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BOTTOM ASH AS PARTIAL SAND REPLACEMENT IN CONCRETE- A REVIEW

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ABSTRACT:- There is an emergency need to promote sustainable cement concrete and its development by using alternative materials, to reduce the emission of green-house gases and for the disposal of vast bottom ash product from the power plants. In India there is a growing concern about scarcity of river sand which is a prime source of material used in the manufacture of cement concrete. Many researchers have been carried out in the area of bottom ash utilization in the past. This work deals with the Bottom ash as a replacement of fine aggregates in concrete and the investigation on the use of bottom ash has been very limited. It gives an overview of the various literature and experimental investigations been carried out by many researchers to study the use of bottom ash as aggregates in concrete. Effect of bottom ash on the properties of concrete such as workability, compressive strength, flexural strength, are discussed elaborately. Bottom ash use in concrete is becoming more important in view of the fact that sources of natural sand as fine aggregates are getting depleting gradually, and it is of most significance that substitute of sand must be examined.

Keywords: Bottom ash, Cement, Coarse aggregate, concrete, sands, strengths.

1.0 INTRODUCTION

Concrete, the second mostly used engineering material in the world after water and addition of some other materials may change the concrete properties. It is the composite material most used for the construction of high rise buildings and various Infrastructure developments area particularly in the developing countries like India is more. Concrete is a form of mixing cement, fine and coarse aggregate in addition to water. In general, the fine aggregate used in the production of concrete was Natural River sand. Now days, these natural sources like river sand are exhausting gradually around the world. So, the protection of environment and saving of natural resources the construction industry is look for the alternative constituent material for making concrete. So, there is a need for Replacement of sand. In India, major portion of electricity generated by burning of coal resulting as formed as ash. The ash contents comes from the burning of coal has to be disposed as either in dry state or in wet state to available open areas nearer the plant or both the fly ash and bottom ash grounding and mixing with water and send into lagoons. These are open to atmosphere causes environmental pollution and loss of productive land. Bottom ash is obtaining from bottom of the furnace with burning coal at thermal power plants. The use of bottom ash in high strength concrete is a new dimension in concrete mix design. The chemical composition of bottom ash is similar to fly ash but it contains more carbon quantity than fly ash. BA is a coarser angular material having porous surface texture and distributed the particle size nearly equal to the sand. It exhibits the engineering properties like high shear strength and low compressibility that makes as used in construction applications. It has not only a constructability benefits and also proved to be an economical. So, Government should encourage the bottom ash usage and its related products as a large amount of quantities for many civil engineering construction purposes.

1.1 ENVIRONMENTAL BENEFITS OF FLY ASH USE IN CONCRETE

Use of fly ash in concrete imparts several environmental benefits and thus it is ecofriendly. It saves the cement requirement for the same strength thus saving of raw materials such as limestone, coal etc required for manufacture of cement. Manufacture of cement is high-energy intensive industry. In the manufacturing of one tonne of cement, about 1 tonne of CO is emitted and goes to atmosphere. Less requirement of cement means less emission of result in reduction in green house gas emission. Due to low calorific value and high ash content i n Indian Coal, thermal power plants in India, are producing huge quantity of fly ash. This huge quantity is being stored / disposed off in ash pond areas. The ash ponds acquire large areas of agricultural land. Use of fly ash reduces area requirement for pond, thus saving of good agricultural land.

1.2 NEED FOR THE USE OF COAL ASH IN CONSTRUCTION

Energy is the main backbone of modern civilization of the world over, and the electric power from thermal power stations is a dominant source of energy, in the order of electricity. In India, over 70% of electricity generated is by combustion of fossil fuels, out of which approximately 61% is contrived by coal-fired plants. This results in the origination of around 100 ton of ash. Most of the ash has to be disposed of either dry, or wet to an open area serviceable near the plant or by grounding both the fly ash and bottom ash and mixing it with suitable amount of water and pumping into artificial lagoon or dumping yards this brings out the pollution in water bodies and ruin of productive land. The untiring slackening of natural resources and the environmental imperils posed by the disposal of coal ash has approached appalling proportion such that the use of coal ash in manufacturing of concrete is imperative than a desire.

2.0 LITERATURE REVIEW

P.Ranapratap et al (2016) studied on the effect of replacing fine aggregate with bottom ash in M 40 grade of concrete with OPC-53s cement. In India there is a growing concern about scarcity of river sand which is a prime source of material used in the manufacture of cement concrete. In this context, this study establish the experimental results about strength and economic aspects of concrete, by partial sand replacement with bottom ash in the concrete. Also experimental results presented about the partial replacement of crusher dust and robo sand with bottom ash, as these products are treated as an alternative measures of natural sand. The aim of this project work is to efficient utilization of Industrial wastes for high strength and durable concrete mix. Experimental studies are conducted on M40 grade concrete prepared with 53 Grade special cement and replacement fine aggregate with bottom ash. The investigation on compressive strength of the concrete at different ages such as 7 days, 14 days and 28 days are observed when the bottom ash is replaced 0%, 10%, 20%, 30%, 40%, 50%, and 60% in the place of three control mixes of sand, robo sand and crusher dust which are treated as fine aggregate. The results showed that the optimum dosage of bottom ash when it is replaced with sand/ robo sand /crusher dust is 10% at 28days compressive strength of concrete. OPC 53 Grade special cement is selected for the purpose of attaining high early strength of concrete.

Abhishek Sachdeva et al (2016) studied the Effect of cement and fine aggregate replacement with Alccofine and Bottom ash on mechanical properties of concrete. The study is planned to study the properties of concrete at fresh and hardened stage containing both Alccofine as a partial replacement of cement as well as coal bottom ash as a partial replacement of fine aggregates in concrete together in different combinations. An experimental programme is planned in which controlled concrete (MB1 mix) of grade M40 is designed, casted and tested for compressive strength after 28-days of curing. Three different mixes were prepared containing 20% (MB2 mix), 30% (MB3 mix) and 40% (MB4 mix) bottom ash as partial replacement of fine aggregates. From the workability and compressive strength test results, it was observed that both the workability and compressive strength reduced much for MB4 mix. Therefore, to study the effect of Alccofine as a partial replacement of cement, MB4 mix was selected. The cement was partially replaced by Alccofine by 5% (MB4AL5 mix), 10% (MB4AL10 mix), 15% (MB4AL15 mix) and 20% (MB4AL20 mix) along with the 40% bottom ash as a partial replacement of fine aggregate. Based on the analysis of test results, a reduction in workability and strength was observed by partially replacing fine aggregates with coal bottom ash. Workability, compressive strength and flexural strength improved in the concrete mix containing bottom ash as a partial replacement of fine aggregates along with the incorporation of Alccofine as a partial replacement of cement in concrete. The workability is decreased with the increase in the replacement level of fine aggregates with bottom ash but workability improved on partially replacing cement with alccofine upto 15% in the mix already containing bottom ash as a partial replacement of fine aggregates, after which it decreased. A high strength concrete was developed by using Alccofine as a partial replacement to cement along with the partial replacement of fine aggregates with bottom ash.

Pardeep G et al (2016) reviewed the BOTTOM ASH AS A PARTIAL REPLACEMENT OF FINE AGGREGATE IN ADDITION WITH PPF. In this study fine aggregate in concrete mix has been replaced with bottom ash and Polypropylene fibre is additionally used to enhance the strength characteristics of concrete. The concrete mix design is done for M25 grade concrete. The mix is prepared for different combinations of 0%, 10%, 20% and 30% of replacement of sand by bottom ash with 0.5% of polypropylene fibre by total weight of the Cube. The mechanical properties were compared with control mix and it was found that the optimal combination as 30% bottom ash and 1.0% polypropylene fibre. Flexural strength was compared by testing beams of size 1.5 x 0.25 x 0.15m under two point loading. Results showed that there was no degradation of strength for beams with bottom ash as replacement for fine aggregates

M.Brindha et al (2016) studied the Durability of Cement Mortar Replaced by Bottom Ash and Green Sand as a Fine Aggregate. The main purpose of this paper is to study the durability of cement mortar by using the bottom ash and the green sand to replace natural fine aggregate in the cement mortar products. In this study use high water cement ratio to conduct the experiment, in which the weight ratio of water/cement is 0.55 with the Superplastizers 2.5%. The experiment uses bottom ash fine aggregates, which passes through 4.75mm sieve, and natural sand of the same size as the aggregate. The study shows that, based on the 1:3 cement/aggregate weight ratio while the bottom ash and the green sand is to be varied in proportion 10%, 20%, 30% by its weight of natural fine aggregates in cement mortar. Mortar

compressive strength, split tensile strength, porosity, water absorption studies will be carried out and the best combination is to be selected based on the mortar strength.

T. Balasubramaniam et al (2015) investigated on the Mechanical Properties of Bottom Ash Concrete. In this research Quarry (manufactured) sand is used as hundred per cent substitutes to the river sand. Pozzolona Portland Cement was replaced by silica fume (10% by weight) and hyperplasticizer with varying percentage by weight of binder was added to obtain medium workability. In modern thermal power plants, 20% of ash is fed into the bottom of boilers. To solve the problem of the bottom ash disposal from the power plant, the investigations were carried out for the possibility of using bottom ash as partial replacement (10% - 50%) of manufactured sand (M-Sand) in concrete. Mechanical properties, such as compressive strength, split tensile strength, flexural strength and modulus of elasticity of M60 concrete (Grade of mix 60N/mm2) were evaluated. The result showed that use of bottom ash improves the strength of concrete at later ages.

Ahmad Farhan Hamzah et al (2015) studied on Fresh Characteristic and Mechanical Compressive Strength Development of Self-Compacting Concrete Integrating Coal Bottom Ash as Partial Fine Aggregates Replacement. This paper presents the experimental works to study the effect of use of coal bottom ash as a partial replacement of fine aggregates in self-compacing concrete (SCC). The compressive strength properties studied instead of fresh characteristic of mixtures. The SCC mixtures were produced by three different water cement ratios (0.35, 0.40 and 0.45) and coal bottom ash as a replacement of fine aggregates in varying percentages of 0%, 10%, 15%, 20%, 25% and 30%. The fresh properties were investigated by slump flow, T500 spread time, sieve segregation and L-box test in order to evaluate its self-compatibility. It can be concluding that the filling and passing ability of SCC mixture decreased when the amount of coal bottom ash content increased. The compressive strength development for various percentages replacement of fine aggregates with coal bottom ash was conducted at 28, 90 and 180 days. It is clearly noticeable the progress of compressive strength on intensification of water cement ratio at different curing ages. The increase of water cement ratio decreased the compressive strength for all percentages of coal bottom ash at all ages

Aswathy P.U et al (2015) studied on the Behaviour of Self Compacting Concrete by Partial Replacement of Fine Aggregate with Coal Bottom Ash. This study presents the experimental investigation carried out to study the behavior of self-compacting concrete incorporating coal bottom ash at different replacement level of fine aggregate. To find the optimum replacement level the replacement levels of coal bottom ash to fine aggregate is set up from 5 - 30% at 5% increment. Then the optimum mix was subjected to variations (increment and decrement in coal bottom ash in optimum mix). The fresh and hardened properties such as compressive strength, split tensile strength, flexural strength and modulus of elasticity of the concrete at the age of 28 days of curing were conducted for all the variations. Results shows that the strength of the concrete with coal bottom ash increased up to replacement level of 10%.This show that bottom ash are used as supplementary cementitious materials, having the pozzolanic reactivity.

CONCLUSION

Based on the work of various researchers it was seen that bottom ash can be a suitable material for replacement of concrete mix. Following conclusions can be drawn. The compressive strength for 7, 28, 56 and 90 days was increased up to 15-20% replacement and after that compressive strengths were decreased for further more replacement. A marginal decrease was observed in the flexural strength upto 15-20% replacement level. A decrease in strength of concrete with the increase in levels of fine aggregate replacement by coal bottom ash is due to the replacement of the stronger material with the weaker material. Splitting tensile strength of concrete improved on use bottom ash as fine aggregate in partial replacement of sand. Workability of concrete decreases with the increase in percentage of Bottom ash, as it is more porous, therefore absorb more water than sand hence some super plasticizer can be used in increasing dose as percentage of bottom ash is increased. The densities of hardened concrete linearly decreased as the replacement ratio of ash was increased from 10% to 100% as compared to standard concrete.

REFERENCES

1. M.P Kadam, "The Effect of sieved Coal Bottom Ash as a Sand Substitute on the Properties of Concrete with Percentage Variation in Cement", Science and education publishing, volume 2 issue 5
2. Abdulhameed Umar Abubakar, "Properties of concrete using tanjung bin power plant coal bottom ash and fly ash," International Journal of Sustainable Construction Engineering & Technology (ISSN: 2180-3242) Vol 3, Issue 2, 2012.
3. Abdulhameed Umar Abubakar, Khairul Salleh Baharudin "Properties of concrete using tanjung bin power plant coal bottom ash and fly ash" International Journal of Sustainable Construction Engineering & Technology (ISSN: 2180-3242) Vol 3, Issue 2, 2012.
4. Chandramouli , Srinivasa Rao P., Pannirselvam N., Seshadri Sekhar T. and Sravana P., Strength properties of polypropylene fibre concrete, 5(2010),1-6.
5. Rama Mohan Rao. P, Sudarsana Rao.H, Sekar.S.K, Effect of Polypropylene fibres on fly ash based concrete, 3(2010), 606-612.
6.] P. Aggarwal, Y. Aggarwal, S.M.Gupta, Effect of bottom ash as replacement of fine aggregate in concrete, 8(2007), 49-62.
7. IlkerBekirTopcu, Mehmet Canbaz, Effect of different fibers on the mechanical properties of concrete containing fly ash, Construction and Building Materials, (2007) 1486– 1491.
8. Sivakumar. A, Manu Santhanam, Mechanical properties of high strength concrete reinforced with metallic and non-metallic fibres, Cement & Concrete Composites, 29(2007), 603–608.Research, 35(2005), 1587– 1591Yeol Choi, Robert L. Yuan, Experimental relationship between splitting tensile strength and compressive strength of SFRC and PFRC, Cement and Concrete.
9. Siddique, R., Effect of fine aggregate replacement with class F flyash on mechanical properties of concrete, Cement and Concrete Research, 33(2003), 539-547.

10. Wu Yao, Jie Li, Keru Wu, Mechanical properties of hybrid fiber reinforced concrete at low fiber volume fraction, Cement and Concrete Research; 3(2003), 27–30.
11. Maslehuddin, M., Al-Mana, A.I., Shamim, M. and Saricimen, H., Effect of sand replacement on the early age strength gain and long term corrosion resisting characteristics of flyash concrete, ACI Materials Journal,(1989), 58-62.
12. IS CODES:

- IS 10262:2009; Mix design of concrete.
- IS 456:2000; Plain and Reinforced concrete code of Practice.
- IS 383:1970; Specification for coarse and fine aggregates from natural sources for concrete
- IS 516: 1959; Methods of tests for Strength of concrete