

EXPERIMENTAL STUDY ON DURABILITY ASPECTS OF COCO-PEAT CONCRETE

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Abstract - Coco Peat is the non-fibrous, spongy, light weight, corky material that holds together the coir fiber in coconut husk. Concrete is the widely used first number of structural materials in the world today. Infrastructure developed across the world created demand for different construction materials. Cost of building materials are increasing day by day so there is a need to find alternative materials in place of ingredients of concrete. Concrete made from coco-peat waste as fine aggregate will be studied for durability properties; the percentage replacement will be 0%, 5%, 10%, 15% and 20% with fine aggregate.

Key Words:- Coco-Peat, Durability, Light Weight Aggregate, Slump, Water Absorption.

1. INTRODUCTION

Concrete is a basic construction material. It is used in a wide range across the world. Usage of concrete becomes vast due to the infrastructural development and increased construction activities. As the demand for concrete increased some negative impacts arises like lack of raw materials, continuous extraction of natural river sand leads to its depletion and decreases ground water level, cement manufacturing plants increases CO₂ content by production of large quantity of cement.

To save the natural resources from over extraction of aggregates from rocks and sand from rivers, many alternate materials are tried in the production of concrete. These alternate materials are found from the wastes generated from domestic, industrial and agricultural sectors.

Durability indicates the life period of the material under the given environmental conditions. In general, concrete is durable under normal environmental situations. The durability issues arise due to either unknowingly introducing deleterious materials while adding the constituents or when the concrete is exposed to severe harmful environmental conditions not expected earlier. Therefore, this study aimed to estimate the durability performance of concrete with coco-peat as partial replacement of fine aggregate.

2. MATERIALS & MIX PROPORTIONS USED

Ordinary Portland cement (OPC) 53 grade conforming to Indian Standard IS 12269: 2013 was used as a binder. Fine aggregate conformed to Indian Standard IS 383: 2016, zone III is used. Coco-Peat of maximum size of 4.75 mm is used as partial replacement of fine aggregate. Coarse aggregate of maximum size 20 mm is used. Mix proportion used for concrete mix was 1:1.61:2.21:0.50 with a cement content of 438.96 kg/m³.

3. DURABILITY TESTS

(A) Water Absorption Test

Concrete specimens were placed in an oven and maintained at 105^oC+/-5^oC for 24 hours. After this period, specimens were allowed to cool at room temperature for 24 h and then the weights were measured frequently until the weights became constant. This value was considered as mass of the specimen and noted as W₁. The specimens were then immersed in water for 48 hours and surface dried properly. The weight of oven-dried concrete specimen is taken as W₂.

Water Absorption (%) =

$$\frac{W_2 - W_1}{W_1} * 100$$

Table -1: Water Absorption of Concrete with varying percentages of Coco-Peat

Coco-Peat (%)	Water Absorption (%)
0	2.70
5	3.01
10	3.20
15	3.34
20	4.70

(B) Acid Test

This test is performed by preparing 5% weight by volume solution of Sulphuric Acid and by immersing concrete cubes in it for 28 days and compressive strength has measured.

Table -2: Compressive Strength of Concrete with varying percentages of Coco-Peat cured with normal water and Sulphuric Acid

Coco-Peat (%)	Compressive Strength (N/mm ²) 28 days	
	Water Cured	Acid Cured
0	38.22	31.02
5	36.97	29.98
10	34.68	25.67
15	33.10	23.93
20	32.45	21.54

(C) Alkali Test

This test is performed by preparing 5% weight by volume solution of Sulphuric Acid and by immersing concrete cubes in it for 28 days and compressive strength has measured.

Table -3: Compressive Strength of Concrete with varying percentages of Coco-Peat cured with normal water and Sodium Hydroxide

Coco-Peat (%)	Compressive Strength (N/mm ²) 28 days	
	Water Cured	Alkali Cured
0	38.22	33.02
5	36.97	31.92
10	34.68	30.48
15	33.10	27.90
20	32.45	27.45

4. RESULTS & DISCUSSIONS

Chart -1: Water Absorption of Concrete with varying percentages of Coco-Peat

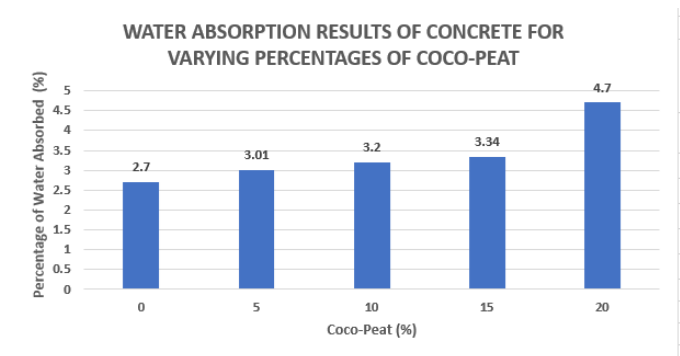


Chart -2: Compressive Strength of Concrete with varying percentages of Coco-Peat cured with normal water and Sulphuric Acid

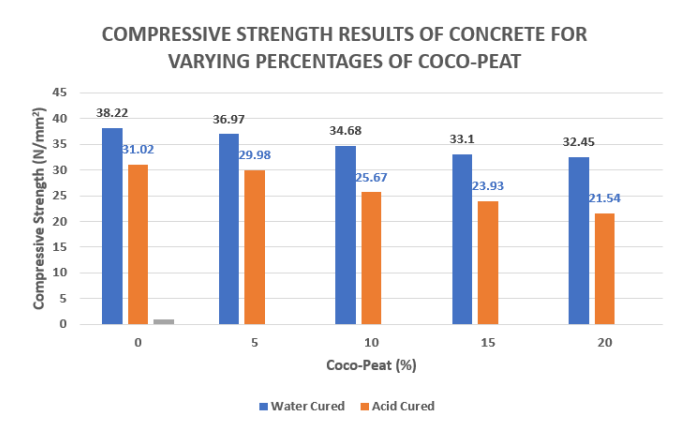
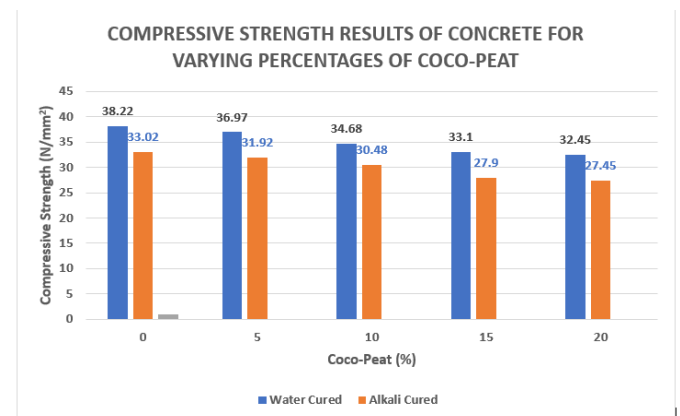


Chart -3: Compressive Strength of Concrete with varying percentages of Coco-Peat cured with normal water and Sodium Hydroxide



5. CONCLUSION

This study was aimed at the durability performance of Coco-Peat concrete with conventional concrete. From the test results on durability properties the significant conclusions drawn are: In case of conventional concrete mixes without and with Coco-Peat, water absorption, acid and alkali tests results are better in the case of full water immersion compared to acid and alkali curing.

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