Metakaolin. The compressive and flexural strength are increased with 10% replacement of Metakaolin and decreased for 13.5% replacement.

Nikhil K. Kulkarni[4] has studied on the strength of Plain concrete with partial replacement of cement by Metakaolin and GGBS. The replacement of 13% cement with Metakaolin and GGBS with 0%, 5%, 10% and 15% and the compressive strength test was conducted for 7 and 28 days and compared results with normal concrete. Upto 10% replacement of cement with MK and GGBS strength was increased and for 15% decreased.

Er. Amripal Kaur[5] has studied that cement has been partially replaced at 0%, 5%, 7%, 9%, 12%, 15% with Metakaolin and 0% 10% with GGBS. Durability of concrete was also analyzed with RCPT. Result shows that the strength with the addition of Metakaolin and GGBS has been increased. The optimized strength value of concrete was achieved for both compressive strength and split tensile strength at 10% MK and 11% MP. Hence it gives good durability

Santosh Kumar Karri, G.V Rama Rao, P.Markandeya Raju[6] have studied characteristics of M20 and M40 grade concrete so the cement is partially replaced with GGBS at 20%, 30%, 40% after that the compressive strength of concrete is increased. So the result shows that the effect of acid on concrete decreases with increase of percentage of GGBS 40%. And the Compressive is increased.

A.Jayaranjini and B.Vidiveli[7] have studied on the cement and fine aggregate is partially replaced with metakaolin and silica fume. The result shows that there is improvement in durability of concrete for the mix having partial replacement of cement by 10% Metakaolin & 10% silica fume with replacement of fine aggregate by 30% bottom fly ash. So the rate of strength loss was minimum of concrete mix and better durability compared to the control mix.

Neelapu Pavanit, Prof. S.B Sankar Rao, Prof. P.Mallesham[8] have studied on strength characteristics of cement has been partially replaced cement with fly ash and addition of fibers, so the result shows that the different percentage partial replacement of cement by 0% fly ash with addition of steel fibers 1%, 1.5% & 10%. The compressive strength of the concrete mixes measured at 7 and 28 days curing. So we noticed that the compressive strength of concrete specimen decrease with increase in replacement of fly ash content and the strength is also increased.

Shahab Samad, Attaullah Shah[9] have studied the partial replacement of cement with GGBS on the strength. There are selected three levels of cement at 30%, 40% and 50% with water cement ratio as 0.35. The result shows that the strength gain in GGBS concrete is more at the ages of 28 and 56 days. The earlier research to use 56 days compressive strength of blended concrete.

Kamal Deep, Ravikanth Sharma[10] have investigated the strength of concrete cement has been partially replaced by Metakaolin (MK) & silica fume in the order of 4%, 8%, 28%. Totally 63 cubes and cylinders is casted. So the final result of silica fume & MK in combination is to find 12% and 12% by weight respectively at both 7 and 28 days compressive strength.

Zubair Ahmad Khan, V.S Sage[11] have studied that cement is partially replaced with Metakaolin (MK) with percentage of 0%, 5%, 10%, 15%, and 20% and natural sand with 40% ROBO sand. Compressive strength, split tensile strength and flexural strength at 7, 28, 90 days. So that the result shows that the compressive strength is increases at all ages of the control mix and split tensile strength and flexural strength is also increases at all ages.

Conclusion

1. Metakaolin and GGBS has some cementitious properties which may help increasing the strength of cement mortar cube.

2. So the compressive strength of cement mortar cube increased with Metakaolin and GGBS as partial replacement of cement with percentage of 0%, 5%, 10%, 15%, 20%.
3. From the experimental result that the strength of different cement mortar cubes increases at all ages. So the percentage increase are 2.5%, 20%, 29.7%, 15.3% & 5.4 at 3 days, 4.7%, 22%, 29.7% & 8.4% at 7 days, 5.6%, 27%, 31.6%, 19.2% & 10.1% at 14 days, 9.9%, 5%, 2% at 28 days.
4. Partially replacement of cement with GGBS and Metakaolin resistant to the effect of carbonation.

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