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"A Review On Self Curing Concrete – A Study Of Incorporating Coir Pith Residue As Fine Aggregate"

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ABSTRACT

This review explores the self-curing properties of concrete when coir pith residue is incorporated as a fine aggregate at varying proportions of 1%, 3%, and 5%. Self-curing concrete aims to retain water within the mixture, enhancing hydration and reducing the need for external curing methods. Coir pith residue, a byproduct of the coconut industry, offers a sustainable alternative to conventional fine aggregates, potentially improving the environmental footprint of concrete production. This paper synthesizes findings from various experimental studies, examining key parameters such as compressive strength, flexural strength, and workability. The results indicate that coir pith residue can enhance the self-curing capacity of concrete, with optimal performance observed at specific inclusion rates. The implications for construction practices and material sustainability are also discussed, highlighting the potential benefits and limitations of using coir pith residue in self-curing concrete applications.

Keywords: Concrete, Self-Curing, Coir Pith Residue, Fine Aggregate, Compressive Strength, Flexural Strength, Workability.

I. INTRODUCTION

Concrete is a popular building material used all around the world because of its affordability, durability, and adaptability. However, because of the significant energy consumption and carbon emissions associated with the manufacture of essential components like cement and aggregates, its production presents environmental concerns. In order to lessen the impact on the environment, there has been a recent trend away from traditional concrete and toward sustainable alternatives that incorporate waste materials and leftovers from many sectors.

One interesting option for achieving sustainability in concrete manufacturing is the usage of agricultural and industrial waste materials as partial replacements for standard aggregates. Among these waste materials, coir pith residue, a byproduct of the coconut industry, has emerged as a possible contender for use in concrete mixes. Coir pith residue is a lightweight, porous, and renewable substance that demonstrates great water-holding capacity, making it a perfect element for boosting the self-curing qualities of concrete.

Due to its capacity to keep moisture within the concrete matrix, self-curing concrete is a concept that has garnered a large amount of attention in the construction industry. This is because it reduces the need for external curing methods, which in turn promotes environmental sustainability. As a result of the incorporation of coir pith residue into concrete mixtures, it is predicted that the water-holding capacity of the material will facilitate internal curing. This will result in increased hydration of the cement, which could potentially improve the overall performance and durability of the concrete. Not only does this make the construction process easier, but it also enhances the efficiency with which resources are utilized.

Through the utilization of coir pith residue as a partial replacement for fine aggregates at different replacement levels of 1%, 3%, and 5% by weight, the purpose of this research project is to carry out an experimental study with the intention of investigating the self-curing potential of concrete via the utilization of coir pith residue. The purpose of this study is to conduct a comprehensive investigation of the impact that coir pith residue has on the various aspects of concrete, such as its workability, compressive strength, Tensile strength.

In addition, the microstructural characteristics of the concrete mixtures will be investigated in order to acquire a better understanding of the mechanisms that are responsible for the self-curing behavior as well as the interactions that occur between the coir pith residue and the cement matrix. The purpose of this research is to contribute to the development of concrete mixtures that are both environmentally friendly and excellent in performance. This will be accomplished by investigating the possible synergies that exist between the porous nature of coir pith waste and the hydration process of cement.

The findings of this study have the potential to pave the way for the efficient usage of coir pith residue, which is a waste material that is plentiful in agricultural production, in the manufacturing of concrete. This would result in a reduction in the environmental impact that building activities have and would promote resource efficiency. In addition, the development of self-curing concrete that possesses improved durability and performance qualities has the potential to have far-reaching ramifications for the construction sector, which would be beneficial to both the economy and the environment.

II. OBJECTIVES:

1. Analyse whether adding coir pith to self-curing concrete as a fine aggregate is feasible.
2. Assess the generated concrete mixes' mechanical attributes, including their workability, flexural strength, and compressive strength.
3. To get the required qualities and performance out of the self-curing concrete with coir pith, optimise the mix proportions and curing conditions.
4. Examine the differences between normal concrete mix and self-curing concrete containing coir pith in terms of sustainability and performance.

III. LITERATURE REVIEW

1. Patel Manishkuma Dahyabhai, Prof. Jayeshkumar R. Pitroda,[2014]

In comparison to conventional concrete, the authors found that the application of self-curing admixtures increased the compressive strength of the concrete mix by 37% and 33.9%, respectively, when 1.0% and 1.0% of PEG600 and PEG1500 were added. For M25 grades of concrete, the optimal dosage of PEG600 was found to be 1% of the weight of cement for maximum compressive strengths.

2. **A. Ananthi, R. Ranjith S. Swarna Latha R. Vimal Raj [2017].**

The authors came to the conclusion that, for M40 grade, 2% of PEG400 was the ideal dosage for maximum strength. According to the results of the workability test, glenium dosage increases result in a 3.3% increase in workability. When self-curing PEG 400 concrete was employed instead of traditional concrete curing at the age of seven days, an average improvement in compressive strength of 2.25% was observed.

3. **Muddassir Bora, Mausam Vohra, Mohammed Sakil Patel, Dhruv Vyas, [2017].**

The authors came to the following conclusions after doing a literature review: It was discovered that 1% of PEG400 was the ideal dosage for the M20 in order to get the highest strength (compressive, tensile, and rupture modulus). For concrete of M20 grade, slump increased as the proportion of PEG400 rose. Self-curing concrete has a strength comparable to traditional concrete. The solution to many issues arising from improper curing is self-curing concrete. Where water shortage is a serious issue, self-curing concrete offers an alternative to traditional concrete in desert environments.

4. **Dr. R. Malathy, Poornima M, Vinothkumar, [2018].**

The authors came to the conclusion that internal healing was effectively accomplished because of the high absorption capacity of coir pith. After 28 days, the highest compressive strength of 25.12 N/mm2 was achieved with a 2% substitution of coir pith. At the 28th day, the maximum flexural strength achieved with a 2% replacement of coir pith is 3.38 N/mm2. In order to replace 2% of the coir pith, concrete's impact strength is found to be 98 blows, which is sufficient to withstand impact loads. In concrete, 2% is the ideal amount of coir pith replacement for fine aggregate.

5. **Rahul Dev Punjab, R. Navaneethan, [2018].**

The authors came to the conclusion that PEG 2 hundred is more expensive for M30 and M40 mixtures and that it costs 0.5% of the cement's weight. In terms of compressive, split tensile, and flexural strengths, the results obtained for the specimen that contains PEG-200 indicate superior energy compared to standard mixtures. At zero, the compressive energy increased by up to 9.5%.for M30 mix, 5% PEG, and for M40 mix, 6.57% PEG. For the M30 mix, the splitting tensile electricity multiplied up to 14.28% at 0.5 percent PEG, while for the M40 mix, it reached 10%. Flexural strength increased to a maximum of 5.

6. **K.Sumangala, M. Banu Sulochana, [2019].**

The writers came to the conclusion that, A thorough evaluation of the literature on self-cured concrete has been conducted. It has been noted that the addition of chemical admixtures accomplished the majority of the internal healing. According to a review of the literature, adding 1-2% of polyethylene glycol (PEG) additive to different grades of concrete enhances strength by 10% to 15% while maintaining strength levels comparable to traditional concrete. By utilizing 0.3% of super absorbent polymer (SAP), the physical characteristics rose to 5%.

7. **N. Y. ELWakkad, KH. M. Heiza, Prof Dr Aqial eladly, [2019].**

The authors came to the following conclusions based on the literature review: 1. Self-curing concrete (SCC) offers solutions for numerous issues arising from inadequate curing. 2. In arid and hot climates where water scarcity is a significant issue, SCC is a viable substitute for conventional concrete (CC). 3. A rise in slump value corresponds with an increase in polyethylene glycol quantity.

8. **Rayees Ali Khan, Chhavi Gupta, [2020].**

The following conclusions are drawn from the analysis of multiple research papers conducted in this study, according to the authors: In both laboratory and real-world settings, the self-curing process works with both

normal and self-compacting concrete. Self-curing admixtures improve the concrete's workability and durability. The majority of the time, self-curing concrete has a stronger mix design than ordinary concrete.

9. **Vedant P. Chavan, [2020].**
The following conclusions can be drawn from this study's experimental examination, according to the authors: The advancement of self-curing concrete can provide solutions to a number of issues relating to insufficient and incorrect curing in the building industry. It is possible to effectively reduce the quantity of water being "wasted" and get very little water usage on building sites. The self-curing concrete's strength is comparable to that of regular concrete, according to the findings of other writers. We will shortly be updating the publication with the ideal dosage based on the findings of our experimental investigation.

10. **Udayabanu, Rajamane, Makendran, R.Gobinath and S Chandra Chary, [2020].**
The authors came at the following conclusions: cost analysis, results on compressive, flexural, and tensile strengths, and successful use of self-curing concrete in polyethylene glycol were all achieved in this laboratory experimental study. According to the lab research, polyethylene glycol (PEG400)-induced self-curing concrete has advanced significantly. For M20 grade concrete, the ideal measured quantity of PEG400 was found to be 1%; also, compressive strength rose by 1% when compared to normal concrete curing. Because PEG400 was entirely soluble in water, the study suggested it be used as an appropriate internal self-curing agent.

11. **Neeraj Kumar Sharma, S. Gurbachan Singh, [2020].**
The authors came to the conclusion that since coir fibers are a freely available agricultural waste, utilizing them as reinforcing elements in concrete lowers pollution levels in the environment. Experimental testing has been done on the compressive strength of coir fiber reinforced concrete, and the results clearly show that the strength drops beyond 6% of the fiber content and increases up to 6% of the fiber content.When compared to normal concrete, the split tensile strength and flexural strength of concrete reinforced with coir fibers improve as the fiber content does, but only very gradually—up to 4% and 5%, respectively—beyond which the strengths begin to decline.

12. **K. Porulselvi, C. Sivasanthosh, I. Michael Raj, [2022].**
The authors came to the conclusion that tests were conducted on the compressive strength and split tensile strength of coir fiber reinforced concrete, and the results indicated that the strength of the material grew gradually as the proportion of fiber increased. It is well known that a 20% increase in fiber marginally boosts strength. In comparison to regular concrete, the concrete's workability has decreased.

13. **Parthasaarathi, Balasundaram, Naveen Arasu, Senthil kumar [2024]**
All things considered, the experimental investigation conducted on Coconut Shell Coir Fibre-Reinforced Concrete (CSFRC) has provided valuable insights into the material's behavior under impact loading. According to research, CSFRC has the ability to take the role of PCC in a variety of building environments. Through the analysis of multiple parameters, including impact force, elastic modulus changes, and critical damage patterns, the structural performance of CSFRC has been better understood. According to the study's findings, CSFRC can withstand impact loads better than PCC, indicating that it will make for a more resilient and long-lasting building material.

14. **A. Rajkohila, S. Prakash Chandar, Panruti thangaraj ravichandran**
When the fiber concentration in HSC is kept to 1% of the concrete volume, adding BF and CF can increase the concrete's compressive strength by 3.84 % and 2.05%, respectively. On the other hand, the balling action of the

fibers causes the compressive strength to decrease when the fiber concentration rises above 1%. Therefore, in order to achieve the intended strength gain without jeopardizing the structural integrity of the concrete, it is imperative that the ideal fiber concentration be carefully determined. • When made using a combination of 1% BF, the split tensile, flexural, impact, and bond strength of HSC were also noticeably superior. This mixture showed notable improvements over the other combinations, with gains of 15.73 %, 54.49 %, 55.10 %, and 5.40 %, respectively.

IV. MATERIALS USED

Cement:

A cement is binder a substance used for construction that sets, hardens, and adheres to other materials to bind them together. The properties of cement are shown in Table No. Fig.shows cement using in project.

Characteristics	Specifications
Type of Cement	Ordinary Portland Cement
Grade of Cement	53
Brand Name of Cement	Birla Super
Specific gravity	3.15

(Ref. Google)

Coarse Aggregate:

IS 383-1970 defines coarse aggregates as Aggregates which is retained on 4.75 mm IS Sieve and containing only so much finer material. Properties of coarse aggregate are shown in Table No. 3.2 Fig. 3.2 Shows coarse aggregate

Characteristics	Specifications
Size	10-20 mm
Shape	Angular
Specific gravity	2.60

(Actual Image)

Fine Aggregate:

To get good quality Fine Aggregate it should be free from inorganic impurities, uniform in size.Properties of fine aggregate are shown in Table.

Characteristics	Specifications
Type	M-Sand
Specific gravity	2.68
Sieve analysis	Zone -II

(Actual Image)

Coir pith:

Coir pith is a byproduct of the coir fiber extraction process from coconut husks. It is the soft, spongy material found between the fibers in the husk. Coir pith is made up of millions of tiny cells that act as a natural moisture-retaining medium.

(Ref. Google)

Water:

According to IS 456: 2000, water used for mixing and curing shall be clean and free from oils,acids, alkalis, salts, other substances that may deleterious to concrete or steel. Potable water is generally considered satisfactory for mixing concrete. The pH of water shall be not less than 6.

V. CONCLUSION

Based on literature review, following conclusion are obtained:

1. The concrete's impact strength, sufficient to withstand impact loads, is found at 98 blows when 2% of the coir pith is replaced. In concrete, a 2% replacement of coir pith as fine aggregate is ideal.
2. When 1.0% PEG600 and 1.0% PEG1500 were added to the concrete mix, the compressive strength rose by 37% and 33.9%, respectively, above normal concrete. It was discovered that, for M25 grades of concrete, the ideal PEG600 dosage for maximum compressive strengths was 1% of the cement's weight.
3. Self-curing concrete can be considered answer too many problems arise due to lack of proper curing.
4. Self-curing concrete is an alternative approach to conventional concrete in desert regions where one of the major problems arises due to scarcity of water.

VI. REFERENCES:

1. Bentz, D.P., “Influence of Curing Conditions on Water Loss and Hydration in Cement Pastes with and without Fly Ash Substitution,” NISTIR 6886, U.S. Dept. Commerce, July 2002.
2. S. Tyagi. An experimental investigation of self-curing concrete incorporated with polyethylene glycol as self-curing agent, IRJET. 2015; 2(6).
3. Mohan Raj A, Rajendran M, Ramesh A S, Mahalakshmi M, Manoj Prabhakar S. (2014). “An Experimental Investigation of Eco-Friendly Self –Curing Concrete Incorporated with Polyethylene Glycol”. International Advanced Research Journal in Science, Engineering and Technology.
4. D.Maragatham Jeyaseeli and Samuel Paul Raj, “Physical characteristics of Coir Pith as a Function of its particle size to be used as Soilless medium”, American-Eurasian Journal Agric & Environ. Sci., 8(4):431437, 2010.
5. Parhizkar.T, Najimi.M and Pourkhorshidi.A.R, “Application of pumice aggregate in structural lightweight concrete”, Asian Journal of Civil Engineering (2012), vol. 13, pp. 43-54.
6. El-Dieb A.S. (2007) “Self curing concrete water retention, hydration and moisture transport”Construction and Building Materials, Vol-21, pp1282- 1287

7. Magda I. Mousa, Mohamed G. Mahdy, Ahmed H. Abdel-Reheem and Akram Z. Yehia, “Physical Properties of Self-Curing Concrete (SCUC)”, HBRC Journal (2015) 11, pp. 167-175.

8. N. Sunanda, Shilpa.V, Experimental investigation on self-curing concrete with partial replacement of cement with metakaolin, IOSR Journal of Engineering, ISSN (e): 2250-3021, Vol. 08, Issue 6 (June. 2018), and PP 33-40.

9. Basil M. Joseph, ‘Studies On Properties of Self-Curing Concrete Using Poly-Ethylene Glycol (IOSR-JMCE)’, 2016.

10. Makendran C, SanthoshPrabhu S, PreginaK,ThirumuruganAand RajakumarS2020 Impact behavior of ferrocement slabs with high strength mortarTest Engineering and Management837352-59.