



## Sustainable Organic Materials Flooring Tile from Coconut Shell as Aggregate

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### ABSTRACT

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Organic flooring tile from coconut shell is produced by replacing the concrete pavement. The coconut shell is the strongest part covered in coconut fruit and is naturally created to protect the interior of the coconut. Coconut shell is also used to make the charcoal used as fuel and coconut shell is much better than others. Coconut shell is also suitable for making handicrafts and is suitable for longer periods due to the strength of the coconut shell. Issues and problems that need to be studied are the problem of the coconut shell waste is high and this may cause pollution. Then, high market prices for coarse aggregate and effects of the use of organic materials in the construction. Some samples have been produced for the purpose of determining the percentage content of the content suitable for the production of concrete 'pavement' products. Then, the preservation process was carried out to dry the coconut shell under the sun. This sample uses Ordinary Portland Cement (SPB), coconut shell, quarry dust and aggregate. The percentage of coconut shell content for this research was (3%), (5%), and (10%) coconut shell compared to the aggregate for spare parts. The laboratory tests carried out are water absorption tests and bending strength. Result for an average of water absorption is 1%- 2.66% and for flexural strength is 3.5%-3.97%. The size used for the concrete pavement is 300mmx300mmx25mm. According to laboratory tests carried out revealed a high percentage of coconut shell will cause high water absorption and flexural strength decreases.

#### Keywords:

Coconut shell; aggregate; concrete pavement tile; water absorption, flexural strength

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## 1. Introduction

Pavement, under construction, meaning outdoor floor surface shallow or superficial. The size of the rectangle is used for asphalt pavement, concrete, and stones like coral, lift, brick, tile, and wood normally. In architecture, square measure how pedestrian part of the hardscape and square size used in pavement, road surface, a terrace, a courtyard, and others. In a factory, a concrete paver made by pouring concrete mix and some types of coloring agent into the mold of form and allow to set. Pavers can be used to make roads, driveways, patios, walkways and other external platforms. This research is carried out to produce alternative concrete pavement tile from a coconut shell. Now, coconut shell

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waste is high and this causes the pollution. Consequently, there is a need to explore alternative building materials from recyclable waste materials such as coconut shells. It can be recycled and can be used as a building material in the present for those who want to maintain the building materials as an alternative material that is economical, environmentally friendly and provide the same quality. Besides, high market demand for coarse aggregate produced in the quarry leads to increased prices resulting in increased paver tiles costs and growth in quarries is increasingly widespread resulting in pollution [1].

Then, the effect of using organic material in construction. Organic materials such as wood, straw, bamboo, cellulose insulation, natural paint and oils or candles can be used to make compact, safe and better energy buildings for the environment. The amount of energy used and the pollution generated from man-made materials is surprising. The amount of harmful chemicals used is increasing all the time, causing many people to be exposed to allergic illness or illness when exposed to new carpets and a variety of other substances made from these chemicals. Inorganic building materials can produce fresh air, absorb and emit moisture for a healthy internal environment. Just as we now associate organic food with healthy food, while for organic building materials leads to a healthier building. With the emphasis taken on energy efficiency and sustainability, organic buildings can guarantee safer [2].

Based on literature review, it is the ability of a beam or slab to resist failure in bending. It is measured by loading unreinforced 150x150 mm concrete beams with a span three times the depth (usually 450mm). The flexural strength is expressed as "Modulus of Rupture" (MR) in MPa. Flexural Strength is about 12 to 20% of compressive strength. However, the best correlation for specific materials is obtained by laboratory tests. Clear specification and low-intensity investigations need to take into account the higher variability of bending strength results. The rest of the standard for projects with a good control range of about 3.0-6.0 MPa. Values above 7.0 MPa test indicates a problem, and there is a high possibility that the test problem, or humidity differences in the beam, will cause low strength [3] then, Water absorption affects concrete workability, water quantity to make good usability depends on water content. Another important aspect to affect water absorption is the "Porosity" aggregate. The advantages of porosity in the aggregate will require higher water content to produce concrete that can be performed properly. Aggregates are slightly porous and absorb more by pore size and by means of water content maintained in aggregate for longer periods. Porosity, permeability and absorption aggregate effect of the bond between aggregate and cement paste. The maximum value for the water absorption of granite and limestone is 0.5 and 1.0% respectively. The experiments and concluded that the use of ceramic aggregate as recycled coarse aggregate in concrete have benefited and aggregate water absorption ceramic and natural gravel respectively 0.55 and 0.23%. Concrete pavement tile from coconut shell, have more advantages such as very environmentally friendly, absorbs heat and save costs. Coconut shell is a good strength property compared with conventional pavement tiles. By doing this research, it can produce and prove that tile pavement of coconut shell can be used as aggregate in the future [4]. The second paragraph starts here. A nanofluid can be produced by dispersing metallic or non-metallic nanoparticles or nanofibers with a typical size of less than 100 nm in a base liquid. The presence of nanoparticles in base fluids contributes to better flow mixing and higher thermal conductivity compared to a pure fluid. A novel study by Matsuda [4] revealed that the dispersion of  $\text{Al}_2\text{O}_3$  particles at 4.3 vol.% can increase the effective thermal conductivity of water by almost 30%.

## 2. Methodology

The cement used in the manufacturing of flooring tiles was Portland Pozzolana cement. The aggregates used in the tiles were stone chips. Paver tile samples using coconut shells as coarse aggregate divided by the percentage rate of 3%, 5%, and 10% set. Then the process of mixing the ingredients is done according to the prescribed rates. The crushed coconut shell is left completely dry it before it is added to the mixture used to form floor tiles. The same materials used generally in the formation of these tiles have been adopted in this study. For traditional concrete pavement tiles, there are two layers. The first layer uses materials from cement and dust quarry used. It is weighed and the water cement ratio used is 0.40. While the second layer uses materials such as cement and aggregate and the water cement ratio used is 4.0. The same mix ratio is also used to produce concrete pavement tiles using coconut shells as well [5]. The next process is carried out to test tiles. There are two types of tests to be carried out flexural strength and water absorption. Both of these tests were carried out in the laboratory for the purpose of determining the strength and water absorption rate imposed on the tile. Besides, the purpose of this test is to determine the objective is achieved.



Fig. 1. Flexural test

## 3. Results

### 3.1 Water Absorption Testing

The water absorption test results for conventional and coconut shell pavement concrete tiles are given in fig. 1. 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 [6].

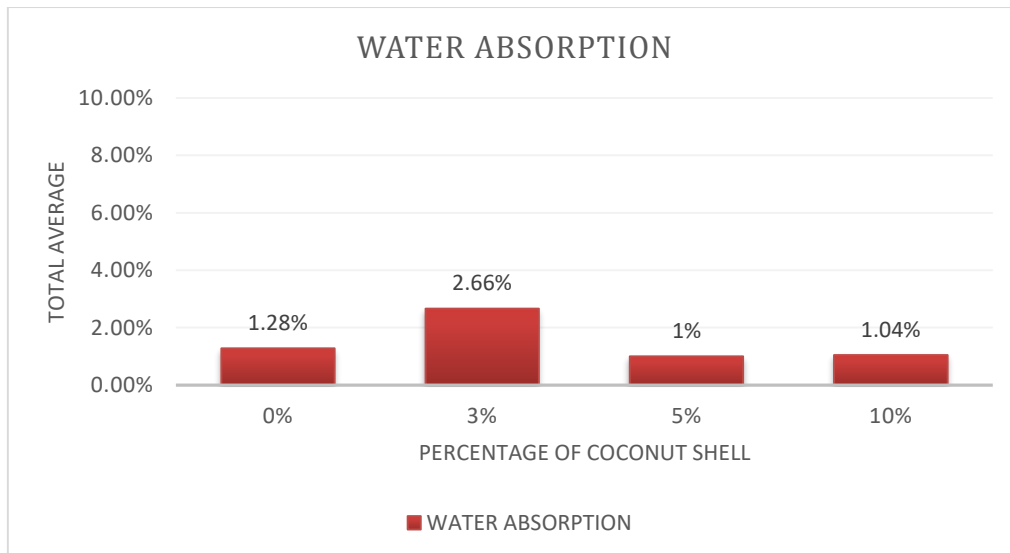


Fig. 2. Average of water absorption test

### 3.2 Flexural Strength Test

Figure 3 shows the average value of concrete pavement strength using replacement of waste materials such as coconut shell with ordinary concrete pavement. The bending average reading strength at 0% (CS) is 3.83 N / mm<sup>2</sup>. At 3% (CS) is 3.97 N / mm<sup>2</sup> and at 5% (CS) is 3.63 N / mm<sup>2</sup>. Finally at 10% (CS) 3.50 N / mm<sup>2</sup>. Variation analysis reveals 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 3% 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. The value above 7.0 MPa test shows the problem, and there is a high probability that the test problem, or the difference in moisture in the beam, will cause a low strength [7].

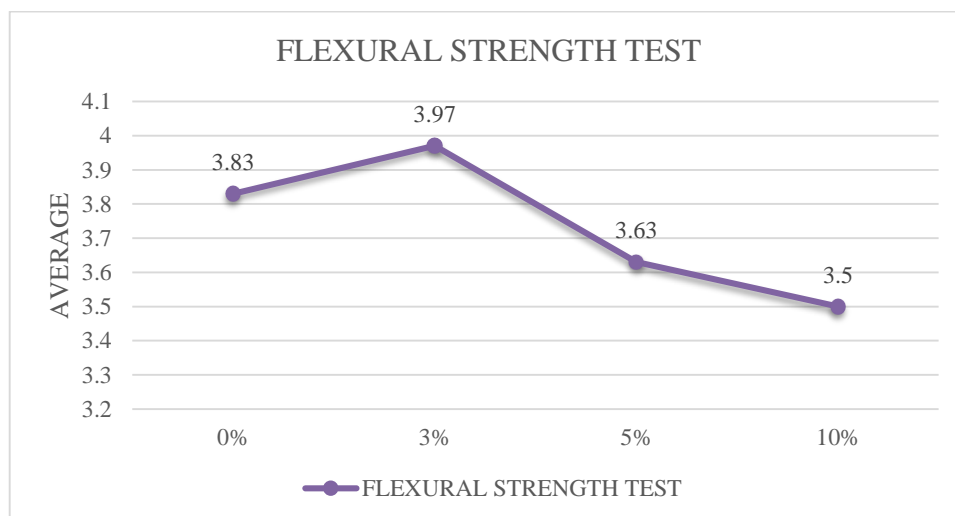


Fig. 3. Average of flexural strength test

#### 4. Conclusions

This research proposes the basic guidelines for the design of concrete pavement tiles using coconut shells. After following the mixed design procedure, the percentage of the appropriate coconut shell added is less than 10% added to the mixture. The flexural strength of the concrete pavement tiles after being immersed for 28 days is a range (3.50-3.97 Mpa). While experimental results for water absorption of range (1.0%-2.66%). Flexural test and water absorption test result are achieved the objective. The coconut shell also has its own advantages which are classified as light aggregates according to their own density and strength. Therefore, this proposed mix design procedure helps in the design of concrete pavements using coconut shells. Therefore, the objectives are achieved. Among other things, to determine the flexural strength of concrete pavements using coconut shell. This is because it is within the standard estimate of the flexural test. Then, the next objective is to know the percentage of water absorption of conventional concrete pavement compared to concrete pavement using coconut shell was achieved. Finally, the results of this study also prove that the pavement concrete uses a very useful coconut shell and can help solve the problems faced by the construction industry today such as higher material costs, for example, coarse aggregates. The importance of pavement concrete based on coconut shells has been highlighted and research on pavement concrete should continue to improve quality and make it more reliable in the construction industry.

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