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Modulus of Elasticity and Flexural Strength of Concrete with Industrial By-Products

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Abstract: ***The study is to make use of industrial waste and to reduce the cement usage in the concrete by using the industrial wastes Ground Granulated Blast Furnace Slag (GGBS), Metakaolin and copper slag. GGBS and Metakaolin is replaced with cement from 5% to 10% and copper slag is replaced with fine aggregate from 10% to 60% and no change in coarse aggregate. The concrete mix is made by using these mixes. There are 84 specimens is to be casted, the specimens include cubes of size 150mm length 150mm breadth and 150mm height, cylinders of 150mm diameter 300mm height and beams of size 500mm length, 100mm breadth, 100mm height. The cubes and cylinders are tested under compression testing machine to find the compressive strength and split tensile strength, and the beams are tested using two point loading to find the flexural strength. The specimens are tested in 14 and 90 days and also the modulus of elasticity at 28 days is determined using the cylinder specimen and the values are compared with the control mix of M30 grade concrete.***

Keywords: GGBS, Metakaolin, Modulus of elasticity, Copper slag.

I. INTRODUCTION

Concrete is widely used in the construction industry for construct mega structures, since now we had not found any alternative for concrete, It is estimated that the present consumption of concrete in the world is of the order of 10 billion tons (12 billion tons) every year. Concrete is a heterogeneous mix of cement fine aggregates coarse aggregates and water mixed together. In the concrete cement takes a major role, it also acts as a binding material, the manufacture of cement is mainly done by wet process and dry process, thus the manufacture of cement liberates large amount of carbon dioxide which mixed up in the atmosphere causing hazardous to the environment, thus to reduce the usage of cement in the concrete and to reduce the liberation of carbon dioxide into the atmosphere the cement is partially replaced with the industrial waste, there are so many industrial waste such as Ground Granulated Blast Furnace Slag, Meta kaolin, Rice husk ash, Bottom ash, Silica Fume and many. These industrial wastes are partially replaced with cement and treated whole as a cement material and used in the concrete.

II. REVIEW OF LITERATURE

Shreepad Daesai et al (2015), the consequences of an exploratory study on different sturdiness tests on concrete containing mineral admixtures and copper slag as fractional substitution of cement and sand individually. He suggested that up to 20% replacement of the fine aggregate by Copper Slag and 10% replacement of mineral admixture is recommended.

R.S.Deotale et al (2014) studied the replacement of cement with Ground granulated blast furnace slag and also with Rice husk ash, quarry sand is replaced with the natural sand. In first phase mix of M40 grade concrete with replacement of 0%, 15%, 30%, 45%, 60%, 75%, 90% and 100% of quarry sand with natural sand is carried out. In second phase, cement is partially replaced with GGBS by 10%, 20% and 30%. In phase three, combination of GGBS and RHA is partially replaced with cement. It is observed that when natural sand is partially replaced with 60% quarry sand maximum strength is achieved. The composition of 22.5% GGBS + 7.5% RHA with 60% of quarry sand gives good strength results In order to increase the strength cement is replaced by combination of GGBS and RHA. The maximum 28 days split tensile strength was obtained with 30% GGBS replaced with cement.

J.M.Srishaila et al (2014), This study investigates the combined effect of Ground Granulated Blast Furnace Slag (GGBS) and Meta kaolin on the properties of self compacting concrete. The workability test for acceptance of self compacting concrete like slump test, V-funnel, and L-Box were carried out on fresh concrete. The compressive, split tensile, and flexural strength test of concrete with replaced GGBS plus Meta kaolin at 5%,15%and 25% and 3%,6% and9% were examined after curing period of 28 and 56 days and it is found that fresh property results show us that as the percentage of Meta kaolin increases the filling and flowing ability of the concrete decreases. The temperature of the concrete increased with the increase in percentage of Meta kaolin.

Binaya Patnaik et al (2014) An experiment was conducted to investigate the strength and durability properties of concrete having copper slag as a partial replacement of sand (fine aggregate) and results have been presented in this paper. Two different types of

Concrete Grade (M20 & M30) were used with different proportions of copper slag replacement (0 to 50%) in the concrete. Strength & Durability properties such as Compressive Strength, Split Tensile Strength, Flexural Strength, Acid Resistivity and Sulphate Resistivity were evaluated for both mixes of concrete.

Anil K Gupta et al (2014), This paper deals with the use of Meta kaolin which is having good pozolanic activity and is a good material for the production high strength concrete. which is getting popularity because of its positive effect on various properties of concrete. The results shows that that optimal performance is achieved by replacing 7% to 15% of the cement with meta kaolin. While it is possible to use less, the benefits are not fully realized until at least 10% meta kaolin is used. Values of compressive strength of concrete with meta kaolin after 28 days can be higher by 20%. Dosage of 15% of meta kaolin causes decrease of workability of suspension in time. Increasing amount of perceptual proportion of meta kaolin in concrete mix seems to require higher dosage of super plasticizer to ensure longer period of workability.

Amrita.E.K (2015) studied that Behavior of M30 concrete by partial replacement of cement and fine aggregate by Ground granulated blast furnace slag as 20% 25% 30%, and Granulated blast furnace slag as 25%, 50%, 75% and he found that Compressive strength increases by increasing percentage of GBS up to 50% and GGBS up to 25% in concrete.

III. CONCLUSION

From the study of literature review the concrete shows a good results when it is replaced with the Ground Granulated blast furnace slag also it give good results when the cement aggregate is replace with the metakaolin. The replacement of natural sand with the copper slag is recommended upto 40%. Hence from the review of literature the concrete shows a good results when cement is replaced GGBS and Met kaolin and the sand is replaced with the copper slag.

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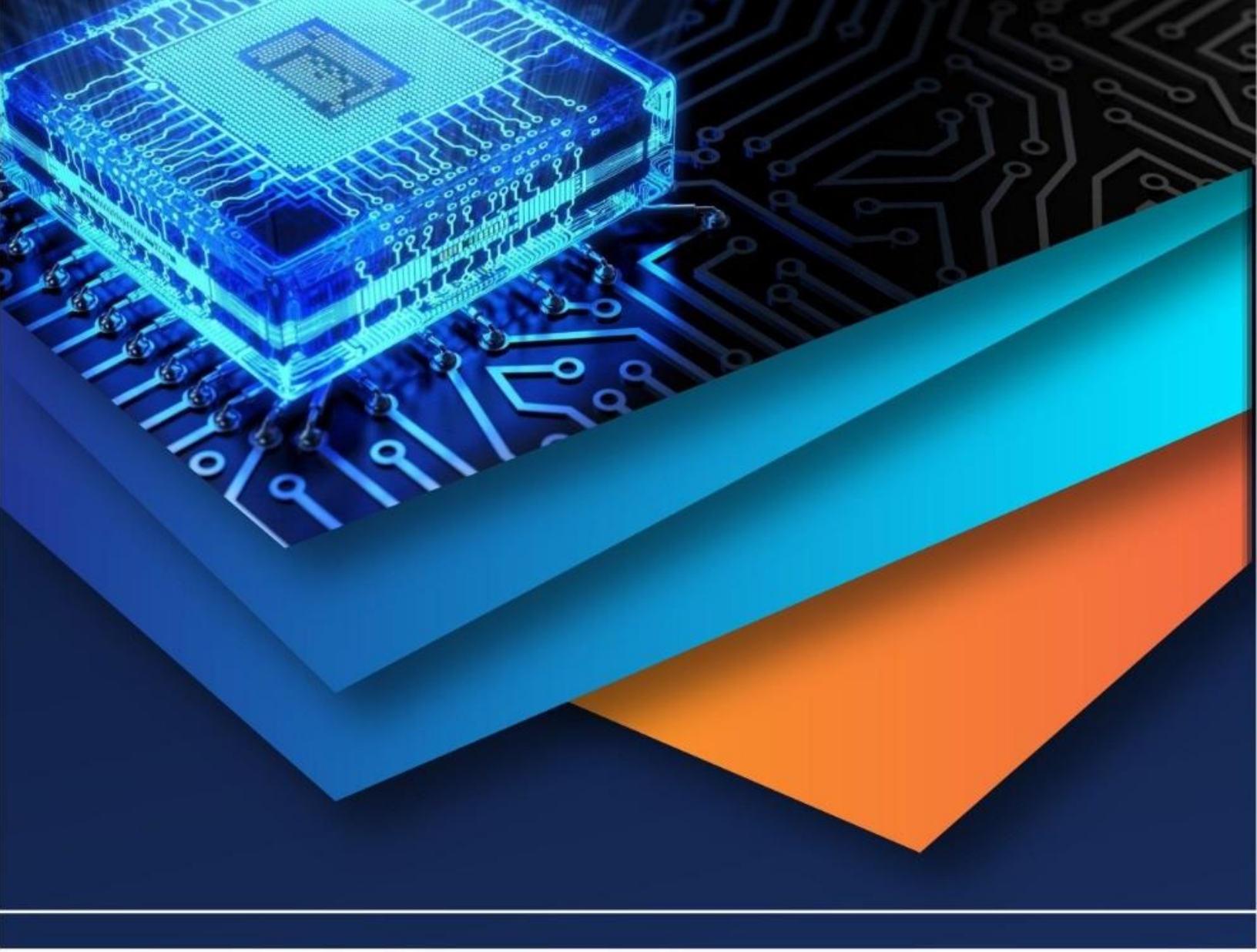

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