RESEARCHERID
THOMSON REUTERS

[Malathy* *et al.*, 7(4): April, 2018]
IC™ Value: 3.00

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

EXPERIMENTAL STUDY ON SELF CURING CONCRETE USING COIR PITH AS FINE AGGREGATE

Dr. R. Malathy [1], Poornima M[2] Vinothkumar M [3]
Professor[1], Research scholar[2], Research Assistant[3],
Department of Civil Engineering, Sona Collage of Technology, India malathycivil@sonatech.ac.in

DOI: 10.5281/zenodo.1215416

ABSTRACT

Curing is the process in which the concrete is protected from loss of moisture and kept within a reasonable temperature range. This process results in concrete with increased strength and decreased permeability. Large quantity of good quality water is needed for curing concrete and labor has to be conscious while curing. Curing is difficult when works carried out at heights. Curing can be done both internally and externally. For external curing ponding, wet covering, fogging, sprinkling, etc., can be adopted. Internal curing can be done by adding admixtures in the concrete. In this project, sand is replaced by coir pith for the internal curing purpose. Coir pith can hold water up to 25-40 days. Due to this water holding capacity coir pith is used in agriculture. So, replacement is done for sand by 2%, 4%, 6% and 8% of coir pith in concrete and concrete tests for these replaced concrete specimens are done. Results of conventional concrete specimens and coir pith replaced concrete specimens can be compared and conclusion is arrived

KEYWORDS: Coir pith, Calcium Internal curing, Self-curing.

I. INTRODUCTION

Around 14,000 million coconuts are being produced annually in India, particularly from the states of Kerala, Tamilnadu, Andhra Pradesh and the Union Territories. Coir pith is a product of the coir industry, producing more than 7.5 million tonnes annually in India. Coir pith, light to dark brown in colour, consists primarily of particles in the size range 0.2–4 mm. Coir pith absorbs water due to indefinite number of micro pores and store water due to macro pores. The elastic cellular cork like pithy material forming the non-fibrous tissue of the husk is generally referred to as the coir pith, which accounts for 50-60% of the total weight of the husk. One ton of coir pith accumulates for every 10,000 husks used in the coir industry. Because of its sponge like structure, coir pith helps to retain water and improve aeration. Coir pith has a phenomenal high water holding capacity. It can hold water up to 6 times or more of its dry weight and can retain it for 25-40 days.From knowing the absorbing capacity of coir pith here in our project we have used it as a material for internal curing or self-curing purpose.

A. Need for self-curing

Self-curing refers to the process by which the hydration of cement occurs because of the availability of additional internal water that is not part of the mixing water. Raoult‟s Law states that when the vapour pressure of the solute in pure state is less than the vapour pressure of the solvent in pure state, it is apparent that theoretically, the addition of such a chemical would lead to a reduction in the vapour pressure of water above the concrete. This would lead to less water being lost from the surface. It was also anticipated that the reduction in solvent, partial vapour pressure would be reduced further if hydrogen bonding exists between solute and solvent molecules.A small amount of fine aggregate is replaced by coir pith in concrete. However, increase in demand of good quality water brings the necessity for self-curing or internal curing.

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

B. Purpose of internal curing

The curing protects the concrete surfaces from sun and wind.The presence of water is essential to cause the chemical action which accompanies the setting of concrete. Normally, there is an adequate quantity of water at the time of mixing to cause hardened. But it is necessary to retain water until the concrete has fully hardened. The strength of concrete specimen gradually increases with age, if curing is efficient. This increase in strength is sudden and rapid in early stages and it continues slowly for an indefinite period. By proper curing, the durability and impermeability of concrete are increased and shrinkage is reduced. The resistance of concrete to abrasion is considerably increased by proper curing.

C. Effects of improper curing

The compressive and flexural strength may found to be lower. The cracks may be formed due to plastic shrinkage, drying shrinkage and thermal effects. The durability may decrease due to higher permeability. The rate of carbonization may increase.

D. Advantages of internal curing

Wastage of water can be avoided. Labour charges can be eliminated. Normal curing is not necessary, so time can be saved

II. CONSTIUENT MATERIALS

A.Physio-chemical properties of Coir pith

Moisture content is 10.1 to 60.2%, Particle size is 0.098 to 0.925mm, Porosity varied from 0.623 to 0.862 Particle density varied from 0.939 to 0.605 gm/cc, Bulk density were in the range of 0.097 to 0.341gm/cc , Static coefficient of friction against mild steel 0.504 to 0.633

B. Chemical Composition of coir pith:

Table 1: Chemical composition of coir pith

S.NO	Chemical Composition (%)	Coir pith
1	Organic Carbon	29.0
2	N	0.26
3	P	0.01
4	K	0.78
5	Ca	0.40
6	Mg	0.36
7	Fe	0.07

B. Properties of cement, Fine Aggregate and Coarse Aggregate

The following table shows the Properties of cement, Fine Aggregate and Coarse Aggregate used in the concrete.

Table 2 Properties of cement, Fine Aggregate and Coarse Aggregate

S. No	Property	Values
1.	Specific gravity of C.A.	2.70
2.	Crushing value of C.A.	25%
3.	Impact value of C.A.	20%
4.	Specific gravity of F.A.	2.58
5.	Fineness modulus of F.A.	2.70 (Zone II)
6.	Specific gravity of cement	3.15

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

C. Mix Proportion

Mix design for M_{20} grade concrete by the Indian standard recommended method of concrete mix design as per design code IS: 10262-2009Mix proportion is 1:1.52:2.67 / 0.45 (C: FA: CA/ w/c ratio)

III EXPERIMENTAL INVESTIGATION

A. Preparation of Coir pith

The following figure shows that the preparation of coir pith. Initially it is taken in powder form then it was mixed with concrete.

Fig 1 Preparation of coir pith

B. Batching of Materials

The measurement of material for making concrete is known as batching. Here, we have adopted weigh-batching method and it is correct method too. Use of weigh system in batching, facilitates accuracy, flexibility and simplicity. Different types of weigh batchers are available; the particular type to be used depends upon the nature of the job (Shown in Fig 2). When weight batching is adopted, the measurements of water must be done accurately

Fig 2 Mixing with water

C. Mixing of materials

Fig 3 Mixing coir pith with cement specimen

Fig4 Removal of water by squeezing the coir pith

Fig 5 Mixing with concrete

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

Thorough mixing of materials is essential for the production of uniform course. The thorough mixing also that cement, sand, coarse aggregate, coir pith and water completely mixed. The whole materials are mixed thoroughly turning a least three times to give a uniform concrete mix. The mix proportion of concrete specimen
Thorough mixing of materials is essential for the production of uniform course. The thorough mixing also that cement, sand, coarse aggregate, coir pith and water completely mixed. The whole materials are mixed thoroughly turning a least three times to give a uniform concrete mix(Shown in Fig 2,3,4). The mix proportion of concrete specimen is 1:1.52:2.67 as cement: fine aggregate: coarse aggregate, in which the fine aggregate is replaced by coir pith in different proportions

D. Casting

Fig 6 Moulding of concrete cube prism.

Fig 7 Moulding of concrete specimen for Impact test

Fig 8 Moulding of concrete

During casting, the concrete shall be put gently in the respective moulds. Precautions to be taken during moulding are the mould which is to receive fresh concrete should be properly cleaned, prepared and well-watered. The large quantities of concrete should not be deposited at a time. Otherwise the concrete will start to flow along the mould and consequently the resulting concrete will not have uniform composition. The concrete should be put on the mould as soon as possible (Shown in Fig 6,7,8). After moulding, it should be seen that all edges and corners of concrete surface remain unbroken and sharp.

E. Internal Curing
According to ACI 308," internal curing refers to the process by which the hydration (Shown in Fig 9,10) of cement occurs because of the availability of additional internal water that is not part of the mixing water." Internal curing

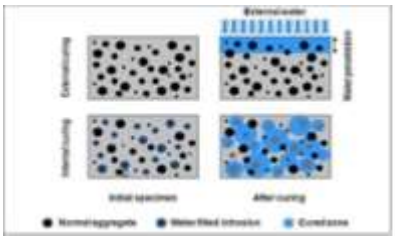

Fig 9 Schematic diagram of Internal Curing

Fig 10 Curing of concrete specimens

refers to the time-dependent improvement of concrete strength due to the gradual release of water which was absorbed before mixing to the cement particles to allow continued hydration. Self-curing concrete is based on the introduction of a chemical admixture that is able to reduce water evaporation by a retaining function.

F. Period of curing for conventional cubes

After moulding the concrete specimen, the specimen shall be kept in curing tank with full of water for 28th days continuously. The compressive strength of the concrete specimen should be taken on 7th, 14th, 21st &28th day.

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

III. RESULT AND DISCUSSION

A. Weight density test

The weight density test was carried out. The results of thetest is shown in Fig 11.

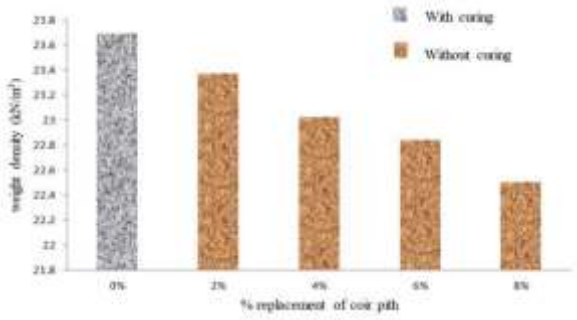

Fig 11 Weight density test results

C. Compressive strength test (IS 516 1959)

The compressive strength test has been conducted as per **IS 516** after immersed in water at room temperature for 24 hours, the concrete specimen is placed horizontally with flat surface facing on the top and placed carefully in between the plates of compression testing machine. Load is applied uniformly on the concrete specimen. The load at which the concrete specimen fails or crushes is noted. The above observations are tabulated for three concrete specimens and the average strength of concrete specimen is calculated. The results are shown in Fig 13, 14,15 and 16.

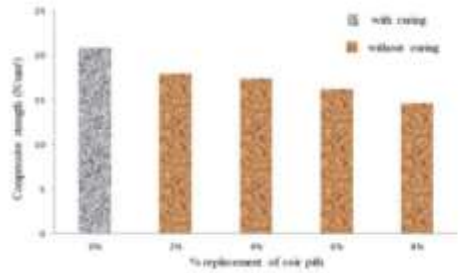

Fig 13 Compressive strength test result at 7th day

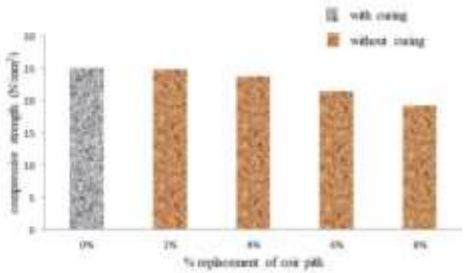

Fig 14 Compressive strength test result at 14th day

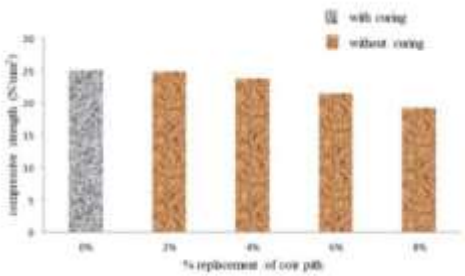

Fig 15 Compressive strength test result at 21st day

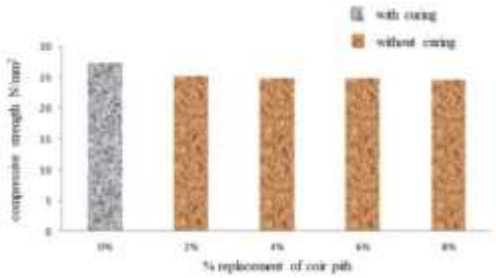

Fig 16 Compressive strength test result at 28th day

C. Flexural strength test (IS 516 1959)

Flexural test is conducted for concrete beam with dimension of 500mmX100mmX100mm. The specimen placed carefully on the support of Universal Testing machine.

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

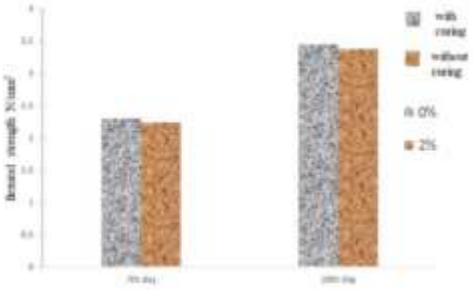

Fig 17 Flexural Strength test results

F. Impact Test (IS 516 1959)
Impact test is conducted for concrete specimen with dimension of 150mm diameter and 64mm. The specimen placed carefully on the plate of Drop weight machine. Iron ball is placed over the specimen and weight is dropped carefully over the iron ball. This procedure continues till the specimen gets crack. Number of blows given for the specimen for cracking is noted.

G.Cost Analysis

Cement, Sand, Coir Pith and Stone chips are used for the manufacture of concrete specimen. Coir pith is replaced to sand in order to reduce the cost and to reduce the consumption of water since to avoid wasting good quality water.The transportation charges, electricity charges, machinery charges and labour charges are taken into account for the calculation of the cost of concrete specimen. Compared to conventional concrete, coir pith replaced concrete is less in cost because external curing in not required and the labour charges for curing work is not required. Compared to conventional concrete, the amount of potable water required and wastage of water is reduced. The fine aggregate is replaced by coir pith hence considerable amount of material cost is reduced.

IV. CONCLUSION

Due to high absorbing capacity of coir pith internal curing was achieved successfully. The maximum compressive strength obtained at 28th day is 25.12 N/mm2 for 2% replacement of coir pith.The maximum flexural strength obtained at 28th day is 3.38 N/mm2 for 2% replacement of coir pith.The impact strength of concrete for 2% replacement of coir pith is obtained at 98 blows, which is enough to bear the impact loads. The optimum replacement of coir pith as fine aggregate in concrete is 2%.

VI. REFERENCES

[1] 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.
[2] D.Maragatham Jeyaseeli and Samuel Paul Raj, "Chemical characteristics of Coir Pith as a Function of its particle size to be used as Soilless medium", The Ecoscan an International Quarterly Journal of Environmental Sciences, 4(2&3) : 163-169, 2010.
[3] IS 10262-2009, "Concrete mix proportioning – Guidelines".
[4] IS 516-1959, "Methods of Tests for Strength of Concrete".
[5] J.Paramanandham and P.Thenmozhi,"Determination of Physico Chemical properties of coir pith in relation to particle size suitable for potting medium", International Journal of Research in Environmental Science and Technology, ISSN 2249–9695, 2012.
[6] M.Manoj Kumar and D.Maruthachalam, "Experimental investigation on self-Curing concrete", International Journal of Advanced
Scientific and Technical Research, Issue 3 volume 2, March-April 2013.
[7] M.V.Jagannadha Kumar and M.Srikanth, "Strength characteristics of Self curing Concrete", IJRET, Volume: 1 Issue: 1, Sep 2012.44
[8] P.Raman and N.K Ram, "Design & Development of a filter press unit,
[9] Gasifier and feasibility of using coir pith for absorption and recovery of
[10] Oil from contaminated sites", T E R I report, The Energy and Resources
[11] Institute. 23 pp., Project Report No. 2007BE09, 2009.