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Review on Change the Properties of Concrete by Adding Rice Husk Ash and Metakaolin

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Abstract: ***In this study the influence of partial relief of Ordinary Portland cement by Metakaolin and Rice Husk Ash were delved. In the last decade the use of supplementary bonding accoutrements has come an integral part of high strength and high performance concrete blend design. Rice hull ash is a by- product material attained from the controlled combustion of rice hull which consists of non-crystalline silicon dioxide with high specific face area and high pozzolanic reactivity. Metakaolin helps to reduce the quantum of calcium hydroxide, therefore performing in stronger and durable concrete. OPC was replaced with these mineral admixtures at 2, 4, 6 and 8% by weight. 0% relief served as the control. Compressive Strength test was carried out on hardened 150 mm concrete cells after at 7 and 28 days curing in water. Compression strength test confirms its felicity as a partial relief mineral amalgamation.***

Keywords: Rice Husk Ash, Metakaolin, OPC- Ordinary Portland Cement, Aggregates , Water and Compressive Strength test.

I. INTRODUCTION

Concrete is the world's most extensively used construction material due to its versatility, duration, sustain-capability, and frugality. Concrete is an admixture of aggregates (beach clay or crushed gravestone) held together bya binder of cementitious paste, generally made up of Portland cement and water. It may also contain supplementary cementing accoutrements (SCMs), similar as cover ash or sediment cement, and chemical cocktails. The cost of constructional accoutrements increases day by day due to huge demand of it. So the concrete masterminds look towards the alternative material that not only improves the strength of concrete but replaces the cement content which in turn reduces the cost of our construction work. The main advantage of incorporating the supplementary bonding material not only improves the strength but also help in precluding the pollution. It also improves the duration. Duration is linked to the physical, chemical and mineralogical characteristics of material and permeability.

RICE HUSK ASH: The rice husk, also called rice hull, is the coating on a seed or grain of rice. It's formed from hard accoutrements including silica and lignin, to secure the seed during the growing season. Each kg of crushed white rice results in roughly 0.28 kg of rice hull as a byproduct of rice product during milling. Common products from rice hull are solid energy (i.e. loose form, briquettes, and bullets), carbonizedrice hull produced after burning, and the remaining rice hull ash after combustion. Rice hull ash is an active Pozzolana and has several usages in the cement and concrete assiduity. The use of RHA is less costly because it reduces the cement demand, thereby decreases the overall product cost of concrete. Reduction in cement demand leads to lower environmental pollution by cement manufactories and provides profitable and environmental benefits, along with supplying a utilitarian way of disposing this farming waste product which has little indispensable use.

A. METAKAOLIN

Metakaolin is a pozzolan, likely the most effective pozzolanic material for use in concrete. It's a product that's manufactured for use rather than a by- product and is formed when demitasse complexion, the mineral humus, is heated to a temperature between 600 and 800ºC. Its quality is controlled during manufacture, performing in a much less variable material than artificial pozzolanas that are by products. When used to replace cement at levels of 5 to 10 by weight, the concrete produced is generally more cohesive and less likely to bleed. As a result pumping and finishing processes bear lower trouble. The compressive strength of hardened concreteis also increased at this degree of replacement.

1) Reduced loss due to molecule padding, making concrete thic
2) Enhanced plasticity and finishing of concret
3) Reduced capability for efflorescence
4) Higher finish ability, color and appearance

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II. LITERATURE REVIEW

1) Ong et al., (2006) concentrated on the compressive strength performance of the mixed concrete containingdifferent percentage of Metakaolin. They concluded that the cement is replaced consequently with the percentage of 5, 10, 15, 20, and 30 by weight. Concrete cubes are tested at the age of 1, 3, 7, and 28 days. In addition, the effect of calcination temperature to the strength performance is included in the study. Eventually, the strength performance of Metakaolin concrete is compared with the performance of concrete mixed with silica cloud and sediment. The results show that the strength development of concrete blended with Metakaolin is enhanced. It was set up that 10% relief appears to be the optimum relief where concrete shows enhanced compressive strength at all periods similar to the performance of SF and GGBS.
2) Elahi et al.,(2009) Conducted an experimental research was carried out to valuate the mechanical and duration characteristics of high performance concretes containing supplementary cementations accoutrements in both double and ternary systems. The mechanical characteristics were assessed from the compressive strength, whilst the duration characteristics were delved in terms of chloride prolixity, electrical resistivity, air permeability, and water immersion. The test variables included the type and the quantum of supplementary cementitious accoutrements (silica cloud, fly ash, and ground granulated blast furnace sediment). All the ternary combinations can be considered to have redounded in high performance concretes with excellent duration characteristics.
3) Kumar et al.,(2012) carried out an experimental study to find the felicity of the alternate construction accoutrements similar as, Rice Husk Ash, sawdust, recycled summation and slurs as a partial relief for cement and conventional summations. For this concrete cells of six 150 mm x150mm were casted with varied alternate construction accoutrements in different blend proportion and with different water cement proportions. Their viscosity, plasticity and compressive strengths were determined and a relative analysis was done in terms of their physical characteristics and also bring savings. Test results indicated that the compressive strength of the OPC/RHA concrete cell blocks increases with age of curing and decreases as the 20 chance of RHA content increases. It was also set up that the other alternate construction accoutrements like saw dust, recovered summations and slipup batons can be effectively used as a partial relief for cement and conventional summations. The compressive strength of Rice Husk Ash concrete was set up to be in the range of 70- 80 of conventional concrete for a relief of cement up to 20. The Rice Husk Ash concrete occupies further volume than cement for the same weight. So the total volume of the Rice Husk Ash concrete increases for a particular weight as compared to conventional concrete which results in frugality. Due to the lower viscosity of RHA concrete the tone- weight of structure gets reduced which results in overall savings. The compressive strength of recycled aggregate concrete was set up to be in the range of 70 to 80 of conventional concrete. The compressive strength of slipup club concrete was set up to be nearly 35 of conventional concrete. The compressive strength of aphorism dust concrete was set up to be nearly 10 to 15 of conventional concrete. So the concrete made with alternate construction accoutrements like slipup batons and saw dust can be used for partition and filling purposes and nailing purposes where the strength isn't the criteria. Wherever compressive strength isn't a criteria, the concrete made with alternate construction accoutrements can always be preferred.
4) Dinakar et al., (2013) studied the effect of Metakaolin Content on the Properties of High Strength Concrete.This study presents the effect of incorporating Metakaolin (MK) on the mechanical and duration properties of high strength concrete for a constant water/ binder ratio of 0.3. MK blends with cement replacement of 5, 10 and 15% were designed for target strength and depression of 90 MPa and 100 ± 25 mm. Fromthe results, it was observed that 10% relief position was the optimum position in terms of compressive strength. Beyond 10% relief situations, the strength was dropped but remained high than the control blend.Compressive strength of 106 MPa was achieved at 10% relief. Unyoking tensile strength and elastic modulus values have also followed the same trend .In durability tests MK concretes have displayed high resistance compared to control and the resistance increases as the MK chance increases. This exploration has shown that the original MK has the implicit to produce high strength and high performance concretes.
5) Jayanti Rajput et al., (2013) have studied on the effect of RHA used as supplementing cementing materialon the strength of mortar by partial relief of OPC. Cement mortar paste were proportioned with varying doses of RHA as partial relief of OPC in the range of 5% to 30% by weight of cement. From the test resultsthey concluded that this paper concluded that if roughly 10% of cement is replaced by equal amount of RHA, there is not any significant deprecation in the compressive strength
6) Bai et al., (2014) Development of a multivariate statistical model for thickness parameter vaticination including slump, compacting factor and vibe time for concrete incorporating FA and MK is described. The models constructed give an effective, quantitative, and quick means for carrying optimal results to thickness vaticination for concrete composites using PC- FA- MK blends as binder. Grounded on the experimental data, comprehensive retrogression analysis and significance tests were

performed and the best fit models for reading thickness parameters were set up. Values of thickness were calculated by the proposed models and gave a good agreement with observed experimental data. It indicates that the models are dependable, accurate and can be used in practice to prognosticate the thickness of PC- FA- MK blends...

7) Dr. Abhay S. Wayal (2015) presents an overview of the work carried out on the use of RHA as partial relief of cement in concrete and its effect on plasticity, compressive strength and chloride permeability of concrete. To produce terrain friendly and durable concrete products objectification of RHA as partial reliefof cement in concrete has gained significance. In the former studies tests were carried on RHA concrete containing RHA as partial relief in comparison with control concrete by varying relief chance. From the literature review it can be concluded that the workability of the fresh concrete blend decreases as the RHA relief chance in concrete increases. The needed plasticity can be attained by good super plasticizer and proper blend design. The partial replacement of cement by RHA improves the compressive strength of hardened concrete whereas; the optimum relief chance varies in the studies. The chloride ion penetration of the concrete decreases as RHA chance increases substantially due to severance refining capacity of RHA.From the below literatures the optimal relief chance was set up to be ranging from 10 to 20%.

8) S.Lenka (2017) studied effect of Metakaolin on the characteristics of conventional and self-compacting concrete. They concluded following statements; The increase in MK relief increases plasticity of CC and SCC in a constant w/b proportion, Increase in MK, decreases the T500 flow time and V- channel time in addition of 0.35 of SP which belongs to VS2 and VF2 classes and satisfy EFNARC(2005) guidelines. The drop in inflow time indicates good inflow capability of SCC, Increase in MK increase filling height of U-funnel and L- box it comes under PA2 classes with 3 rebar's in constant SP(0.35) which satisfies the EFNARC guidelines, Compressive, resolve tensile and flexural strengths of CC and SCC advanced as compared to control sample at all age of curing, relief of MK up to 10 in cement increases compressive and disunited tensile and flexural strengths of CC, But after that increase in relief results in a drop in strength. This might be because of padding weight, braking of PC hydration and also pozzolanic response of MK. Compressive strength of SCC is bettered up to 10 of MK relief compared to CC and later the strength decreases whereas at 15 and 20 compressive strength of CC is lesser than SCC. The maximum split tensile and flexural strength of SCC observed at 20 relief but in CC, it bettered up to 10 of relief of MK and later the strength decreases. In CC and SCC, 10 relief of MK with OPC gives advanced viscosity value than 5, 15 and 20. The relief of MK with OPC increased the viscosity value up to 10 after that it dropped. As the MK relief increases, the total water immersion decreasesw.r.t w/ b rate in both CC and SCC. In SCC, precious consequence of MK on water immersion lessening was further substantial because of inferior porosity and advanced severance size dispersion of MK blended matrix, as compared to normal concrete, so SCC absorbed lower water than CC. The test results showed that CC has further carbonation depth than that of SCC. It indicates the continuity of CC is lower than that of SCC

9) Muzammil Ahmed(2017) cement with rice hull ash and fine summation with ceramic powder reveals that there's a significant change in the strength characteristics of concrete like as compressive strength, flexural strength and split tensile strength. These trials were carried out in different grade of concrete to find out the result. From the said literature reviews optimum chance of rice hull ash varies from 10 to 30 by weight of cement and ceramic powder varies from 10 to 20 by weight of fine total. Up to these chance relief enhancement in the strength of concrete has been observed in terms of Compressive Strength, Flexural Strength and Tensile Strength former studies also show that application of rice cocoon ash and ceramic greasepaint as partial relief in concrete enhances the continuity of concrete

10) Yaghuob mohammadiet.al studied that the effect of silica fumes on characteristics of self-compacting featherlight concrete (SCLC) containing perlite and leca. For this purpose, silica fume has been replaced by different contents. In this study, all mixes total cementitious accoutrements (cement silica fume) were kept at 450 kg/m3. Test was carried out similar as Slum inflow, L-box, U-box, V- channel and J- ring. This exploration showed that fusions without silica cloud weren't satisfactory. For all tests added the silica fume demonstrated satisfactory values. However, for the SCLC mix containing 15 silica fume significant results were attained. Adding silica cloud, compressive strength of samples increased.

11) Krishna MurthyN.et.al reported Self-compacting concrete possesses good characteristic, productivity and working conditions due to disposal of avoids. Designed for self-compacting concrete blend design with 29 of coarse total, relief of cement with Metakaolin and class F fly ash, combinations of both and controlled SCC blend with0.36 water/cement proportion and 388 liter/ m^3 of cement paste volume. After that they introduced Metakaolin and class F cover ash were stoner friendly for SCC design blend, and considered to be most promising structure for the revolutionary changes on structures.

III. AIM OF WORK

1) The objective of this work is to obtain the behavior when the comparison between properties of Rice Husk Ash (RHA) and Metakaolin is used as partial replacement for Ordinary Portland Cement (OPC) in concrete. OPC was replaced with these mineral admixtures at 2%, 4%, 6% and 8%by weight. 0% replacement served as the control. Compression strength test confirms its suitabilityas a partial replacement mineral admixture.
2) The need of time is to make a high performance concrete by at economical ease
3) The use of metakaolin has a potential advantage than other pozzolanas as it enhances the impermeability along with the strength of concrete.
4) While as the Rice Husk Ash is produced in large quantities and is available at local level, thusadding to the economic side of concrete
5) The concrete in which cement is partially replaced by Metakaolin and Rice Husk Ash will providebetter results than others.

IV. CONCLUSIONS

The use of Rice hull ash and Metakaolin (MK) as partial relief of cement in mortar and concrete has been considerably researched in recent times. The literature reviewed easily demonstrates that MK is an effective pozzolan. Metakaolin finds operation in multiple aspects of concrete: -

1) High performance, high strength and feather light concrete
2) Precast concrete for architectural, civil, artificial, and structural purposes
3) Fiber cement and ferrocement products
4) Glass fiber corroborated concrete
5) Mortars, stuccos, form material, pool plasters
6) Increased compressive and flexural strengths
7) Reduced permeability
8) Increased resistance to chemical attack
9) Increased duration
10) Reduced result of alkali- silica reactivity(ASR)

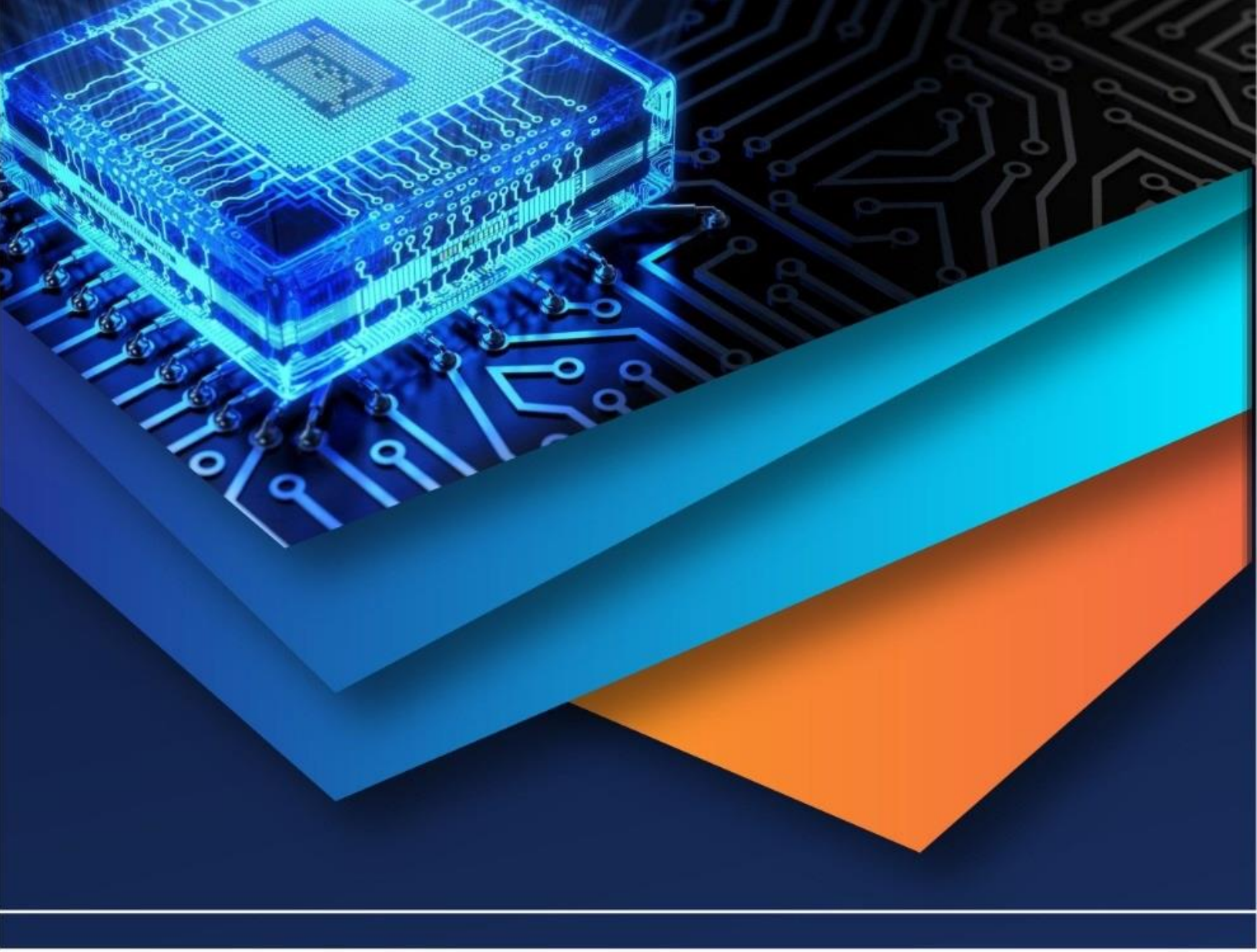
The following characteristics of the concrete are altered with the addition of rice hull

a) Rice hull ash provides good compressive strength to the concrete.
b) It's a by- product hence, it helps in cutting down the environmental pollution.
c) The high silica content makes it a good supplementary cementitious material or pozzolanic amalgamation.
d) The viscosity of concrete containing rice hull ash is analogous to the normal weight concrete hence, it can also be used for the general purpose operation too.
e) The impervious microstructure of rice hull ash concrete provides better resistance to the sulphate attack, car bonation etc.
f) Rice hull concrete has good loss property and increases the duration of concrete.

REFERENCES

[1] P. Dinakar , PradoshK. Sahoo, and. Sriram,(2013) " Effect of Metakaolin Content on the characteristics of High Strength Concrete " International Journal of Concrete Structures and material, Vol. 7,No. 3,pp.215 – 22
[2] Lenka S and Panda, Kishore, (2 0 1 7) "Effect of metakaolin on the characteristics of conventional and tone- compacting concrete", Advances in concrete construction, Vol. 5, pp. 31- 48.
[3] A. Elahi, P.A.M.Basheer, S.V. Nanukuttan, Q.U.Z.Khan. (2010) "Mechanical and duration characteristicsof high performance concrete containing Supplementary cementitious material." Construction of Building material, Vol. 24, Pg. 292- 299
[4] Bai, Jiping; Gailius, Albinas," consistence of cover ash and metakaolin concrete" Journal of Civil Engineering and operation 2009
[5] Moser, Robert D, Jayapalan, Amal R, Garas, Victor Y And Kurtis, Kimberly E, Assessment of Binary and Ternary mixes of Metakaolin and Class C Fly Ash for Alkali- Silica response Mitigation in Concrete, Cement and Concrete disquisition, pp. 1664- 1672.
[6] Couthino JS. The combined benefits of CPF and RHA in perfecting the duration of concrete structures.Cem Concr Compos. 2003; 2551- 9.
[7] Siddique R, KlausJ. Influence of Metakaolin on the characteristics of Mortar and Concrete- A Review.Appl Clay Sci. 2009; 43392- 400
[8] Raheem AA, Ikotun BD. objectification of Agrarian remainders as Partial replacement for Cement inConcrete and Mortar. J Build Eng. 2020; 31(101428)
[9] Birick H, Akoz F, Berktay I, Tuglar AN. Study of Pozzolanic characteristics of Wheat Straw Ash. Cem Concr Res. 1999; 29637- 43.
[10] RaheemKA., Abdulwahab, R, Kareem MA. Objectification of metakaolin and Nanosilica in BlendedCement Mortar and Concrete- A Review. J Clean Prod. 2021; 1.12.
[11] Razak, H. Chai, H, K. and Wong, H, S., 2004. Near Surface Characteristics of Concrete containing drag-plementary Cementing Accoutrements. Cement

and Concrete exploration, 26, pp. 883- 889.
[12] Godwin, A, A. Maurice, E, E. Akobo, I.Z.S and Joseph, O, U., 2013. Structural characteristics of Rice Husk Ash Concrete, International Journal of Engineering and Applied knowledge, Vol. 3(3), pp57- 62.
[13] Nagrale, S, D. Hemant, H. and Pankaj, R, M., 2012. Application of Rice Husk Ash, International Journal of Engineering Research and Applications (IJERA), Vol. 2(4), pp. 1- 5.
[14] Shivram Bagade and NageshPuttaswamy., 2007. Beforehand High Strength Concrete Advantages andCR, pp. 38- 41.
[15] Ong, Chee Huat (2006) Performance of concrete containing metakaolin as cement replacement material.
[16] Kumar A, Mohmata K , Kumar D , Parkash O. (2012). Properties and industrial application of Rice husk : A review. IJETAE. Vol.2.



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