STUDY ON THE SUITABILITY OF FIBRE MOULD AND ROOF TILE WASTE AS ALTERNATIVES FOR FINE AND COARSE AGGREGATES IN CONCRETE

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The amount of roof tile and fibre mould waste produced by construction companies and sites has become a significant threat to the environment. Regrettably, these waste products are typically recklessly piled up on vacant lands or discarded in landfills, resulting in harmful environmental and groundwater pollution. In response, a comprehensive study was conducted to explore the potential of utilizing these waste products as a replacement for fine and coarse aggregates in concrete work. The study's objective is to substantially decrease the amount of roof tile and fibre waste disposed to the environment while offering a practical solution to this pressing issue.

Initially, several aggregate tests were done to find quality material. Concrete mixtures were suggested according to grade 30(1:0.75:1.5) concrete mix design and cubes were prepared with 0, 10, and 25% replacements of crushed fibre mould and roof tile wastes separately. The concrete cubes were characterized using compressive strength and water absorption tests and results were compared with the 0% replacement, which is the conventional concrete sample.

The results showed that the compressive strength values were decreased with the increment of roof tile waste percentage from 0 to 25%. However, for 10% replacement, the compressive strength value was still above the required standard value. When the water absorption of test samples of three percentages is compared, 10% replacement samples showed a slightly lower value than the 0% sample, however, 25% replacement showed a significantly higher value. In conclusion, 10% replacement of roof tile waste for coarse aggregate showed satisfactory results in both compressive strength and water absorption tests. Suggesting that the roof tile waste can replace coarse aggregate up to 10% in grade 30(1:0.75:1.5) concrete.

When the fibre mould waste is considered, compressive strengths are considerably lower for both 10% and 25% than the required value, and the water absorption test values are undesirably higher for both cases. Therefore, the research evinces that the use of fibre mould waste as a substitute material for fine aggregate in concrete is not a technically feasible solution.

Keywords: Roof Tile waste, Fibre mould wastes, Compressive strength test, Water Absorption, Grade 30 concrete.

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INTRODUCTION

Today many researchers are looking for alternative materials for fine and coarse aggregates of concrete. Several studies have suggested that some construction waste can be used as alternative material for aggregates. In the modern world many types of waste are generated from demolition work and new construction work, with no proper methods for their disposal. Regrettably, these waste products are typically carelessly piled up on vacant lands or discarded in landfills, resulting in harmful environmental and groundwater pollution. The study's objective is to whether the roof-tile and fibre mould waste can be used as a replacement of fine and coarse aggregates. Therefore, the possibilities of incorporating fibre mould waste and roof tile waste in concrete as a replacement for fine aggregates and coarse aggregates were studied.

METHODOLOGY

Experimental work was begun with the selection of material. Ordinary Portland cement was used as bonding agent. For all experimental work British Standard (BS) were followed. First the selected alternative materials were manually crushed to the required size. Sieve analysis tests (according to B.S 812 103.1:1985) were performed to ensure that the required sizes are achieved. The water absorption test (BS 812 2:1995) for coarse and fine aggregates involves two different methods. For the fine aggregates, the pycnometer method is used, while for the coarse aggregates, the wire-mesh basket method is employed. Moreover, the bulk density test-(BS 812: part 2:1995) and flakiness index test-(BS 812-105.1:1989) were also carried out. Steel cube mould with the standard size of 150mm×150mm×150mm was used for cube casting work. Five grade 30 concrete mix designs with 0%, 10% and 25% replacement of fine and coarse aggregates were incorporated and altogether 45 cubes were casted and cured. Table 1 provides the amount of each aggregate used in different mix designs.7 and 28 days compressive strength tests and water absorption tests were performed.

Table 1-Composition of various constituents used in different concrete mixes

Mix	CS-0%	Fibre-10%	Fibre-25%	RT-10%	RT-25%
Cement(Kg)	14.58	14.58	14.58	14.58	14.58
Water(Kg)	8.43	8.54	8.63	8.43	8.43
Coarse Aggregates(Kg)	38.11	40.03	39.06	34.299	28.58
Fine aggregates(Kg)	25.12	21.14	18.31	25.12	25.12
Roof tile(Kg)	-	-	-	3.81	9.53
Fibre(Kg)	-	2.34	6.10	-	-

CS-0%-Control Sample
RT-10% – 10% Aggregate replaced by Roof tile waste.
RT-25% – 25% Aggregate replaced by Roof tile waste.
Fibre-10% – 10% Aggregate replaced by Crushed fibre mould waste.
Fibre-25% – 25% Aggregate replaced by Crushed fibre mould waste.

According to the table 1, for fibre 10% and 25%, there were different coarse aggregate values. The reason was that water absorption values differed by both 10% and 25%

RESULTS AND DISCUSSION

1) Compressive strength (BS 1881-116:1983)

The 28 day compressive strength values decreased as the percentage of roof tile waste increased from 0 to 25% (See Figure 1). However, at 10% replacement, the compressive strength remained above the required standard value which is 30 Mpa.

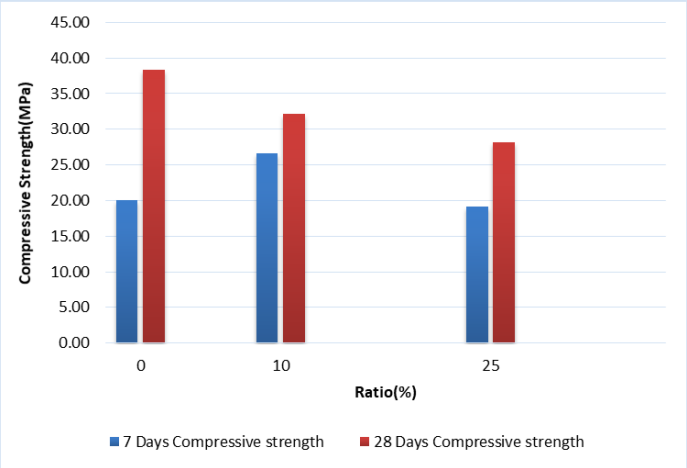


Figure 1-Compressive strength properties of Roof tile replacement cubes

The 28 day compressive strength of cubes with fibre wastes replacement was significantly decreased with the increment of waste replacement percentage from 0% to 25% (as in Figure 2).

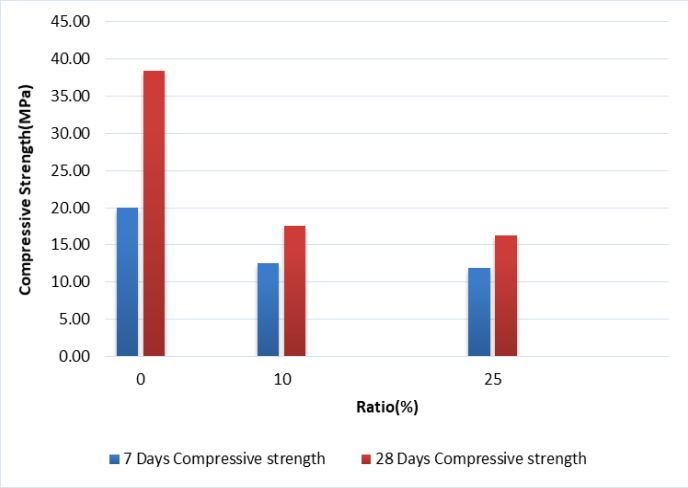


Figure 2- Compressive strength properties of fibre mould replacement cubes.

2) Water absorption (BS 1881-122:1983)

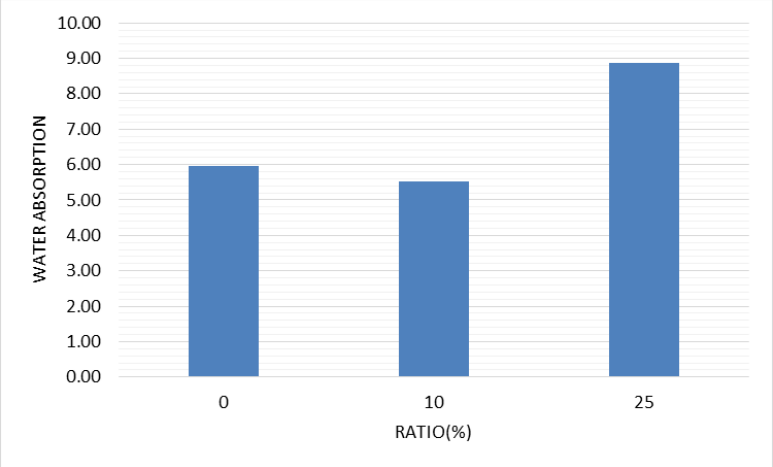
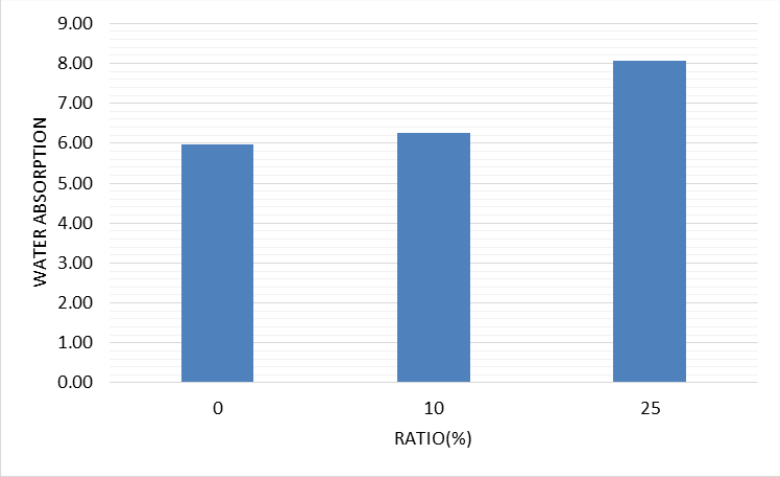


Figure 3- -water absorption of Roof Tile replacement cubes

For roof tile replacement (see figure 3), the concrete mixture with RT10% replacements were within the allowable 6% limit, but the RT 25% replacement mixture exceeded the limit.



When the water absorption of samples with fibre mould waste is considered, the 10% and 25% replacement samples exceeded the allowable limit range (as in Figure 4).The formula below was used for finding the water absorption.

Water absorption=$\frac{A-B}{B}$

A=Wet weight of cube
B=Dry weight of cube

CONCLUSIONS/RECOMMENDATIONS

This study focused on investigating the suitability of construction material waste as a replacement of natural aggregates. In this context, fibre mould waste and roof tile waste were used as alternative materials for fine and coarse aggregates in 10% and 25% replacement separately in grade 30(1:0.75:1.5) concrete mix design.10% replacement of roof tile waste for coarse aggregate showed satisfactory results in both compressive strength and water absorption tests. Though 25% replacement of roof tile showed satisfactory compressive strength, water absorption test results were well above the standard value. Therefore, the study concludes that the roof tile waste can replace coarse aggregate

up to 10% in grade 30(1:0.75:1.5) concrete. When the fibre mould waste is considered, compressive strengths are considerably lower for both 10% and 25% than the required value, and the water absorption test values are undesirably higher for both cases. Therefore, the research evinces that the use of fibre mould waste as a substitute material for fine aggregate in concrete is not a technically feasible solution.

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