Utilization of Coir Fiber as a Component Material in Concrete Floor Tiles

Grace O. Manlapas

Abstract— This study was conducted to utilize coco coir fiber as a component material in concrete floor tiles. As technology innovation, the compressive strength tests of the concrete floor tiles after 14 days curing period was taken to determine the maximum amount of compressive axial force the material can withstand without failure using a Universal Testing machine. Coco coir fibers were air-dried and shredded, segregated and cut into a maximum length of ten millimeters (10mm) to prevent these from bending during the mixing process. Statistical results showed that the use of coco coir fiber as a component material significantly affected the compressive strength of concrete floor tiles. The tiles using mixture A (control/or without coir fiber) had a lower compressive strength compared to the concrete floor tiles using the mixture B (with coir fiber) which resulted to a higher compressive strength, but both passed the standards set by the American Society for Testing and Materials. With all these results, it is highly proposed and recommended that a ready–cut and ready-packed coco coir fiber be available in the market for use as a component material of Concrete Floor Tiles; and the use of concrete mixer for proper mixing and workability.

Index Terms— concrete floor, coco coir, compressive strength, fiber, component material, axial force, tiles, aggregate

1 Introduction

Natural stone tiles can be beautiful but being a natural product, they are less uniform in color and design. As such, this requires more planning for use and installation. Some stone tiles such as polished granite, travertine, and marble are very slippery when wet. With coir fiber as a component material of a concrete floor tile for use in wet areas can be made more slip- resistant either by using small tiles so that the grout lines acts as grooves or by imprinting a contour pattern as additional design on the face of the concrete floor tile.

Tiles make for a modern, yet rustic look and come in a variety of styles. However, making our own concrete floor tiles allows us the freedom to design exactly what we want according to our own taste.

Traditionally, tiles are manufactured following different methods and made by means of a practically manual process. The process has gradually been automated and methods have been unified considerably, with dry pressing being the most common method of production and allowing the product to be manufactured in different ways and styles, and be installed as interior or exterior flooring like terrace and garage.

The Benefits acquired by concrete containing fiber reinforcement are controlled plastic shrinkage, minimized crack growth, reduced permeability, improved surface durability, and uniform reinforcement in all direction. (Brown, R. et. al., 2002)

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Considering the quality attributes of the sand and coco coir fiber used in the study, sand has a moisture content of 5.67% and 24.8% for the coco coir fiber; sand has a unit weight per mass determination of 17050.31N/m^3 and 735 N/m^3 for the coir fiber. Sand has a specific gravity of 2.76 and 0.42% absorption. (Manlapas, G., 2008)

2 Objectives of the Study

This study on the utilization of coir fiber as a component material in concrete floor tiles has the following objectives:

1. To determine the compressive strength of the concrete floor tiles with and without the coir fiber after 14 days curing period.
2. To determine the significant mean difference of the concrete floor tiles considering its compressive strength after 14 days curing period.
3. To determine the cost and return analysis of the concrete floor tiles.

3 Materials and Methods

This study was an experimental type of research that involved the preparation of materials such as the cutting of the shredded coir fiber into an approximate length of 10mm to make it strong and to prevent it from bending during the mixing process. Cement, sand, and water were also prepared. Ten kilograms (10kgs) of cement was used in every mix.

There were two (2) treatments used in the production of the concrete floor tiles, namely: Mixture A (control) employed 10 kilograms cement, 0.50 cubic foot of sand and 4.5 liters of water; and Mixture B employed 10 kilograms cement, 0.50 cubic foot; 50 grams of coir fiber, and 4.5 liters of water. For every treatment, cement and sand were first mixed, before mixing the cut coir fiber. Water was then poured to the mixed cement, sand and coir fiber. When it was thoroughly mixed, it was placed into the tile molder, properly tamped and released

in an open space for air- drying and curing. After 14 days curing period, the floor tiles were subjected to compression test using the Universal Testing Machine.

4 RESULTS AND DISCUSSION

4.1 The Compressive Strength of Concrete Floor Tiles

After 14 days curing period, four (4) pieces or replications of the concrete floor tiles for every mixture were subjected to compression test using a Universal Testing Machine to determine its compressive strength.

TABLE 1
COMPRESSIVE STRENGTH OF CONCRETE FLOOR TILES

Treatments	Compressive Strength, Psi				Total	Average, Psi
	1	2	3	4		
Mixture A (control)	1,241.32	1,432.29	1,480.03	1,432.29	5,585.93	1,396.48
Mixture B (with 50g coir fiber)	1,480.03	1,527.78	1,623.26	1,432.29	6,063.36	1,515.84

Based on the results shown in Table 1, Mixture B (with 50g coir fiber) resulted an average compressive strength of 1,515.84 psi higher than Mixture A (control) which resulted to an average compressive strength of 1,396.48 psi. All the two (2) mixture passed the allowable compressive strength set by the American Society for Testing and Materials (ASTM).

4.2 The Significant Mean Difference

After 14 days curing period, four (4) pieces or replications of the concrete floor tiles for every mixture were subjected to compression test using a Universal Testing Machine to determine its compressive strength.

4.3 The Cost and Return Analysis

There were 24 pcs tiles produced using the mixture A, and 41 pcs tiles using mixture B. There will be 96 pcs of concrete floor tiles that will be produced using the control mix per bag of cement since one (1) bag of cement is equivalent to 40 kilograms, while 164 pcs of concrete floor tiles will be produced using the mixture with coir fiber per bag of cement.

TABLE 2
COST AND RETURN ANALYSIS

Treatment	Material Cost, MC (Php)			Labor Cost, LC (Php)	Total Cost, TC (MC+LC) (Php)	Profit, P (30% of TC)	Net Cost, NC (TC+P)	Tiles Produced (Pcs)	Price per Tile	ROI (%)
	Cement/ Bag (Php)	Sand/m³ (Php)	Coir Fiber							
Mixture A	220	33.96	-	110	363.96	109.18	473.14	96	4.95	29.90
Mixture B	220	33.96	1.40	130	385.36	115.60	500.96	164	3.05	29.91

Prices: Cement - P220/bag
Sand - P600/m³
Coir Fiber - P7/kilo

Based on the results shown in Table 2 considering the concrete tiles produced per bag of cement, a tile using mixture A costs P4.95, higher in cost than that of the tile using mixture B which is only P3.05. It was due to the addition of the coir fiber that resulted to a bigger number of produced concrete floor tiles. Mixture A (control) has a return of investment of 29.90%, while Mixture B (with coir fiber) has a return of investment of 29.91%.

5 CONCLUSIONS

Based on the findings of the study, the utilization of coir fber as a component material in concrete floor tiles gave a higher compressive strength passing the standards set by ASTM. Therefore, coir fiber was considered as a good component aggregate of concrete floor tiles.

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