A Comparitive Study on Durbality of Coconut Fibers, Coconut Ash and Coconut Fiber+Ash Mix in Concnrete a Review

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Abstract: *Conventional concrete is brittle and rigid in nature. It has high compressive strength, low tensile strength, ductility and it is not highly durable. Coconut fiber, which is a horticultural waste if not appropriately arranged, can develop social and ecological issues. There is have to channel this waste item to a progressively productive endeavor like Concrete innovation. Utilization of these additionally helps in decreasing the expense of solid generation by lessening the amount of concrete utilized. In this particular study coconut fiber and coconut Ash has been invistegated with different percentages in the concrete mix. Conventional concrete was compared with coconut fiber concrete and coconut ash concrete. Coconut fiber were mixed with 5 % and coconut ash were mixed by 0.25 % and 0.5 %. from the results obtained showed that mixing the coconut fiber by 5 % by mass and coconut ash by 0.25 % of cement mass have increased the flexure and tensile strength of concrete.*

Key Words: Coconut Fiber, Coconut Ash, compressive strength, Tensile strength, and flexural strength

1. INTRODUCTION

Concrete is one of the most versatile materials used in the building industry. Which comes second after water, in rank. Concrete is the most commonly used, inexpensive, and hard material that can be cast in any form, excellent against water and fire resistance, energy efficiency, and concrete is the material that can be used effectively with steel and reinforcing bars. Concrete is a strong compressive strength material, but poor tensile strength materials. Concrete contains fine concrete, coarse aggregate, water, some admixture, cement/lime from these materials. The planet uses about 10 billion tonnes of concrete, which causes an immense fear about natural resources, such as fine aggregate and course aggregate. To reduce these anxiety researchers have conducted studies on utilization Some waste materials such as (fly ash, silica fume, GGBS ground granulated blast furnace slag, steel powder, foundry sand, rice husk ash, plastic) have been used in concrete for the development and environmentally friendly environment to minimise the usage of natural resources, Because of shrinkages and some other factors, concrete has a lot of cracks to minimise cracks and improve concrete's mechanical properties, some of the fibres are suggested by the researcher (steel fiber, glass fiber, coconut fiber, polypropylene fiber, sisal fiber, bamboo fiber, etc...). Coconut fiber, which is a horticultural waste, is acquired from the stringy husk (meso carp) of the coconut (cocoas nucifera), from the coconut palm which has a place with the palm family. Vast amounts of this waste, if not appropriately arranged, can develop social and ecological issues. There is have to channel this waste item to a progressively productive endeavor like Concrete innovation. Utilization of these additionally helps in decreasing the expense of solid generation by lessening the amount of concrete utilized. Coconut powder can be Gathered under either high calcium or low calcium type contingent upon its CaO content. The carbon content in coconut fiber remains to be within 5%. The surface territory of the coconut slag particles is in the scope of 300–400 m2/kg. The utilization of coconut powder is suggested from perspective of its strength, economy and vitality sparing contemplations.

1.1 Literature Review

(F. A. Anifowoshe and N. E. Nwaiwu, *2016*) Based on the results obtained, coconut fibre ash mixed showed some potential for use in concrete cubes in the construction of pit latrines, The compressive strength of the cubes from 28 days to 90 days indicates that 10 percent and 30 percent replacement levels fulfil the requirement of BS EN 206-1; 2000 FOR CLASS C20/25 concreting. From the results obtained, coconut fibre ash mixed showed some potential for use in concrete cubes in pit latrine construction. In conclusion, the study shows that 10 to 30 percent partial replacement of ordinary Portland cement with coconut fibre ash with a W/C ratio of 0.55 is suitable for the production of concrete cubes in pit latrine construction. The study shows that 10 to 30 percent partial replacement of ordinary Portland cement with coconut fibre ash with a W/C ratio of 0.55 is suitable for the production of concrete cubes in pit latrine construction.

(N Kaarthik Krishna, M Prasanth, R Gowtham, S Karthic, K M Mini , 2017) In this work, natural fibres, namely coir and sisal fibre, are selected to enhance the properties of natural concrete fibres, namely coir and sisal fibre, in order to strengthen the concrete's properties. The aim of this project is to determine the optimum level of coir fibre content for the efficient improvement of ductile properties of concrete and the use of sisal fibre to increase the strength properties of concrete From the current work, it can be seen that the increase in ductility and strength of concrete was achieved by adding 1.5 percent of coir to the weight of cement.

(Mehran Khan, Majid Ali, 2018) In this study, with the addition of optimised silica fume and various super plasticizer materials, i.e. 0 percent, 0.5 percent, 1 percent and 1.5 percent, by cement mass, the medium strength concrete (MSC) and medium strength coconut fibre reinforced concrete (MSCFRC) are examinedMSCFRC's mix feature ratio is 1:2:2 (cement: sand: aggregate) with a ratio of water-cement of 0.50. The optimization of silica fume content by cement mass for MSCFRC is 15 per cent. By cement mass, coconut fibre with a length of 5 cm and 2 percent content is added. Based on the number of parameters against compressive, flexural and splitting-tensile loading, the best MSC and MSCFRC are chosen. The elasticity modulus, compressive power, compressive total absorbed energy and the best MSC compressive toughness index, i.e. MSC1 has been strengthened by 85%, 78%, 40% and 4%, respectively, relative to MSC. The elasticity module, compressive strength, compressive total absorbed energy and compressive toughness index of the best MSCFRC are increased, i.e. MSCFRC1 was 93%, 92%, 51%, and 15%, respectively, compared to MSCFRC1.

(Mayank Gupta, Maneek Kumar, 2019) In this work Coir fibre has been added with the variations of 0.25 percent, 0.5 percent, and 0.75 percent by the weight of the fine aggregates, along with this 2 percent and 3 percent nano-silica and 15 percent fly ash has partially replaced cement in the matrix. Addition of coir fibre and nano silica enhanced the compressive strength but had an inverse effect on the workability and abrasion resistance. Rate of increment in the 7 days compressive strength is comparatively higher than the 28 days.

(G.B. Ramesh Kumar, V.Kesavan, 2019) In comparison to typical solid examples relieved in ordinary water and ocean water, the compressive quality, flexural quality and split rigidity of cement with coconut filaments as a bond admixture at rates of 1.5 percent, 2.5 percent, 5.0 percent are seen to increase at 7 days, 28 days, With halfway substitution of bond by coconut slag at rates of 10 percent, 20 percent, 30 percent and by holding coconut strands as an admixture at 5.0 percent stable for all blends, the compressive consistency, flexural quality and split rigidity of cement with halfway substitution of bond by coconut slag at rates of 10 percent, 20 percent, 30 percent and by keeping coconut strands as an admixture at 5.0 percent stable for all blends is seen to increase at 7 days, 28 days, when compared with conventional solid examples relieved in ordinary water and ocean water.

(Mehran Khan, Majid Ali, 2019) Concrete is investigated with fly ash, silica-fume and coconut fibres (FA-SCFRC). The content of silica-fume and coconut fibres is 15% and 2% respectively. Fly ash contents are considered to be 0 percent, 5 percent, 10 percent, and 15 percent. The operability of various FA-SPC and FA-SCFRC mixes is reduced by up to 66 percent-100 percent as compared to PC and CFRC, respectively. There is an improvement in elastic module, compression strength, total energy absorbed compression and best FA-SCFRC compression toughness index, i.e. FA10-SCFRC compared to CFRCC by 40 percent, 35 percent, 68 percent and 22 percent, respectively.

(Habibunnisa Syed Ruben Nerella, Sri Rama Chand Madduru, 2020) Concrete with different fiber contents has been measured with standard concrete or pre-treated concrete and different strength parameters such as coconut fiber bending, compression and tensile strength vary with the proportions (0.6% and 1.2%) of the total weight of the concrete coconut fiber volume being performed. Impact of the fiber form on the strength property studied by testing with pre-defined dimension coconut fiber mesh. With the test and error process, the optimum percentage of both treated fiber yarn and raw fiber nets was found and the maximum percentage of super plasticizer needed for both ordinary cement as well as coconut fibers was also calculated in the concrete for basic operability. The tensile split strength increases to a maximum of 5 percent when the fiber content is increased. A decrease in tensile stress is observed as fiber content rises after this value. This is due to the fact that tensile failures arise due to the disruption of the interaction of atoms and molecules in concrete. They serve as a bond that ties them together while adding fibres.

(M.A. Othuman Mydin, N.A. Rozlan, S. Ganesan ,2014) , This study describes experimental studies on the use of coconut coir fibre as a mechanical improvement of foamed concrete properties that focuses on 3 compressive strength, flexural strength and tensile strength splitting parameters with different percentages of coconut fibre (0 percent , 0.2 percent and 0.4 percent). All the properties investigated were greatly enhanced by the addition of coconut fibre. The test results showed that, as the fibre volume percentage of the coconut coir fibre increased in the concrete mix, the compressive strength, flexural strength and fracturing tensile strength of the foamed concrete increased.

(Waqas Ahmad, Syed Hassan Farooq, Muhammad Usman 2020), the mechanical properties of high-strength concrete reinforced by coconut fibre (CFRHSC) are explored in this work. The CFR-HSC is also added with silica fume (10 percent by mass) and super plasticizer (1 percent by mass). The effects of coconut fibres 25 mm, 50 mm, and 75 mm long and 0.5 percent, 1 percent, 1.5 percent, and 2 percent by mass content are studied. CFR-microstructure HSC's is analysed using electron microscopy scanning (SEM). The experimental results showed that compressive, splitting-tensile, and flexural strengths, and energy absorption and toughness indices compared to HSC have been enhanced by CFR-HSC. For the CFR-HSC with 50 mm long coconut fibres with 1.5 percent cement mass content, the best overall results are obtained.

(Mahyuddin Ramli, Wai Hoe Kwan, Noor Faisal Abas, 2012) The goal of this experiment is to mitigate this limitation by introducing short, discrete coconut fibres into high-strength concrete, incorporating a small amount of coconut fibre (the best at 0.6 percent) with respect to compressive strength, improves the performance of concrete exposed to tropical environment by about 12 percent. As a consequence of the exposure of concrete to the environment, coconut fibre counters the adverse effects of expansion and shrinkage in alternate wet and dry environmentsAt 546 days, the findings from the experiment indicate a maximum of 13 percent greater intensity than the CTRL. Coconut fibres display discouraging effects on strength when the specimens are continually exposed to seawater. In general, mineralogical and microstructure studies show that both plain and fiber-reinforced specimens are influenced by seawater. However, cross-checking with strength efficiency suggests that the low dosage of coconut fibres is capable of suppressing the harmful effects of seawater on concrete, while the natural degradation properties of coconut fibres are limited to such suppression. The amount of coconut fibre used should, therefore, remain low. The suggested threshold value of the fibre content that will support the long-term strength and resilience of the concrete in all hostile environments tested is 1.2 percent by taking all the tested parameters into account.

(P. Purnachandra Sai, K. Murali, 2018) The use of agricultural waste material in concrete improves concrete's properties. Concrete made of fly ash, coconut fibre and coir fibre for M40 has been carried out and tested to research this phenomenon. Cement is supplemented by fly ash by 10 percent, 20 percent, and 30 percent. Coir fibres are used in the proportions of about 0 percent, 1 percent, 1.5 percent, 2 percent, 2.5 percent, 3 percent by binder weight. In the position of coarse aggregate, coconut shells are substituted. The coconut fibre width can range from 0.25 cm to 1.0 cm. The current study has shown that the addition of coconut fibre and coir fibre to concrete enhances concrete properties, the use of coir fibre is not recommended at all because it decreases concrete strength with an increase in material, compressive strength increases with an increase in coconut shells as a partial replacement of coarse aggregate, 5 percent is the optimum percentage replacement.

(Utsev, J. T., Taku, J. K, 2012) The CSA/OPC (Coconut Shell Ash/Ordinary Portland Cement) combination showed some promise from the results obtained for use in reinforced concrete as well as mass concrete structures in building construction. The compressive strength of the cubes at 28 days of curing indicates that the replacement levels of 10 percent and 15 percent comply with the specifications of BS EN 206-1: 2000 for heavy concreting class C25/30 and C20/25 and LC25/28 and LC20/22 respectively for lightweight concreting. In conclusion, the study shows that 10 to 15 percent partial replacement of OPC with CSA with a W/C ratio of 0.5 is appropriate for both heavy weight and light weight concrete manufacturing. Additional research areas are recommended. This requires the use of calcined CSA under controlled conditions, as the temperature and time of calcination tend to have a pronounced impact on the ash amorphosity and change in the water/cement ratio.(Prasad et al., 2016).

(Oyedepo OJ, Olanitori LM and Akande SP, 2015)Concrete is essentially used to support any form of load for several structures because of its compressive power. This study showed that partial cement replacement in concrete with 20 percent palm kernel shell ash (PKSA) and coconut shell ash (CSA) gives an average optimum compressive strength of 28 days of 15.4 N/mm2 and 17.26 N/mm2 respectively The value obtained is sufficient for the aggregate light weight. The optimum compressive strength value obtained at 28 days, however, is 20.58 N/mm2 at 10 percent cement substitution with CSA that can be used for heavy-weight concrete. The partially substituted cement with PKSA and CSA is therefore ideal for the construction of light load structures such as floor lintels and low-cost housing projects, using a water cement ratio of 0.63;

Using PKSA and CSA as partial replacements of cement, cheaper structural lightweight concrete is manufactured using the optimal compressive strength value stated in the research; research shows that using PKSA and CSA as partial replacements of cement in concrete at lower replacement volumes would increase the decrease in the use of cement in concrete, thereby reducing production co-production.

(Majid Ali, Anthony Liu, Hou Sou, Nawawi Chouw, 2012)The mechanical and dynamic studies were carried out according to the report. Properties of reinforced concrete coconut fibre The members of (CFRC) were well investigated. Comparison of A There was a static and dynamic module between thePerformed. The 1 percent, 2 percent, 3 percent and 5 percent impact Fiber content by mass of cement and length of fibre 2.5, 5 and 7.5 inches are being examined. Md. Noor. Sadiqul Sadiqul And Hasan, et. Al, from Malaysia, studied the Concrete physical and mechanical characteristics After the volume-based addition of coconut fibre.

(Noor Md. Sadiqul Hasan, Habibur Rahman Sobuz, 2012) In all cases, as the volume percentage of coconut fibres increased in the concrete mix, the compressive strength of the concrete decreased as test results showed that the compressive strength of plain concrete after 28 days of curing time is 31,57 N mm-2. However, at the curing age of 28 days, concrete compressive strength with 3 percent coconut fibre volume is between 18.85 N mm-2 and meets the structural requirement of lightweight concrete. The authors say that the 3 percent reinforced concrete coir fibre volume has the optimum collection of mechanical properties compared to other reinforced concrete fibre volume, When their ultimate failure load was reached, traditional concrete samples were completely crashed, but when their ultimate failure load was reached, the samples did not crash in the case of 1% and 3% of coconut fibre by the total amount. Coconut fibre reinforced concrete can also increase higher durability. Coconut fibre reinforced concrete has demonstrated less improvements in crack and crack duration. So, in the construction zone, it can be a good option. In order to study the impact of coconut fibre on concrete of varying lengths and amounts, more work needs to be performed.

It is concluded that the capacity for coconut fibre to be used for the development of structural lightweight concrete in traditional concrete.

(Yalley, P. P. and Kwan, A.S K, 2009) The results are recorded from experimental studies on the strength characteristics of concrete enhanced with coconut fibres, The assumptions that follow can be derived. The addition of coconut fibres has greatly strengthened many of the concrete's engineering properties, especially torsion, strength and tensile strength. The capacity to resist cracking and spalling has also been improved. The addition of fibres, however, adversely affected the compressive strength, as predicted, due to compaction difficulties that led to an increase in voids. Despite its outstanding properties, for the vast majority of buildings, coconut fibre is unlikely to substitute steel as a concrete enhancement. Experiments and demonstration projects around the world have shown that improving natural fibre is a viable and cost-effective alternative to traditional construction materials.The construction industry, however, is extremely conservative, so the use of new materials in non-structural applications or in those where the effects of failure are not too significant is the most likely development direction.

(P. Paramasivam, G. K. Nathan t and N. C. Das Gupta.t, 1984) This study explores a systematic and simple method of casting corrugated fibre reinforced slabs that can easily be adapted to mechanised processes suitable for precast industries. To achieve a flexural strength of about 22 N/mm 2, a volume fraction of 3 percent and a fibre length of 25 mm are recommended. In securing improved strength and good appearance, casting pressure plays an important role. The thermal conductivity of 0.64 W/m°K and the low frequency sound apsorption coefficient of 3-8 percent are close to those of asbestos boards. This research shows that the performance of the boards reinforced with coconut fibre is comparable to that of asbestos boards. In most tropical countries, raw coconut fibres are currently available at low prices, and the treatment is relatively inexpensive. In view of this, reinforced corrugated slabs of coconut fibre should be seriously considered for use in low-cost housing, especially in developing countries.

(Kshitija Ndgouda, 2014) The study comprises of comparative statement of properties of coconut fibre reinforced concrete with conventional concrete based on experiments performed in the laboratory.The low density of coconut fibre decreases the total weight of the reinforced fibre concrete, so it

It can be used as a light-weight structural concrete. We can minimise environmental waste by strengthening the concrete with coconut fibres that are readily available. In the case of a 3 per cent fibre blend, flexural strength increases. Economics can also be accomplished in design. Since 5% & 7% of fibres do not display favourable results, it can be inferred that there should be no use of fibre material beyond 3%.[18]

(Anthony Nkem Ede and Joshua Olaoluwa Agbede, 2015) This research studied the compressive and flexural strength of coconut fiber reinforced concrete using destructive and non-destructive test methods. Conventional compression tests and Schmidt Hammer Rebounds on cube specimens and two point bending test on short beam specimens with different coconut fiber content were conducted. From the results and analysis of this research work it can be concluded that the addition of a 0.5% coconut husk fiber as a constitutive material of concrete affected the rheological properties of the fresh concrete, in-creased the compressive and flexural strength of concrete by 35.8% and 22.15% respectively. It was verified that coconut fiber content in the excess of 0.75% reduces the workability and drastically weakens the compressive and flexural strength. The presence of coconut fiber significantly improves the toughness and the ductility behavior of concrete. The test results have shown that coconut fiber at 0.5% content is opti-mal for enhancing the rheological and mechanical properties of concrete. This research proves that coconut fiber can be sus-tainably adopted for enhancing the properties of concrete es-pecially in the tropics where this fiber abound and are not economically being put to use in the spirit of waste to wealth.

Based on the test results obtained, the integration of coconut fiber in making FRC composite would be one of the promising strategies to improve the performance of concrete. The greater improvement in flexural and toughness behavior of FRC is highly encouraging as the tensile strength enhancement have been one of the biggest challenges of concrete material behav-ior over the years. The improve toughness behavior will allow the coconut fiber FRC to absorb sufficient amount of energy and hence increase the ductility of structural members and give adequate warning before the ultimate capacity is attained and possibly save lives as fragile collapse is avoided. This will help greatly to reduce the incidence of building collapse in Nigeria. Further researches are recommended for fatigue, shear capacity, durability and field applications to confirm the promising test results obtained in this research.

3. CONCLUSIONS

- The present work examines the use of coir and sisal fibre to enhance its strength, ductility and load carrying ability as an additional material in concrete. Different experiments have been conducted and the Results are recorded for compressive strength, deflection and axial load carrying ability. Coir fibre slows and controls the tensile cracking of composite materials and also increases the ability to withstand ductility and energy. It can be seen from the present work that the improvement in ductility and strength of concrete was achieved by 1.5 percent of the weight of cement for the addition of coir, which was considered to be the optimum percentage. The increase in the load carrying capacity of the concrete cylinder can be seen when the maximum percentage of coir has been wrapped with sisal fibre. In order to avoid catastrophic failure, the enhancement of ductility can be regarded as a critical criterion for seismic resistant structure design. The incorporation of coir into concrete containment can thus increase the seismic resistance of structures in concrete containment

  Areas which are vulnerable to earthquakes.

- When 0.6 percent coconut and 1.2 percent aqueous coconut are added,Cement water ratio of 0.40. The test for compression strength yields Nice outcomes. Compression strength decreases, however, While the other fibres are added. That should be because of the fact that, At the initial stage of concrete, when fibres are inserted, fine micro processes Reach the fibre surface pores, which contributes to stronger bonding Between the blend and the fibres. Yet another addition to the fibres is This contributes to the creation of the fibre mass in the mixture, which leads to In connectivity, to a decrement. There is an ideal meaning, therefore, to After compression strength decreases, the fibre cement ratio. Accordingly, The 0.40 value is taken as the perfect ratio of water cement and the optimum ratio of water cement The ratio of fibre material is 0.6 and 1.2 percent .

- The slump and density of CFR-HSC were reduced compared to those of HSC. With changing fiber length and content, the slump of CFR-HSC was reduced up to 87.5%, and the density is reduced up to 2.7% compared to HSC.

- The percentage of the coir fiber in the concrete affects the compressive strength of concrete. As the percentage of coir fiber increases, the compressive strength of the concrete increases up to 0.5%, however, the percentage of coir fibers increases to 0.75% there is a sharp decline in the compressive strength as compared to the control sample. This behavior is similar for all water to binder ratios (0.47, 0.45, and 0.42) after 7 days as well as 28 days.

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- **Biography**

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