EXPERIMENTAL INVESTIGATION ON CEMENT FLOORING TILES USING COCONUT SHELL AS COARSE AGGREGATE

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Abstract

*Integrated Waste management is one of the important themes in our day to day life. In this aspect the construction industry is involving in finding the alternative materials for production of construction materials. Flooring tile is manufactured by replacing coconut shell with coarse aggregate. Coconut shell can be used as an alternative material in construction industry. Coarse aggregate is replaced by coconut shell in the proportions as 5%,10%,15%,20%. The utilization of coconut shell can help to improve waste utilization and more resistant towards abrasion, crushing and impact. The tile manufactured by coconut shell is light in weight. The dimension of the tile used in this project is 300mm*300*25mm. The main objective of this project is to spread awareness about the utilization of waste products and to effectively use the coconut shell as a construction material. Based upon the conclusion the tiles manufactured from the above-mentioned proportions can be effectively used as pavement tiles.*

Keywords: *Alternative Materials, Coconut Shell, Abrasion, Flooring Tile, Waste Utilization*

1. Introduction

Tile is a composite material consisting of cement, sand and aggregates. Aggregate is one of the most important ingredients in tile manufacturing. The ascending cost of aggregate is increasing periodically. Hence there are many experimenters all over the world being performed to replace its main ingredients by the waste produced from many sources such as agriculture, domestic etc.,

Coconut shell is one of the agricultural wastes which is used as a coarse aggregate. Using coconut shell is not only as a waste utilization but also act as a green construction.

2. Coconut Shell as a Coarse Aggregate

The tile obtained using coconut shell aggregate satisfies the minimum requirements of tile. Coconut shell has better workability because of its smooth surface on one side of the shell. Coconut shell is light in weight when compared with conventional tile

3. Materials and Method

The raw materials used in this project is vernacularly available and this includes ordinary Portland cement as coupling agent, river sand as fine aggregate and chips as coarse aggregate and coconut shell as coarse aggregate. A sanitary water was used for mixing and curing throughout the entire project.

Fig1.Coconut Shell

Fig2.Crushed Coconut Shell

Table 1 Different Proportioning of Mix

S.NO	MIX PROPORTIONING	CEMENT (kg)	SAND (kg)	CHIPS (kg)	COCONUT SHELL (kg)
1.	Conventional tile (1:1:2)	1.35	1.35	2.7	-
2.	1:1:2 (5%)	1.35	1.35	2.56	0.135
3.	1:1:2(10%)	1.35	1.35	2.43	0.27
4.	1:1:2(15%)	1.35	1.35	2.295	0.405
5.	1:1:2(20%)	1.35	1.35	2.16	0.54

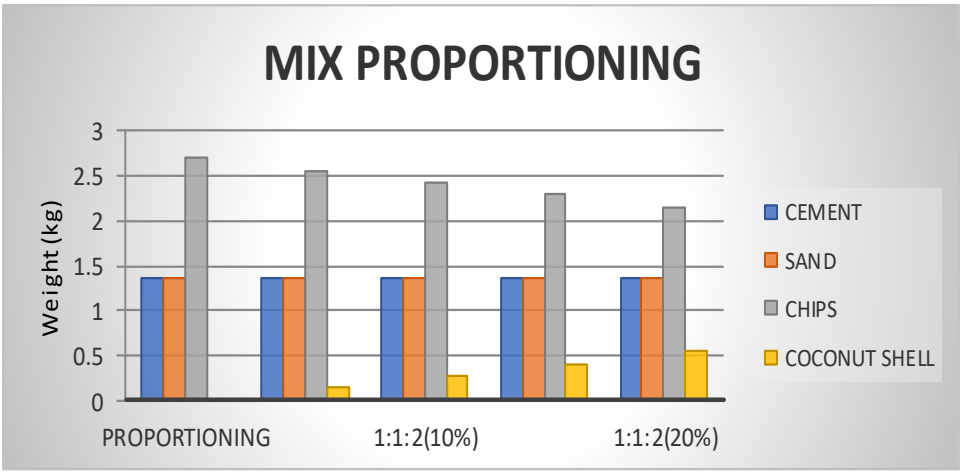

Figure 3. Comparison Chart for Different Mix Proportion of Tiles

4. Preparation of Specimens

Mix design: M 25 grade of concrete was designed by IS 10262-1982 method. The coarse aggregate was replaced as 0%,5%,10%,15%,20%. The outgrowths were analyzed and compared with conventional tile.

Batching and mixing: Weigh batching was done with the help of digital weigh balance. Mixing was done by manually.

Placing and compaction: The mould was cleaned and applied with oil for easy removal. Place the concrete mix in the mould and placed in vibrator for entrapping air voids using table vibrator.

Demolding: After placing concrete in mould and it was granted to set for 24 hrs. After removing concrete from mould it was allowed to dry for few hours.

Fig 4. Mould used for tile making

Fig 5. Conventional tile

5. Experimental Programme

As recommended in IS 1237:2012, tiles were manufactured and tested**.**

5.1 Flatness test

The flatness of the tile surface was tested by means of a metal ruler; whose length is not less than the tile diagonal. For testing surfaces that are concave, the

ruler is placed on the surface of the tile along one of the diagonals so that the ruler touches the tile at not less than two points. The largest gap is measured and the test is repeated along the second diagonal. The larger gap is the amount of concavity. For testing surfaces that are convex, the ruler is placed on the surface of the tile along one of the diagonals so that the distances between the ruler and the tile, at the ends of the diagonal, are equal.

5.2 Perpendicularity Test

One arm of a 'square', the arms of which are longer than the sides of the tile, is placed along one of the edges of the tile, so that the corner of the' square ' touches the corner of the tile. The distance between the other arm of the ‘square' and the other edge is measured at the end of the tile. The test is repeated such that two opposite edges shall be tested. The largest gap between the arm of the 'square' and the edge of the tile is reported.

6. Results and Discussion

6.1 Water Absorption Testing

The water absorption test results for conventional and coconut shell pavement concrete tiles are given in chart. The water absorption results of conventional and coconut shell pavement concrete tiles are in accordance with the literature review. The coconut shell used to make the concrete pavement causes water absorption to decrease from ordinary pavement concrete. This explains why the concrete pavement based on pavement is lower than the normal pavement concrete because the weight of the coconut shell decreases and has been added to the amount of water that is abundant and the inaccurate aggregate weight. Thus, the increase in the percentage of coconut shell increased water absorption.

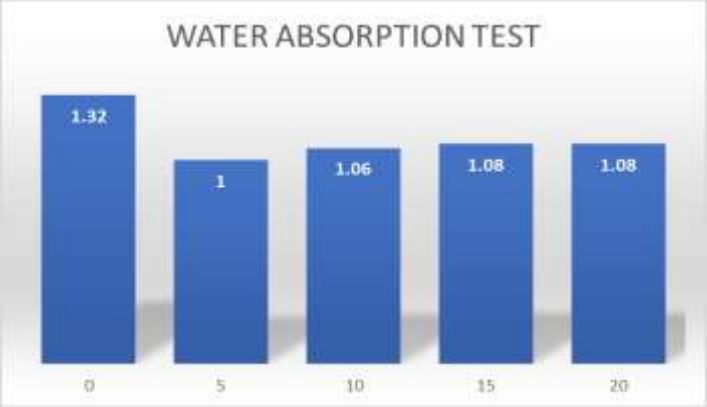

Fig 6. Water Absorption Test

6.2 Flexural Strength Test

The Figure 7 shows the values of concrete pavement strength using replacement of waste materials such as coconut shell with ordinary concrete pavement. The Flexural Strength test at 0% (CS) is 3.8 N/mm². At 5% (CS) is 3.83 N/mm² and at 10% (CS) is 3.67 N/mm² and at 20% (CS) 3.23 N/mm². The Variation in these values states that the change in flexural strength on concrete pavement is very important to determine the resilience level of the innovation product over the market product. The concrete pavement 5% concrete has the highest bending strength while 10% concrete pavement tiles using coconut shell (CS) shows the lowest average value. This means that replacing coconut shell more than 10% can weaken concrete paving concrete. This is because based on intensity research for the average range of standard bending strengths for projects with a good range of control around 3.0-6.0 MPa. But the tiles manufactured from the above mentioned proportions can be effectively used for the light traffic and low load pavements by using some of the durability inducing agents like NaOH with proper molarity and the properties also be modified for coconut shells.

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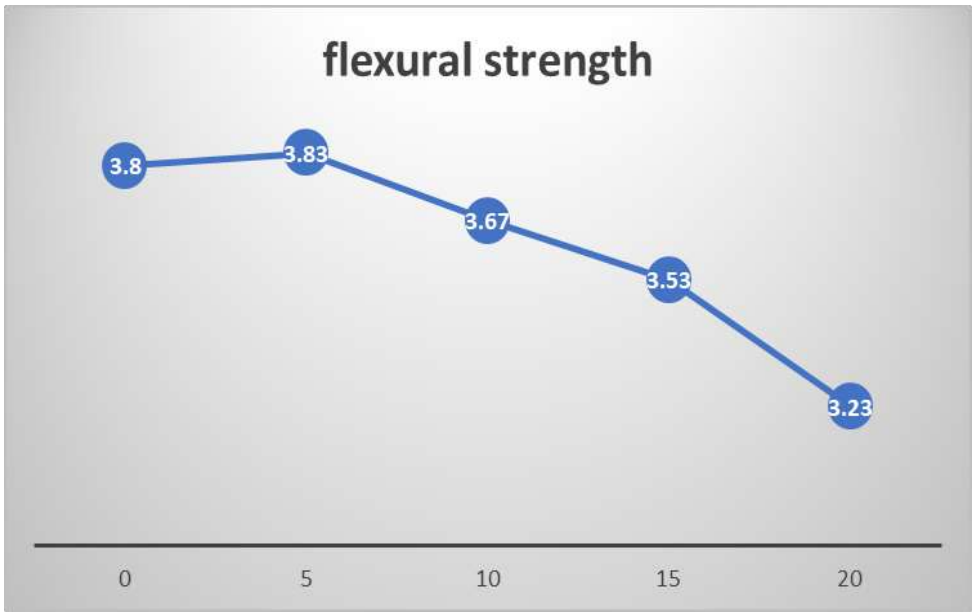

Fig 7. Flexural Strength Test

7. Conclusions

Tiles are normally used as a flooring material where light loads are transmitted to it. This paper includes the investigating engineering properties of both the conventional tiles and coconut shell tiles. Also, these tiles were tested for their flatness, perpendicularity, straightness, water absorption test in accordance with 1237: 1980. Based on the results obtained, the following conclusions were made. Mix ratio used conventionally for the production of flooring tiles by the manufacturer can also be used for the coconut shell flooring tiles production. Coconut shell flooring tiles have shown good results compared with conventional flooring tiles in their dimensional properties. Coconut shell flooring tiles are good in all their properties as compared with conventional one. Coconut shell flooring tiles have met the requirements of Indian Standards in all the properties and hence it can be suggested and recommended that the coconut shell flooring tiles can be produced and implemented in field practice. By doing this the self-weight of the floor finish may get reduced and hence may lead to economic design of floor supporting structural elements. Hence the coconut shell can be effectively utilized as the construction material in partial replacement with coarse aggregate in manufacturing of flooring tiles. Based on the laboratory tests carried out resulted a high percentage of coconut shell will cause high water absorption and decrease in flexural strength.

8.References

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