EFFECT OF WOOD ASH ON YHE PROPERTIES OF HIGH STRENGTH CONCRETE: A REVIEW

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Abstract: ***Wood*** Ash (WA) prepared from the uncontrolled burning of the saw dust valuated for its suitability as partial cement replacement in conventional concrete. The physical and chemical characteristics of WA is presented and analyzed. The quality parameters (compressive quality, split rigidity and flexural quality) of cement with mixed WA concrete are assessed. Two different water-to-binder ratio (0.4 and0.45) and five different replacement percentages of WA (5%, 10%, 15%, 20% and25%) including control specimens for both water-to-cementations considered. Also we can added steel fibre in concrete mix to maintain higher initial cracking and yield loads, post-cracking stiffness, and better cracking performance of RC beams.
Keywords:-Wood Ash, Cement Replacement, Compressive Strength.

I. INTRODUCTION

Wood slag (WA) is the buildup created because of ignition of wood and wood items (chips, saw dust, bark, and so on.). It is the inorganic and natural buildup staying after the ignition of wood or unbleached wood fiber. Hardwoods usually produce more ash than softwoods and the bark and leaves generally produce more ash than the inner woody parts of the tree [1]. In this way, expanding the quantity of biomass filled warm power plant will prompt the age of huge measure of wood fiery debris which would require appropriate observing and sustainable management of the ashIn the present pattern, around 70% of wood cinder is arrive filled, 20% will in general be utilized as a dirt enhancement in farming and 10% are utilized as other uses mainly in metal recovery and pollution control [2].

Sawdust is generated as a waste product from the mechanical milling of timber into various sizes. It becomes continuously heaped up thereby causing nuisance to the environment. The use of SDA in cement has been shown to be beneficial to concrete in terms of low heat of hydration and strength gain at later curing age[9]. The wood powder brought into the concrete builds the carbon substance and this expands the water required to accomplish a sensible functionality. The underlying and last setting occasions. Increments with increment in wood fiery debris content. The increased water demand was due to the relatively high carbon content in wood ash. [10]. Blending of wood waste ash and ordinary Portland cement (OPC) at various levels of cement replacement produces a new type of blended cement with altered physical properties and heat kinetic properties in comparison to neat OPC. Wood waste ash/OPC blended cement exhibit significant difference in terms of the standard consistency, setting times, soundness, heat evolution characteristics and the microstructure of hardened cement paste with respect to OPC[11].

India was chosen to assess its appropriateness as cinder for OPC substitution. The Wood Ash (WA) was obtained from open field burning with average temperature being 700 _C. The material was dried and carefully homogenized. An adequate wood ash particle size was obtained by mixing wood ash and coarse aggregate together for a fixed amount of time. This mixing was done to facilitate easy pozzolanic reaction and reduced water content due to uniform size dstribution. gives the physical and concoction properties of the wood fiery remains. The physical properties evaluated were in perfect harmony with the findings of Naik et al. who et al. who reported specific gravity of wood ash ranged between 2.26 and 2.60 and unit weight ranged from 162 kg/m3 to a maximum of 1376 kg/m3. The chemical analysis results are corroborated by the findings of several researchers who reported the presence of significant silica in the ash specimens obtained from uncontrolled incineration of saw dust and gave a mean of 72.78% for the absolute synthesis of pozzolanic fundamental mixes specifically silica, alumina and ferrica.

(1). Physical Properties:-
The physical and synthetic attributes of wood fiery debris sourced from various factories. Wood cinder was seen to be a heterogeneous blend of various estimated particles by and large precise fit as a fiddle. These particles fundamentally comprised of somewhat consumed or unburned wood and bark. To evaluate fineness, average amount of wood fly ash passing sieve (75 µm) is 50% and percentage of ash retained on sieve (45 µm) is 31%. Test results showed the average unit weight of fly ash and bottom ash as 490 kg/m3 and 827 kg/m3 respectively and average specific gravity was 2.48 and 1.65 respectively. The normal water necessity for fly cinder was 116% and normal auto clave development test esteem 0.2%. Udoeyo et al. evaluated the physical properties of waste (WWA) wood ash used as partial replacement of cement. He reported that WWA had a specific gravity of 2.43, 1.81% of moisture content and a pH of 10.48. The average loss on ignition was 10.46. specific gravity of wood fly ash to be 2.54 collected from a forestry biomass fired power plant and observed finer particles with average diameter of 50 mm.

(2). Chemical properties:-

swelling of wood ash occurred due to the possible hydration of silicates and lime present in the ash. studied the chemical composition of wood ashes from five different sources for their possible use in making controlled low-strength materials. The LOI obtained for the wood ashes ranged from 6.7 to 58.1%. reported the chemical composition of waste wood ash (WWA). The results of the oxide concentrations of the ash, measured using an X-ray diffraction (XRD) test, showed that its major oxide components are: CaO, SiO2, Al2O3, K2O, Fe2O3, MgO, SO3, TiO2, and P2O5. Other substances, such as Na2O, ZnO, Cl, MnO, SrO, Cr2O3, CuO, ZrO2, and Rb2O, were found in trace amounts. The chemical composition of wood ash to be used as partial replacement of cement. The total percentage composition of iron oxide (Fe2O3 = 2.34%), aluminium oxide (Al2O3 = 28.0%) and silicon dioxide (SiO2 = 31.80%) was found to be 62.14%. This is less than 70% minimum required for pozzolana (ASTM C 618, 1994). This reduces the pozzolanic activity of the wood ash. The loss on ignition obtained was 27%. The value is more than 12%; the maximum as required for pozzolana (ASTM C 618-94). This means that the wood ash contain appreciable amount of un-burnt carbon which reduces its pozzolanic activity. The un-burnt carbon is not pozzolanic and its presence serves as filler to the mixture. The alkali content (Na2O) was found to be 6.5%. This value is higher than the maximum alkali content of 1.5% required for pozzolana.

II. REVIEW OF PREVIOUS STUDIES

Rafat Siddique [1] was obtained to inclusion of wood ash partial replacement of cement adversely affects the slump of the concrete. Water absorption capacity of the concrete increases with increase in wood ash content. Strength properties of concrete mixtures decreases marginally with increase in wood ash contents, but increases with age due to pozzolanic actions. Wood ash can be used for making precast products and structural grade concrete.

Swaptik Chowdhury, Mihir Mishra & Om Suganya [2] presented in This study reviewed quantity and quality of wood ash may vary with many factors such as combustion temperature, species of wood and combustion technology used. Hence proper analysis of wood ash is important before its application in concrete. Wood ash chemical characteristics differ with species of wood but chiefly contains lime and silica. The particles of wood ash are coarser than that of cement and have higher specific surface as compared to cement due to porous nature and irregular shape. Incorporation of wood ash as partial replacement of cement adversely decreases the slump of concrete. There was an increase in water absorption with increase in wood ash percentage.

S. Chowdhury, A. Maniar & O.M. Suganya [3] In this study According to physical and chemical analysis, the presence of pozzolanic essential compound as required by standards, the presence of much finer particles and hence, larger surface area per particles make WA pozzolanic material. The strength parameters decrease slightly with increase in wood ash content in the concrete when compared to control specimen. However the strength obtained is still higher than the target strength of 20 N/mm2. Also the strength increases with age due to pozzolanic reactions. Thus, use of WA in concrete helps to transform it from an environmental concern to a useful resource for the production of a highly effective alternative cementing material.

Eleanor Y. Reed, David R. Chadwick, Paul W. Hill & Davey L. Jones [5] says that here we demonstrate that when realistic doses of biochar and wood ash are applied to an inherently fertile grassland soil, both amendments result in no major changes in soil quality or agronomic yield. A key finding was that wood ash repressed native SOM turnover while biochar had no effect. Nevertheless, the retention of native soil organic C associated with wood ash was low in comparison to the amount of C added in a single dose of biochar.

Muhammad Usman, Asfand Y. Khan & Syed H. Farooq [6] as an In this experimental study, wood waste consisting of coarse sawdust and fine sawdust has been successfully used to fabricate self-compacting pastes. While the inclusion of sawdust to the cementitious system increases the water demand due to its absorbing nature, this allows for the SD particles to act as internal curing agents, thus reducing the drying shrinkage thereby providing moisture for cement hydration at later ages after concrete casting. However, the strength decline at early ages owing to the lower iso-static crush strength and reduced unit weight of SD particles hampers its incorporation in rapid repair mortars and high early strength concrete.

A.A. Raheem, A.I. Ige [9] SDA is a suitable material for use as a pozzolan, since it satisfied the requirement for such. SDA-blended cements have higher setting time and are most applicable where low rate of heat development is required such as in mass concrete and dam construction. Up to 15% SDA replacement is adequate for maximum benefit in compressive and flexural strength of the OPC-clinker-SDA blend.

Rafat Siddique [10] Inclusion of wood ash partial replacement of cement adversely affects the slump of the concrete. Water absorption capacity of the concrete increases with increase in wood ash content. Strength properties of concrete mixtures decreases marginally with increase in wood ash contents, but increases with age due to pozzolanic actions. Wood ash can be used for making precast products and structural grade concrete.

Cheah Chee Ban, Mahyuddin Ramli [11] Wood ash has a chemical composition which varies significantly within species of trees from which the wood biomass was derived but is generally rich in lime and silica compounds. Particle distribution of wood ash is generally coarser in comparison to ordinary Portland cement (OPC). However, specific surface of wood ash is comparatively higher than OPC due to high irregularity in the shape of wood ash particles and its porous nature. Quantity and quality of wood ash are dependent on several factors namely, combustion temperatures of wood biomass, species of wood from which wood biomass fuels were derived and types of combustion technology used.

Felix F. Udoeyo and Philibus U. Dashibil [12] SDA has a combined proportion of silica, alumina, and iron oxide of 80.67%. The workability of fresh SDA concrete decreased with a higher ash content while both initial and final setting times increased with a higher percentage of ash. There is need to study the shrinkage and other long-term properties of SDA concrete, such as volume change, prior to its acceptance as a construction material.

CONCLUSION

This Paper presents a various research work on waste wood ash. Inclusion of wood ash partial replacement of cement adversely affects the slump of the concrete. Water absorption capacity of the concrete increases with increase in wood ash content. Strength properties of concrete mixtures decreases marginally with increase in wood ash contents, but increases with age due to pozzolanic actions. The particles of wood ash are coarser than that of cement and have higher specific surface as compared to cement due to porous nature and irregular shape. Wood ash at replacement percentage up to 10% of the weight of binder can be successfully used as additive in place of cement to produce structure grade concrete. Replacement of cement by wood ash does not have negative impact on the chloride permeability. The incorporation of wood ash in concrete does not have negative impact on its ability to resist freeze thaw resistance. There was a significant decrease in the drying shrinkage on the incorporation of wood ash. Water absorption increased with increasing wood ash percentage.

III. REFERENCES

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