iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 4 **Issue:** V **Month of publication:** May 2016

DOI:

Volume 4 Issue V, May 2016
ISSN: 2321-9653

International Journal for Research in Applied Science & Engineering Technology (IJRASET)

A Review of Water Absorption, Porosity and Sorptivity of Cement Mortar made with metakaolin and flyash partially replaced in cement cured in seawater

A.Thanam Krishna Kumar[1], N.Sakthieswaran[2], G.Shiny Brintha[3], O.Ganesh Babu[4]

[1,2,3,4]*Department of Civil Engineering*

[1,2,3,4]*Anna University Regional Campus, Tirunelveli, TN, India.*

Abstract – In this present study the effects of flyash, metakaolin and their combinations has been evaluated for optimal level of replacement as blending component in cement. The results showed that the water absorption, porosity and sorptivity property of the mortor comparatively improved with flyash, metakaolin and their combinations than ordinary Portland cement mortor cured in seawater

Keywords— water absorption, porosity, sorptivity, metakaolin, flyash, cement mortar, seawater

I. INTRODUCTION

Flyash also known as pulverized fuel ash. It is one of the coal combustion products. And is composed of the fine particlesthat are driven out of the boiler with the flue gases. Ash that falls in the bottom of the boiler is called bottom ash. Flyash is generally captured by electrostatic precipitators or other particle filtration equipment before flue gases reach the chimineys of coal fired poweplants, and together with bottom ash removed from the bottom of the boiler is known as coalash. Depending upon the source and makeup of the coal being burned. The components of flyash vary considerably, but all flyash includes substantial amounts of silicon dioxide (sio2), aluminium oxide (Al2O3) and calcium oxide.

Metakaolin is also a valuable pozzolanic, and thermally activated aluminosilicate material obtained by calcining kaolin clay within the temperature range of 700–850°C(Shebl et al., 2009 and Sabir et al., 1996). Kaolin from natural sources may be notably impure, even after beneficiation. During heating, it converts unreactive kaolin to reactive Metakaolin. The impurities present in the precursor kaolin may become activated with respect to dissolution in alkaline cement pore fluid. The most important impurities in this context are muscovite and potassium-rich feldspar. Heated and unheated potassium feldspar and muscovite is mixed with Calcium hydroxide and water at 22°C up to 28 days. Significant alkali release is obtained even from unheated minerals.

Cement mortar is a material having tiny spaces through which liquid or air may pass. The durability of mortar depends largely on the movement of water and gas enters and moves through it. After evaporation of excess water in the mortar, voids inside the mortar creates capillaries which are directly related to porosity and permeability of the mortar. Due to incomplete compaction; mortar may consists gel pores & capillary pores, which leads to low strength of mortar. Due to problems associated with the absorption test and permeability test; which are measuring the response of mortar to pressure which is rarely the driving force of fluids entering in to mortar; hence there is a need for another type of test. Such tests should measure the rate of absorption of water by capillary suction; “sorptivity” of unsaturated mortar.

II. LITERATURE REVIEW

J.M.Khatib et al [1] This paper investigates the compressive strength, ultrasonic pulse velocity and density for cement mortar containing high volume of metakaolin as partial substitution of cement. (a) Replacing cement with up to atleast 20% metakaolin causes increase in strength compared to the control mix. However, using more than 20% metakaolin as partial cement replacement does not cause further increase in strength compared with the other metakaolin mixes. (b) The optimum replacement level that causes a maximum enhancement in compressive strength appears to be around 10%. The ultrasonic pulse velocity seems to follow a similar trend to the strength.

Hisham M.Khater [2] An experimental study for the resistance of mortar specimens incorporating 0%, 5%, 10%, 15%, 20%, 25% and 30% metakaolin [produced by firing Kaolin at 820 °C for 2 hrs (MK)] to the magnesium chloride solution was reported. (a

Metakaolin provide a good resistance to aggressive chloride solution by consuming liberated lime and so prevent the formation of Friedel's salt. (b) The maximum development of compressive strength was achieved for the specimens made from OPC-MK blended cement mortars containing a metakaolin content of 25 wt.%. (c)Microstructure of the MK-blended mortar exhibit a homogeneous and a compact structure, where the optimum mix of 25 wt.% MK provide a pronounced development in the hydration materials as well as a relatively low porosity leading to an enhancement in the mechanical properties

Rudolf Hela et al [3] The paper describes that research of different dosage of metakaolin used as active addition and its influence on final rheological properties of fresh cement paste and resulting physico-mechanical properties of hardened cement stone. (a) Higher amount of superplasticizer increases workability of fresh mix. Higher addition of metakaolin also enhances workability. Dosage of 15% of metakaolin causes decrease of workability of suspension in time. Increasing amount of percentual proportion of metakaolin in concrete mix seems to require higher dosage of superplasticizer to ensure longer period of workability. (b) Addition of metakaolin increases also final strength of cement stone. Compressive strength was growing with higher dosage of additive. Since the amount of 15% metakaolin results in loss of viscosity in time, it seems appropriate to use dosage of 10% by volume of cement.

Anupama P.S et al. [4] this paper describes that use of super pozzolanic supplementary cementing materials such as silica fume, rice husk ash, metakaolin etc in concrete and mortar improves the strength even at a higher water binder ratio. (a) The inclusion of metakaolin results in faster early age strength development of mortar. (b) Mix with 15% metakaolin is superior in all water/binder ratios investigated. (C) The increase in metakaolin content improves the compressive strength, irrespective of water binder ratio used.

Nazeer.M et al. [5] This study aims to find the effect on strength and sulphate durability of masonry mortars while using quarry dust as fine aggregate and replacement of part of cement with fly ash. Ordinary Portland cement (OPC) is partially replaced with fly ash (a) In the present investigation, the strength and sulphate induced durability issues of a ready-to-use dry mortar mix was studied. (b) The study revealed the mortar mix modified by replacing sand with quarry dust performs similar to that of the conventional mix, further a partial replacement of cement with the fly ash improve the later age strength and sulphate resistance of mortar

Dr. Rajamanya V. S. [6] The present report deals with the effects of mineral admixtures, by partial replacement of cement, in terms of improved performance on compressive and flexural strength. (a) Plain concrete is a brittle material and fails suddenly. Addition of Meta kaolin & Fly ash to concrete changes its brittle mode of failure into a more ductile one and improves the concrete ductility. (b) The compressive strength and flexural strength of concrete increases with meta kaolin & fly ash content. It is true up to 15% replacement if we replace cement by more than 15% strength starts reducing. Therefore it always preferable to use Meta kaolin & Fly ash with 10% replacement of cement and it gives us better result.

Sabria Malika Mansour [7] In the present work, several rheological tests were carried out at 20°C, by using the stress controlled rheometer AR2000, on the fresh cement pastes incorporating 0%, 5%, 10%, 15% and 20% of MK. Effect of metakaolin on the rheological behaviour of cement pastes were discussed.(a) The MK exhibit better rheological parameters (viscosity, shear stress) and improve the cement paste flowability, especially the replacement rate of 10%MK and 15%MK.(b) The MK acts as filler and controls rheology. The dense microstructure, the micro filler and pozzolanic effects of the metakaolin provide the positive effect on the cement pastes flow behaviour.(c) The dynamic tests have shown two types of behaviour: Viscous behaviour for the cement pastes containing MK and elastic behaviour for the control cement paste (0%MK). So, addition of MK improves the cement paste behaviour. It has significant effect when the replacement takes 10%MK and 15%MK.

II. CONCLUSION

From reviewing the above research papers related to metakaolin and flyash relevant conclusions can be made:

A. All Replacing cement with up to atleast 20% MK causes increase in strength compared to the control mix. However, using more than 20% metakaolin as partial cement replacement does not cause further increase in strength compared with the other metakaolin mixes. The optimum replacement level that causes a maximum enhancement in compressive strength

B. Saturated water absorption in percentage of the cement mortor with ricehush as metakaolin and their combinations is lesser than that of plain cement mortor with the same water binder ratio at all replacement levels and the decrement in percentage of saturated water absorption where 25% at 25% replacement of rice husk ash, 3705% at 25% replacement of metakaolin and 39.58% at 40% replacement of ricehusk ash, metakaolin combination

Volume 4 Issue V, May 2016
ISSN: 2321-9653

REFERENCES

[1] Wild, S., J.M. Khatib and M.J. Craythorne, 1997 Strength Development of Metakaolin Mortar. 5th International Conference on Modern Building Materials. Structures and Techniques, Lithuania, Vilnius Gediminas Technical University, 1: 58-63.
[2] Saveria Monosi, Daniela Sani and Francesca Tittarelli "Used foundry sand in cement mortars and concrete production", The Open Waste Management Journal, Vol. 3, pp. 18-25, 2010.
[3] Ambroise,J.Maximillen,S,Pera,J (1994). Properties of metakaolin blended cements. Advanced cement materials. 1(4) 161-168.
[4] Rudolf Hela,J, Marsalova (2009). Study of metakaolin influence on rheological properties of cement mortars. Annual transactions of Nordic rheology society.17.
[5] Sabir, BB, Wild, S, Khatib, JM (1996). On the workability and strength development of metakaolin concrete. Concrete for environmental enhancement and production. London, UK: E&FN Spon: 651-656
[6] Jian-T ong Ding and Zongijur Li. 'Effects of metakaolin and silica fume on properties of concrete', ACI materials journal by july-august 2002
[7] Raya Yaseen Mohammed, ' Properties of high performance steel fiber reinforced concrete containing High reactivity matakaolin', institute of technology/Baghdad 2011
[8] B.B patil, P.D.Kumbhar,'Strength and durability properties of high performance concrete in corporating high reactivity metakaolin', International journal of modern engineering research Vol.2, Issue.3,May-June-2012
[9] J.Khatib,S.Wild, Sulphate resistance of metakaolin mortar,CEm.concr. res.28(1)(1998) 83-93
[10] I.S. 12269-1987, Specification for 53 grade ordinary Portland cement.
[11] I.S. 456-2000, Indian Standard Plain and Reinforced Concrete – Code of Practice.
[12] I.S. 4031-1988, (Part – 5) Methods for physical tests for hydraulic cements: determination of initial and final setting times.
[13] I.S. 4031-1988, Methods for physical tests for hydraulic cements.