A REVIEW ON BEHAVIOR OF BLENDED CONCRETE USING AGRICULTURAL WASTES AS PARTIAL REPLACEMENT OF CEMENT

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ABSTRACT

Cement manufacturing consumes a lot of natural resources and energy. Alternate cementitious materials such as fly ash, blast furnace slag, etc. are often utilized as partial cement replacement materials to minimize the environmental impact of concrete manufacturing. These materials, however, are industrial by-products, and their availability is to be expected to decline in the future. Furthermore, these materials are not readily available everywhere, such as in developing countries. In such nations, agricultural and industrial wastes with pozzolanic behavior provide opportunities for use in concrete production. The use of agro-waste in concrete production provides a suitable solution to many environmental concerns and waste management hardships. Sugarcane Bagasse, rice husk, wheat straw, coconut shell, and other agricultural wastes are produced in large quantities in most developing and developed countries. The majority of these wastes are burned as fuel for electricity generation, resulting in ash. As a result, agro-waste such as sugarcane bagasse ash, ground shell ash, rice husk ash, and other agro-waste can be utilized as a cement substitute. The engineering properties of concrete made from common agricultural wastes such as rice husk ash, sugarcane bagasse ash, coconut shell ash, etc., and so on are summarized in this review paper.

Keywords: Agro-Waste Concrete, Blended Concrete, Agro Waste, Coconut Shell Ash Concrete, Ground Nut Shell Ash, Rice Husk Ash, Sugarcane Bagasse Ash.

I. INTRODUCTION

Blended cement is a consistent combination of ordinary Portland cement (OPC) and blending additives used to promote economy and improve characteristics for various uses. Concrete's workability, strength, durability, and chemical resistance can all be improved with blended cement. As we know that the advancement in construction technology and management is growing day by day many alternative materials have been found out that can be used as partial replacement of cement, sand, and aggregates that can increase the performance of concrete and can lower down the harmful effects caused by the concrete to the environment. agricultural wastes such as rice husk ash, sugarcane bagasse ash, coconut shell ash, etc., can be used as a partial replacement for cement which can form an eco-friendly concrete. the main aim of the project is to find out the exact percentage of agro wastes that can be used as partial replacement of cement with the same strength as that of conventional concrete.

II. LITERATURE REVIEW

a) M. Siva ChennakesavaRao, M. M. Vijaya Lakshmi, Praveen Kumar T R – Behavior of Green Concrete using Agro-Industrial Waste AS Partial Replacement of Cement. Today, investigations are focusing on methods for using agricultural or industrial wastes as a source of materials for construction projects all over the world. These Wastes Utilized Wouldn't Just Be Practical, But Could Also Be Beneficial and Make a Feasible and Contamination Free Condition. Industrial Waste and agricultural Waste Such as Sugar-Cane Bagasse Ash, Rice Husk Ash, and Saw Dust Are Causing Serious Pollution Related Problems, Which Needs Immediate Ways of Handling the Waste-Materials. The first step in the research will be to create blended cement from agro-industrial waste and determine the properties of the best-blended cement using various mix proportions. Then, green concrete will be developed for M30 grade using blended cement. At the ages of 7 and 28 days, an experimental investigation will be carried out to assess the workability and mechanical properties. This paper concludes that 10% substitution (SCBA, rice husk fiery remains, and saw residue cinder) can be utilized as a partial replacement of cement material with specialized and ecological benefits. Beyond the replacement level of 15%, the mechanical properties of concrete were reduced drastically.
Concrete. Agricultural waste is generated in massive amounts throughout the growing, harvesting, and processing of goods, and it should be viewed as a resource due to its abundance and renewability. While progressive countries are worried about utilization and environmental issues, developing countries, particularly in rural regions, are concentrating on the economic aspects of social housing. Fortunately, agricultural waste has been used as a partial replacement for fine aggregate, coarse aggregate, reinforcing materials, cement, and binders, raising environmental consciousness in the construction industry. This research paper aims to compile global data and references for future estimations of agro-waste applications in concrete, with a focus on fine aggregate replacement. This paper concludes that there was insufficient information on the tensile and bending tests, and the research could not provide an accurate definition of workability. Because some structures are designed to be used as structural elements in rural locations, tensile and flexural tests are critical. There was no information on the chemical composition of OPS, CNS, or WNL. In addition, the chemical heterogeneous qualities stated earlier must be considered and their impact on the combination. Furthermore, investigations are required to homogenize the chemical makeup of agro-wastes.

Soudagar Ahemad Mohamadali - "Effect on Properties of Concrete Using Agro-Waste as Replacement of Sand". The rising demand for natural resources caused by rapid urbanization, as well as the disposal problem of agricultural wastes, has provided the potential for using agro-waste in the building sector. The features of fresh and hardened concrete, as well as their durability and thermal conductivity when admixed with agricultural waste, are discussed. Agro-waste concrete with bagasse ash, sawdust ash, and oyster shell met the requisite strength with a fine aggregate replacement rate of 20%, the highest of any agro-waste type concrete. The addition of sugarcane ash as fine aggregate in mortar improved heat resistance and cyclic performance. The results reveal that the replacement values of 5%, 10%, and 15% show the effective strength of concrete, but when we transcend 15% to 20%, it shows a drop in strength. Thus, as a result of a replacement, we can effectively utilize agro-waste, and we can also acquire a replacement approach towards traditional natural materials; this also demonstrates the reduction of the cost of concrete, and thus the economy is also achieved.

Jing He, Satoru Kawasaki, and Varenyam Achal - "The Utilization of Agricultural Waste as Agro-Cement in Concrete": A Review. Concrete, the world's most widely used construction material, is becoming more popular as a result of the fast rise of industrialization and urbanization. Due to limited resources and the growing depletion of the environment, scientific efforts are being directed toward the development of alternative and effective materials that can be used as the partial replacement of cement. Cement is a main component of concrete. To solve and minimize environmental issues, research is being conducted to incorporate agricultural wastes such as sugar cane bagasse, rice husk, sugar cane straw, and palm oil fuel, among others, into cement and, ultimately, to bring sustainable and environmentally friendly properties to the concrete. Agro-waste materials are crushed or burned into ashes before being mixed with cement to form agro-cement. The partial or complete substitution of aggregates is also regarded as a sustainable material in building. This paper primarily examines current research on agro-cement, which has been explored and applied to improve the strength and durability of concrete. It also highlights essential knowledge and techniques, as well as offers optimal parameters for using agricultural wastes in concrete. This paper concludes that Agro-waste can be used as an alternative eco-efficient and long-lasting pozzolan in future concrete businesses. The inclusion of these residues into cementitious materials has demonstrated that the addition of wastes is not only beneficial to the environment but also results in excellent concrete performance. Currently, rice husk ash is recognized as the best substitute material for volcanic ash, although other agricultural wastes are also being examined on a wide basis.

M. Vignesh Kumar, Keba Lemessa - "Behavior of Concrete with Agro and Industry Waste as a Replacement for Constitutive Materials. Partial replacement of agro wastes in concrete can decrease the usage of cement and decrease pollution and protect the environment. So by using several agro wastes such as Groundnut shell ash, Rice husk ash they can be used as filler materials and help to reduce the air voids in the concrete and may increase the workability of concrete. As per this review paper, the workability of normal concrete is greater than the replaced concrete with agro wastes. By replacing 50% quarry dust and 10% of GSA in
We can use the replaced concrete instead of normal concrete after 28 days of strength. This paper concludes that mixing the quarry dust and groundnut shell ash in concrete gave good results so we can mix this agro-waste in concrete and keep the environment safe.

f) Oyedepo OJ, Olanitori LM, and Akande SP - “Performance of coconut shell ash and palm kernel shell ash as a partial replacement for cement in concrete”. The high cost of cement, which is used as a binder in the production of concrete, has prompted a search for alternatives. Concrete cubes were cast with varied quantities of OPC: PKSA palm and OPC: CSA using a mix design ratio of 1:2:4 and a water binder ratio of 0.63. The partial replacement of cement with 20% PKSA and CSA in concrete resulted in an average optimal compressive strength of 15.4 N/mm² and 17.26 N/mm² at 28 days. At 10 percent replacement with CSA, the optimum value of compressive strength obtained at 28 days is 20.58 N/mm². The value obtained is appropriate for both lightweight and heavyweight concrete. This paper concludes that Replacing 20% of palm shell ash and coconut shell ash in concrete gives a compressive strength of 15.4 N/mm² and 17.2 N/mm² respectively at 28 days of strength. Adding 10% of CSA in concrete gives the compressive strength of 20 N/mm² which can be used for heavyweight concrete.

g) Green concrete is a very interesting topic in the construction industry as it is very cheap to produce and its behavior resembles the same as conventional concrete and it requires a very minimum amount of energy for the production of concrete. Since concrete is highly used after water it releases a lot of co2 emissions which creates pollution to the environment. So preparing the green concrete with some agro wastes can solve the problem of large production of concrete and pollution. After the tests are done at 15% replacement of glass powder the strength obtained is 24.2% more than conventional concrete. At 30% replacement of strength obtained to 5.34% than conventional concrete. At 15% replacement with glass powder and fly ash, the strength obtained is 34% more than normal concrete. At 30% replacement glass powder and fly ash strength obtained to 6.48% than normal concrete.

h) Suvash Chandra Paul, Peter B.K. Mbewe, Sih Ying Kong, and Branko Šavija - Agricultural Solid Waste as Source of Supplementary Cementitious Materials in Developing Countries. Concrete manufacturing makes use of cement as its most important ingredient. Cement manufacturing is a crucial patron of natural sources and energy. Furthermore, the cement enterprise is a vast Co-producer. To reduce the environmental effect of concrete manufacturing, supplementary cementitious materials are normally used as (partial) cement alternative substances. This article provides an overall summary of research devoted to the utilization of various agricultural wastes in concrete production, especially in developing countries. It was found that the various waste sources highlighted can be employed in concrete as partial cement replacements or aggregate components. Ash has pozzolanic qualities when appropriately treated, which aid in the hydration and hardening of concrete. If designed properly, such concretes are not inferior to OPC concretes in terms of workability and long-term durability, and lower heat of hydration. As a result, such wastes are suitable candidates for a variety of specific applications, such as the production of durable concrete or massive concrete structures. At the moment, it can be considered that the feasibility of the use of agricultural waste materials in concrete has been proven. Although more research is needed, particularly on long-term properties, progress in production technology and quality control of these materials is essential. Only when ashes of constantly high quality can be produced at low financial and environmental costs will their use in engineering practice become more widespread. This is important, as many developing countries are the only SCMs available.

i) Manasseh Joel - A review of partial replacement of cement with some agro wastes. The usage of Acha husk ash (AHA), bone powder ash (BPA), groundnut husk ash (GHA), rice husk ash (RHA), and wood ash (WA) to substitute cement as a binder was investigated. Laboratory experiments revealed that only the replacement of cement with 10% BPA resulted in a substantial increase in compressive strength. The drop in compressive strength with other agro waste was related to a decrease in the CaO component of cement-agro waste mixes. Only a 10% BPA solution has demonstrated encouraging results in the replacement of cement in agro-wastes. In the case of partial replacement of cement with agro-wastes, the addition of lime via the application of hydrated lime to the cement and agro-wastes combination is recommended.

j) Devinder Singh & Jaspal Singh - "Use of Agro Waste in Concrete Construction". The use of agro-waste in
concrete manufacturing gives an appropriate solution to waste management issues. A considerable portion of these wastes is used as fuel for electricity generation, resulting in ash. During cement hydration, the ash will become rapidly reactive for pozzolanic activity. As a result, agro-waste such as ground shell ash, rice husk ash, and so on can be utilized as cement substitutes, while coconut shell, oil palm shell, and so on can be used as aggregate substitutes in concrete. The effects of these wastes on concrete qualities such as workability and compressive strength are discussed. This article concludes that the use of agro-waste in concrete will aid in waste and pollution reduction. Its usage in concrete buildings will assist to alleviate the possible challenges associated with depleting natural resources. Its use will also help to cut construction material costs.

k) Arpit Choudhary - Review on Use of Agricultural Waste as a Partial Replacement of Cement in Concrete. It has been discovered that agricultural waste such as Rice Husk and Saw Dust are abundant on our planet, and their by-products, Rice Husk Ash and Saw Dust Ash have a binder characteristic that allows them to be utilized in concrete as a partial replacement for cement. The exact percentage of Rice Husk Ash and Saw Dust Ash that can substitute cement has been attempted to find in this research, as cement is the most expensive substance used in concrete and also releases Carbon dioxide, which is hazardous to our environment. This review paper concludes that partial replacement of cement with agricultural waste can be a very good and beneficial step to form an environmentally friendly concrete; however, it is also very important that concrete gives its best strength, so the percentage of RHA should be kept between 5 and 15% and the parentage of SDA should be kept between 5 and 10%, whereas percentages can vary for different grades of concrete. Excessive percentages may reduce concrete's compressive strength. Further investigation into the proportion of RHA and SDA in the mix with varied water-cement ratios is possible.

l) K. Parand, Karthik Stalin, Ravi Kumar Thangrajan, and M. S. Karthikeyan—Utilization of Agro residual Waste in Effective Blending in Portland Cement. Indigenous mineral admixture resources, both natural and manmade Many countries throughout the world have used parade high pozzolanic reactivity. Extensive research has been carried out for this goal. Apart from increasing the qualities of concrete, the major advantages of using agricultural waste residue are the savings of natural resources and energy, as well as the protection of the environment by using these mineral admixtures (agro agricultural waste). The effective amount of blending Portland cement (PC) in mortar or concrete with such mineral admixtures is determined by a variety of criteria, including admixture type and cement replacement level. In this paper rice husk, ash, and bagasse ash are used. The admixtures listed above were thermally processed at 650 degrees Celsius. Several tests were conducted, including water absorption, coefficient of water absorption, a bulk volume of the specimen, and dry weight of the specimen saturated mass. The results showed that as the percentage of replacement level grew in all three admixtures investigated, so did water absorption. According to the findings of this research, the admixture studies for the three systems are as follows: A higher replacement level of RHA components in concrete results in weaker strength properties and increased water absorption. This is because an excess of RHA will not react with the lime freed during the hydration process, resulting in excess silica leaching out of the concrete and generating a strength deficit.

m) Buari T.A, Ademola S.A, Ayegbokiki S.T--Characteristic Strength of groundnut shell ash and Ordinary Portland cement blended - Concrete in Nigeria. This research paper discovers the possibility of using groundnut shell ash (GSA) as a partial replacement for ordinary Portland cement (OPC) in concrete. Analysis of the ash was carried out to find out its cementing characteristics, and the partial replacement of OPC by GSA in the concrete was varied from 0% to 20%. This paper concluded that GSA is an excellent Pozzolanic material that combines with calcium hydroxide to generate calcium silicate hydrate. GSA's Pozzolanic activity rises as time passes. The specific gravity of the GSA obtained was lower than that of the OPC it replaced, thus a mass replacement will result in a significantly higher volume of cementitious materials. The groundnut shell ash and ordinary Portland cement mixed concrete at 10% replacement level showed better compressive strength and would be acceptable and a favorable development for the building of masonry walls and mass foundations in low-cost homes in Nigeria.

n) Jayminkumar A. Patel*, Dr. D. B. Raijivwala--Experimental study on compressive strength of concrete by partial replacement of cement with sugar cane bagasse ash. The utilization of waste material in concrete is beneficial to the environment. Bagasse ash from sugar cane is a waste byproduct of the sugar mill. The
The influence of sugar cane bagasse ash in concrete is investigated in this research report. In this experiment, sugar cane bagasse ash is partially substituted with cement at 0%, 5%, 10%, 15%, and 20% by weight in concrete. The concrete grade was M25 and the w/c ratio was 0.49. Cubes of 150*150*150 mm were cast and tested for 7, 14, 28, and 56 days. The results reveal that sugar cane bagasse ash in concrete has significantly better compressive strength than regular concrete. It was discovered that cement may be substituted with a maximum of 10% sugar cane bagasse ash. However, the results demonstrate that the highest strength of concrete was obtained with a 5% substitution of cement with sugar cane bagasse ash with no superplasticizer. On increasing the percentage of ash it was seen that the strength of concrete decreases.

NJayendra Kumar Prusty a, Sanjaya Kumar Patro b, S.S. Basarkar—“Concrete using agro-waste as fine aggregate for the sustainable built environment—A review”. The increased demand for natural resources caused by rapid urbanization, as well as the problem of agricultural waste management in industrialized countries, have provided the potential for the use of agro-waste in the building sector. Many agricultural waste materials have been already used in concrete as a replacement for cement, coarse aggregate, fine aggregate, and reinforcing materials. This review paper examines some of the agro-waste elements that are utilized in concrete as a partial replacement for fine aggregate. The qualities of concrete, as well as its durability and thermal conductivity when combined with agro-wastes, are discussed. Agro-waste utilized in self-compacting concrete and mortar is also evaluated and contrasted. It was discovered that agro-waste concrete including groundnut shell, oyster shell, cork, rice husk ash, and tobacco waste performed better than its equivalents. Agro-waste concrete combining bagasse ash, sawdust ash, and oyster shell attained the needed strength by replacing 20 percent of the fine aggregate, which was the highest of any agro-waste type concrete. Following the study, it was determined that more research on all fine aggregates substituting agro-waste materials is warranted to provide greater confidence in their use in concrete. This study concludes that in the case of agro-waste concrete comprising bagasse ash, sawdust ash, and oyster shell, a minimum strength of concrete was attained by the inclusion of an optimal 20% replacement, but strength dropped with further increase. It was discovered that cork-based mortar had a cyclic activity. It has been discovered that the incorporation of cork improves the performances of the specimens throughout the mortar investigation, which is advantageous for the seismic protection of a building.

### III. METHODOLOGY

- Studying the peer-reviewed papers related to the project or study
- Collecting the AGRO-WASTES from nearby places.
- Studying the physical and chemical properties of agro–wastes.
- Partially Replacing the agro–wastes with cement.
- Preparing the concrete of different grades as per mix design after replacing the agro wastes partially with cement.
- Testing the concrete with a different test such as slump cone, vee-bee test, compaction factor test, and compressive strength test.
- Comparing the results of agro-based concrete with conventional concrete.

### IV. CONCLUSION

The following conclusions are made from the following study:

1. Using agricultural waste as a partial substitute for cement in concrete will assist to reduce waste and pollution.
2. Its application in concrete buildings will aid in mitigating the risk of natural resource depletion.
3. Its use will also help to cut construction material costs.
4. It is crucial that concrete provides its maximum strength, therefore the percentage of RHA should be kept between 5 and 15%, and the parentage of SDA should be kept between 5 and 10%, however, percentages can vary for different grades of concrete. Exceeding the percentage can result in a loss in concrete’s compressive strength.
5. At 28 days, partial substitution of cement with 20% palm kernel shell ash (PKSA) and coconut shell ash
Therefore, Agro-waste can be used as an alternative eco-efficient and long-lasting pozzolan in future concrete businesses. The incorporation of these residues into cementitious materials has demonstrated that the addition of agricultural wastes is not only beneficial to the environment but also results in excellent concrete performance.

At this time, the viability of using agricultural waste materials in concrete can be considered proven. However, more analysis is needed, particularly on long-term properties, progress in production technology and quality control of these materials is essential.

Therefore, further research can be conducted on the percentage of agro-waste mixed with varied water-cement ratios.

V. REFERENCES