

EXPERIMENTAL STUDY ON PAPERCRETE CONCRETE BY ADDING QUARRY DUST

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Abstract

The constant development activities in civil engineering and growing industries have been created a continuous demand for building materials which satisfy all the stringent requirements regarding the short term and long term performance of structure. The objective of this work is to determine the strength and durability features of papercrete by using quarry dust, which gives better understanding on the properties of concrete. In this study examined the mechanical properties of papercrete concrete like compressive strength, split tensile test designed using papercrete varying mix ratio. These tests were conducted by using 5% 10% 15% 20% 25% 30% 35% and 40% of papercrete with the quarry dust and it was to be found that by usage of the papercrete, can be used for making light weight strength able and ecofriendly concrete.

Keywords: *Papercrete, Compressive strength, Split tensile strength, Mix ratio.*

1. Introduction

Papercrete concrete is a construction material which consists of re-pulped paper fiber with Portland cement. Papercrete concrete gets its name from the fact that most formulas use a mixture of water and cement with cellulose fiber. The fiber is usually acquired from recycled newspaper, lottery tickets and phone books. First patented in 1928, it was revived during the 1980s. Though supposed as an environmentally friendly material due to the substantial recycled content, this is balanced by the presence of cement. Papercrete is a material firstly developed 80 years ago but it is only recently revived.

2. Methodology

Papercrete is a tricky term. The term seems to imply a blend of paper and concrete, hence papercrete. But more accurately, only the Portland cement part of concrete is used in the mix-if used at all. It might have been termed "paperment" papercrete may be mixed in numerous ways. Different types of papercrete contain 50-80% of waste paper. Up to now, there is no hard and fast rule, but recommended standard will undoubtedly be established in future. The basic elements are waste nearly any kind of paper, board, glossy magazine stock, advertising brochure, junk mail or just about any other types of "mixed grade" paper is acceptable. Some sorts of paper work better than other, but all types of works, newsprint are the best.

3. Materials

3.1 Cement

Ordinary Portland cement, 53Grade conforming to IS: 269 – 1976. Ordinary Portland cement, 53Grade was used for molding all the Samples.

Physical Properties of Cement

Properties	Results
Fineness	1%
Specific Gravity	3.15
Initial setting time(Minutes)	32
Final setting Time (Minutes)	490

3.2 Coarse aggregate

Locally available crushed blue granite stones conforming to graded aggregate of nominal size 20-25 mm as per IS: 383 – 1970. Crushed granite aggregate with specific gravity of 2.77 and retained through 4.75 mm sieve and will be used for casting all specimens. Numerous investigations established that maximum size of coarse aggregate should be limited in strength of the composite. In addition to cement paste – aggregate ratio, aggregate sort has an excessive influence on concrete dimensional stability. The papercrete is used as a spare for the coarse aggregate from 0% to 40%

3.3 Sand

Sand is used as a fine aggregate. It consists of a grainy units fundamentally of a finely distributed rock and minerals. It is defined by size, being finer than gravel and coarser than silt. Sand can also denote to a textural class of soil or soil form; i.e. a soil containing more than 85% sand-sized elements by mass. An Arrangement of a sand units, depending on the native rock sources and areas, but the ultimate collective component of sand in inland mainland settings and non-tropical coastal settings is silica (silicon dioxide, or SiO₂), usually in the form of quartz. Quarry dust is used as a replacement for the fine aggregate from 0% -40%.

Physical properties of sand

Properties	Results
Specific Gravity	2.67
Bulk Density	30%
Fineness Modulus	2.96(Zone2)

Properties of Quarry dust

Properties	Results
Specific Gravity	2.69
Bulk Density	25%
Fineness Modulus	2.31(Zone2)

3.4 Papercrete

Papercrete is a tricky term. The term seems to infer a mix of paper and concrete, hence papercrete. But more accurately, only the Portland cement part of concrete is used in the mix-if used at all. It might have been termed “paperment” papercrete may be mixed in numerous ways. Different types of papercrete contain 50-80% of waste paper. Papercrete is made of 50% paper 25% cement, 25% quarry dust

Properties of paper

Properties	Values
Weight	47 GSM
Thickness	0.06mm
Moisture	7.5%
Bursting Strength	168kPa
Tearing resistance	12.6kg
Tensile strength	1.13kg

3.5 Water proofing admixture

In this work, paper is the key component in papercrete concrete mix and it is a fully water absorbable material. Hence to curtail the water absorption, water proofing admixtures were used as one of additives in papercrete concrete mix.

3.6 Preparation of papercrete concrete

Slump cone test

The workability is one of the physical constraints of concrete which affects the strength & durability and the appearance of the finished surface. The workability of concrete depends on the water cement ratio and the water absorption capacity, if the water added is more which will lead to bleeding or segregation of aggregates.

Slump cone test for normal concrete

Slump Type	W/C Ratio
True	0.45
Shear	0.5
Collapse	0.52

Slump cone test for papercrete concrete

Slump Type	W/C Ratio
True	0.42
Shear	0.45
Collapse	0.5

Weight analysis of papercrete concrete Cube and Cylinder

Percentage of replacement of papercrete in concrete	Weight of Cube (kg)	Weight of Cylinder
0	8	12
5	7.52	11.60
10	7.34	11.46
15	6.93	11.40
20	6.75	11.32
25	6.65	11.02
30	6.54	10.82
35	6.43	10.69
40	6.35	10.56

Figure.1 Variation of Cube weight w.r.t Papercrete

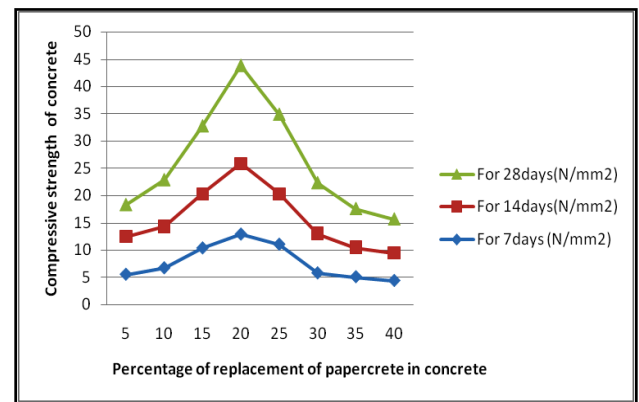
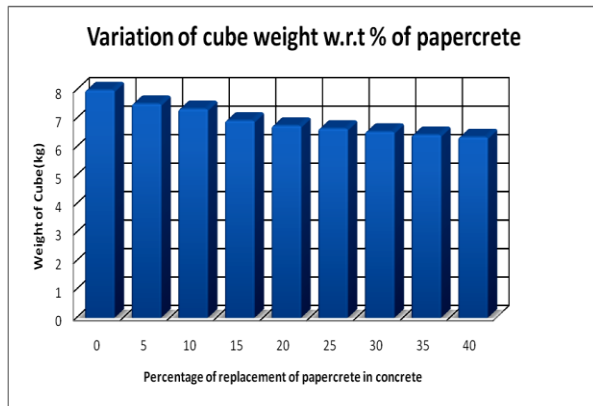
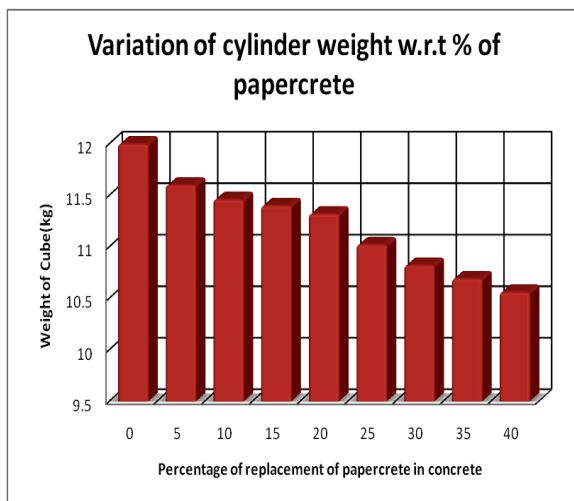


Figure. 2 Variation of Cylinder w.r.t Papercrete



Compressive Strength of Concrete cube

Percentage of replacement	For 7days (N/mm ²)	For 14days (N/mm ²)	For 28days (N/mm ²)
5	5.56	6.89	5.86
10	6.74	7.57	8.58
15	10.42	9.87	12.46
20	12.96	12.89	17.98
25	11.10	9.21	14.57
30	5.80	7.21	9.32
35	5.10	5.40	7.10
40	4.41	5.07	6.20

Figure. 3 Variation Compressive strength w.r.t % of papercrete

Split tensile strength of Cylinder

Percentage of replacement	For 7days (N/mm ²)	For 14days (N/mm ²)	For 28days (N/mm ²)
5	2.37	2.73	3.14
10	3.21	3.32	3.47
15	4.89	5.75	5.56
20	6.59	7.24	7.17
25	7.47	8.20	7.89
30	4.88	6.83	6.83
35	3.29	4.78	4.47
40	1.70	2.77	2.73

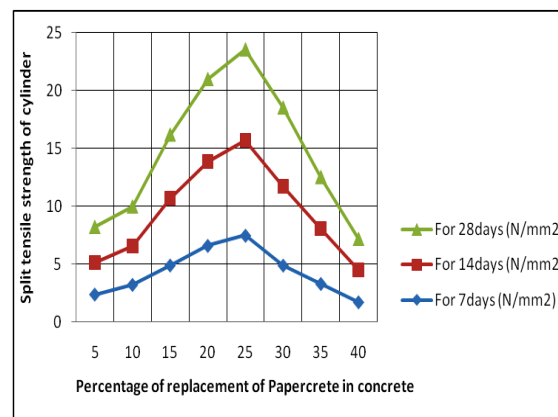


Figure. 3 Variation Split tesile strength w.r.t % of papercrete

Conclusion

- 1) The density of papercrete concrete was decreased when the replacement ratio of waste paper of papercrete concrete increased. When paper replacement ratio was 5%, density was measured 2228 kg/m³, and it was reduced to 1881 kg/m³ for 40% respectively by increasing papercrete
- 2) The shrinkage of papercrete concrete was increased according to increase of papercrete replacement ratio.
- 3) The average compressive strength of which include 0% papercrete replacement to 40% replacement and it has seen that up to 20% replacement , compressive stress increases and then decreases for 40%.
- 4) The stress curve for the compressive stress for 7,14&28 days curing is similar to the parabolic shape and it shows that from 0%-20% replacement of papercrete concrete , compressive stress is increases and then up to 40% it is decreases , it shows that up to 20% is acceptable.
- 5) The splitting tensile strength also decreased by including higher replacement ratio of papercrete.
- 6) The average split tensile strength of which include 0% papercrete replacement to 40% replacement and it has seen that up to 25% replacement , compressive stress increases and then decreases for 40%.
- 7) □ □The stress curve for the tensile stress for 7,14&28 days curing is similar to the parabolic shape and it shows that from 0%-20% replacement of papercrete concrete , compressive stress is increases and then up to 40% it is decreases , it shows that up to 20% is acceptable.

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