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Experimental Investigation of Concrete by Using Wheat Straw Ash and Bamboo Wood Ash as Partial Replacement of Cement- A Review

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Abstract: *This study considering the recycling of agricultural/industrial wastes into cement and to bring sustainable and environmental-friendly concrete. In this investigation, studied about the mechanical properties of Wheat straw ash and Bamboo wood ash. The mechanical properties was evaluated in terms of compressive strength test, flexural strength test & split tensile strength test of concrete. Addition of WSA & BWA in concrete by replacement material with different percentage i.e. 5%, 10%, 15% & 20% by the weight of cement. The aim of this study is to check the effect of mechanical properties of WSA & BWA in concrete for sustainable development. During the production of cement involves an intensive use of raw material and energy, while at the same time, releases high quantities of carbon dioxide into the atmosphere. Which causes environmental pollution and greenhouse gases. Thus WSA & BWA can be used as a cementitious material in the replacement of cement in concrete. This one of the effective way to reduce its impact on environment.*

Keywords: Wheat Straw Ash, Bamboo Wood Ash, Sustainable Development

I. INTRODUCTION

Concrete is widely used construction material consisting of cement, fine aggregate, coarse aggregate and required quantity of water. Cement is the important constituent of concrete. During the production of cement one of the greenhouse gasses namely carbon dioxide is emitted which is responsible for causing global warming. Currently some of the agro- industrial waste such as wheat straw ash and bamboo wood ash will be used as an admixture. This one of the effective way to reduce its impact on environment. In the current study, an attempt have been made in order to use wheat straw ash & bamboo wood ash as partial replacement of cement. This waste usage can be economical and also have positive impact in minimizing environmental pollution.

As several types of agricultural wastes are being generated in large quantities especially in developing countries. The recycling of these agricultural wastes into concrete involves combusting the agricultural wastes and using the resulting residue (i.e. ash) used as a replacement of PC in concrete mixtures. Agricultural ashes are suitable as a replacement for PC due to their high silica content which embodied them with pozzolanic capabilities. Several types of agricultural ash have been used as partial replacement of PC concrete mixtures.

A major agricultural by-product obtained from cereal production is wheat straw waste, which increases environmental pollution because the farmers burn it in open field. However, when wheat straw waste is properly burnt under a controlled situation results in a material that has cement properties and that can be used in concrete as supplementary cementing material. WSA is one type of agricultural waste that has high content of silica, which makes it an option to substitute fine ingredients in concrete and when used as OPC substitute, it can enhance compressive strength of mortar, improve sulphate resistance and increase pozzolanic efficiency. Few studies have explored the use of WSA as partial replacement of cement. However, these studies have been carried out on mortar mixtures only and the evaluation restricted to only compressive strength.

Bamboo stem is an important engineering material used daily in the local construction industries, where they serve essentially as scaffolds. When these stems are weak, and can no longer support load, they are discarded as waste from whence they are used as locally as cooking fuel or left to pollute the environment. Growing environmental consciousness

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as well as advances in science and technology continues to account for a steady decline in the use of fire woods (bamboo stem and other wood trunks) and a paradigm shift towards the use of green energy as cooking fuel. As an agricultural waste, bamboo stem has the potential to contribute positively to the environment through the prospective pozzolanic activities of its ash. The burning of bamboo trunks under controlled conditions, for its ash could take care of environmental pollution caused by its waste, and provide an alternative to cement.

II. LITERATURE REVIEW

Naraindas Bheel & Wan Ibrahim MH (2020) In this investigation entitled "Mechanical performance of concrete incorporating wheat straw ash as partial replacement of cement", study concludes that the incorporation of WSA as a replacement of Portland cement has a detrimental effect on the slump of the concrete mixtures. However it is suggested to use chemical admixture to improve workability of concrete mixtures incorporating WSA when the higher slump is needed. In addition to the sustainable advantage of the WSA, its incorporation up to 10% replacement of PC was found to enhance the compressive strength, split tensile strength and flexural strength by 12%, 10% and 11% respectively. Hence, the use of 10% WSA as replacement of PC was deemed optimum as there was a decrease in the strength at higher content (i.e. greater than 10%). The enhancement in the mechanical properties with the incorporation of the WSA as partial replacement of PC was due to filler ability and reaction with calcium hydroxide to produce more reaction products. As only the mechanical performance of the concrete mixtures incorporating WSA was carried out in this study, it is recommended that future studies should be carried out to evaluate the durability performance of these mixtures. Also, future studies should endeavour to incorporate higher content of WSA as partial replacement of PC or as the sole aluminosilicate precursors in alkali- activated concrete.

Vijayvenkatesh Chandrasekaran (2020) In this study entitled "Charecteristics investigation of dry bamboo ash fractional replaced cement in M25 Grade Concrete". This project aims to charecteristics of experimental tests to conduct the dry bamboo ash composite mix M25 grade concrete. Its exposed effect of tests is passes in required strength, a performance of concrete cube in a compression test, concrete cylinders in split tensile test and flexural strength of concrete beam. If 30% to 40% of DBA cement composite in more preferable and economic strength characters. It is based on the experimental work results subsequent the concrete compression, flexural and split tensile test with DBA powder as % mixed with replaced the materials of cement. The additions of the DBA inexpensive peak of view reduced the cement productions and save the natural assets. In addition of DBA, it improved the micron frictions bondings nature and corrosion resistance of RC bars. If final analyses of experimental investigation charecteristics investigations of dry bamboo ash partial replaced cement within M25 grade concrete is suitable for constructions and concrete structural frames.

Mohammed Abd Al-Kadhim Hameed (2021) They studied on "Studying the behavior of the concrete mixture with wheat straw as part of the cement", The proposed paper summarizes the potential usage of agricultural waste (wheat straw) as a sustainable material in the production of green concrete. In the chemical analysis of the wheat straw ash additive, it shows that 77.36% of the straw ash component is silica SiO2, this reaction is one of the slow reactions, so the amount of heat released is less and the strength of the concrete is less from concrete that does not contain an ash additative gave more strength for this reason, while the sample containing 10% of the straw ash is lower than the sample that contains 15% of the straw ash.

K. V. Boobala Krishnan(2017) In this experiment entitled " Experimental investigation on partial replacement of cement by wood ash and fine aggregate by wood powder", They describes about an experimental investigation conducted to study the behavior and strength of concrete by replacing cement with wood ash and fine aggregates with wood powder. Replacement up to 10% is beneficial in concrete. Usages of wood powder in concrete reduces its weight. Water absorption capacity increases with increases in wood ash and wood powder content. Waste material can be effectively utilize in concrete.

Monstair Osman Ahmed ali & Aneel kumar (2021) investigate that "Fresh and mechanical properties of concrete made of binary substitution of millet husk ash and wheat straw ash for cement and fine aggregates", the agricultural waste can be processed into the mixture of concrete as cementitious supplementary substituition ingredients. The reprocessing of these agro waste into mixture of concrete includes burning agricultural waste and utilizing the resulting residues (i.e. ash) to replace the PC in concrete mix. Owing to the high content of silica in the ash of pesticide residues, it has pozzolanic properties, therefore it is suitable for use as a substitute for PC. Additionaly, various kinds of agro wastes in the form of

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ashes have been utilized as supplementary substitutes for PC in concrete mixes. It was found that the inclusion of such type of ashes used in concrete mixes can improve the mechanical properties of concrete.

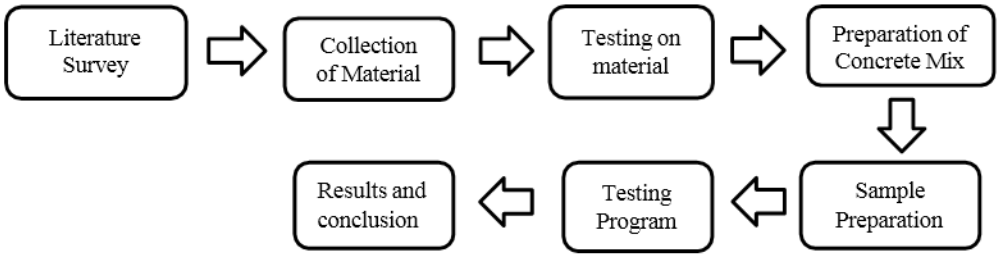
Chijioke Christopher Ikeagwauani (2019) In this study entitled "Potential of bamboo stem ash supplementary cementitious material in concrete production", this research has attempted objectively, to examine the potential of the bamboo stem ash (BSA) as a partial replacement for cement in concrete production. The cementitious value of the BSA for partially replacing cement in concrete production is justified. Its adoption into concreting will help to check the environmental problems associated with its waste bamboo stem, and ultimately reduce the levels of CO2 emission associated with the production of cement.

Adeyemi Oluwasen Adeboje et al (2021) investigate the " Engineering properties of paving stones made with bamboo ash as a partial replacement for cement" this research work shows that although substitution of cement with bamboo ash in paving stone reduced the compressive strength of the paving stone, replacement of only 5% cement with bamboo ash can give valuable or promising results for the promoting of the utilization of bamboo ash for paving stone which will be useful for external works of building, walk ways and paying of low to medium traffic road.

2.1 Conclusion of Literature Review

- It is concluded that WSA is a feasible pozzolanic material and could be partially replaced with a percentage of cement without any negative effect upon its properties.
- Sustainable replacement of the cement within DBA increased the strength of the concrete structure.
- It was also found out that the high surface area and absorption of WSA resulted in a decrease in the slump of the concrete mixtures with increasing WSA content.
- Greenhouse gases emission can be cheap by substitute of cement with OPC.
- The strength of mortar decreased with an increasing percentage of WSA.

III. METHODOLOGY



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