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# To Study the Potential of Spear Grass as an Additional Material In Brick

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**Abstract**: *Imperata cylindrica*[1] or well known as spear grass is the most difficult and competitive weeds to control in agriculture. The use of spear grass in the making of brick will give an economical value to it as well as to reduce the amount of clay use. Spear grass brick was made to ensure the strength and water absorption when adding spear grass in the brick. It also to discover and produce a new product in construction industry. The ratio for the design mix of brick produced was 1:5:12. Spear grass with mix 0%, 1% and 2% were incorporate into the brick. The spear grass will cut into 10mm ± 20mm lengths then sieve to ensure all size were equivalent. Thirty six (36) numbers of brick will be produced with dimension 215 x 102.5 x 65 mm (length x width x height) for seven (7) and fourteen (14) days curing. The testing of compressive strength, water absorption, and dimension will be done to obtain a result. In comparison to 2% of spear grass, which achieved 4.06 MPa in 14 days, 1% of spear grass had the maximum compressive strength at 4.70 MPa. When, the spear grass add in the brick mix, the compressive strength of the brick decreases. According to test results, spear grass mix is more water-absorbent than regular brick. For both the 7 and 14 days periods, 1% is the maximum percentage of water absorption. There no major different between the standard requirement and spear grass brick size but still can acceptable in dimension test. Overall, the method used does not follow the real standard, because each brick sample does not contain the exact ratio of spear grass. This data and result is based on the mixture of the three ratios of spear grass in one mixture of ingredients to be made into three sample.

**Keywords**: : *Imperata Cylindrica*,

## 1. Introduction

Spear grass is one of the dominant, competitive, and difficult grass to control in the humid and sub-humid tropics of Asia, West Africa, and Latin America[2]. In Malaysia, spear grass a perennial grass has been found to have similar properties as the energy crops Switch grass and Miscanthus[1]. It is

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commonly called *lalang*, spear grass, silver spike, cogon grass, kunai grass, or Japanese blood red grass in diverse societies. It can grow to a height of about 120 cm and has a narrow, rigid and hairy leaf-blade of about 100 cm long and 3 to 10 mm wide.

**Figure.1: Spear grass**

In this research, spear grass used as an additive in clay brick mix. Brick is a very important material for a construction [5]and brick also has various types and functions for each type which is very suitable for this study and easy to produce. Cost of making a brick also can be reduced by using spear grass as an additive and increased the quality of it and to make a new innovation in construction.

1.1 Problem statement

In the era of globalization, construction material industries are out of resources. This research will be conduct because to find a new resource that can always fulfill the demand of the industries. If the research succeeded, the new source of material in construction will be founded. Imperata cylindrica is the scientific name or can be known as spear grass. The chosen of materials were because of a few reasons that can be acceptable. First of all, the spear grass does not have any economical value which it is not a part of the industries used or demand. This is because spear grass is always be the material that been thrown away without known the good benefits that the materials hide behind it. Moreover, in response to the kempen larangan pembakaran terbuka call which is recommended by the government, usage of spear grass will reduce environmental pollution due to burn of spear grass by farmers. Burning the spear grass is the easy, fast and cheap way to get rid of it. By bringing in the material in the industries, environment issues will reduce. If this material is brought into the industry it will decrease the problem face by farmers. Spear grass are a plant that grows wild and naturally this caused problem for farmers to destroy this plant by means of poisoning or cuts and its involves a high cost per season. Last but not least, spear grass always is used as a symbol of uselessness. This mentality need to be changed. This research will give the benefit to spear grass to become one of the most important materials in industry. Brick is one of the oldest building materials in the construction industry. therefore, new innovations must be studied and created to make this material more reliable.

1.2 Objective

Primary objective of this project to find out the alternative way to make the use of spear grass is more functional. The usage of spear grass will help to increase the economical value as well as increasing the profit income of the farmers. The environmental pollution will be reduce due to the farmers that not burn the spear grass. The research objectives are:

1. To produce brick with spear grass as additive.
2. To testing the brick with the compressive strength test, water absorption test, and dimension test
3. To identify the potential of spear grass as additive in brick.

## 2. Literature Review

In Malaysia, bricks are commonly use as partition walls, cladding, perimeter and garden wall, paving and floorings. However, bricks can also serve as external and internal load bearing wall or load bearing piers and column. It has been used in our dwellings in most pre-war buildings and commonly found in European countries. The use of this structural masonry can result in cheaper and faster construction of structural components in buildings. It eliminates costly formwork and reinforcing steel, and achieves speedier construction process because frames are less or not required at all.

Bricks are solid masonry units composed of inorganic non-metallic materials hardened or burned by heat or chemical action. Building bricks may be solid or it may have covered openings not to exceed 25% of its volume. Bricks are produce in a wide variety of colors, shapes and textures. In Malaysia, bricks are produce in abundance and with better manufacturing process it offer great flexibility and varieties. There are many types of bricks that use in construction such as clay bricks, sand-cement bricks and engineering bricks.

### 2.1 Materials of brick

Bricks can be made in a variety of ways, often from clay -based materials, cement and water then it molded into shapes, and then fixed in shape by heat or other drying processes.

#### 2.1.1 Clay

Clay soil is mixed into brick. as an essential part of its load bearing structure. Also a primary ingredient in many natural building techniques.

#### 2.1.2 Cement

Cement is a binder, a substance used for construction that sets, hardens and adheres to other material to bind them together. In this process of spear grass brick, used of cement is crucial to harden the brick and bind all material together.

#### 2.1.3 Water

Water is a key ingredient in the manufacture of brick it is also a material in its own right. Understanding it properties is helpful in gaining and understanding of its effects on brick and other building material. Although it is critical to be construction Process, water has properties that make it a key role in corrosion. It is also a highly effective solvent and may cause damage due to moisture migration as it moves from warm to cool regions in a structure or structural number.

## 3.0 Methodology

The methodology in this project was divided into four (4) stages of work. For the first stage of the process was collecting information from journals, books and articles. Second stage was collecting a material which is spear grass from nearby area at Pagoh and prepared the mould to produce clay brick. The third stage was Preparing sample and physical testing which are compressive strength, water absorption, and dimension of brick. The last stage was result and discussion on the data that collected from the test.

3.1 Design mix

The design mix will referring to the ASTM C62 and ratio use is 1:5:12. The ratio of the spear grass are taken from the previous research (M H Ahmad.2020), the design mixes are as below:

**Table 1: Design mix**

| Design | Ratio | Cement | Water | Clay | Spear grass |
|---|---|---|---|---|---|
| 0% | 1:5:12 | 0.150kg | 0.735kg | 1.765kg | 0 |
| 1% | 1:5:12 | 0.150kg | 0.735kg | 1.765kg | 0.025kg |
| 2% | 1:5:12 | 0.150kg | 0.735kg | 1.765kg | 0.025kg |

3.2 Sample preparation

The brick will produce by mix the spear grass in clay brick that act as an additive to reduce the use of clay with the percentage of 0 %, 1% and 2%. The production of spear grass brick will produce at laboratory in Universiti Tun Hussein Onn, Pagoh. The process started by collecting the material which is spear grass then the spear grass will cut in range between 10mm to 20mm length, and it was dry at the temperature of 110℃. The second step is preparing the design mixture by using the mixer and the third step is compressing the mix using the mould that have made to produce the brick. The process will repeat to produce 36 samples of brick for curing 7 day and 14 days. To measure its compressive strength, water absorption and dimension test, 3 sample for each testing is tested on 7 and 14 days.

3.3 Testing

3.3.1 Compressive strength

This test is performed to determine the compressive strength of bricks. It is additionally known as crushing strength test of brick. A sample of brick are selected and transported to laboratory for testing. A brick sample is kept on crushing machine and then pressure is thoroughly applied axially until it breaks. The maximum pressure at which the brick starts to crack is noted.[6]

3.3.2 Water absorption

In this test, bricks were weight first in dry condition and then fully submerged in water for 24 hours. After immersion of 24 hours, the bricks are collected and weight again in wet codition. The difference of weight between dry and wet condition is considered as water absorbed by the bricks. Then the amount of water absorption is determined in percentage.[6]

3.3.3 Dimension test

20 bricks are randomly collected and arranged in a straight line. This test is done to see the variation of shape, size and color with the standard brick.[6]

## 4.0 Result

This chapter discussed on the result obtained from the testing according to BS 3921:1985. The testing involved is compressive strength, water absorption and dimension test.

4.1 Compressive strength

**Table 3: Compressive Strength Test**

| SAMPLE | | 1 | 2 | 3 | Average strength (Mpa) |
|---|---|---|---|---|---|
| | | Compressive Strength | | | |
| **Ordinary (0%)** | 7 days | 5.36 | 5.95 | 4.72 | 5.34 |
| | 14 days | 9.13 | 11.22 | 7.53 | 9.29 |
| **Content 0.025kg (1%)** | 7 days | 2.66 | 4.13 | 4.26 | 3.68 |
| | 14 days | 4.58 | 5.10 | 4.14 | 4.70 |
| **Content 0.050kg (2%)** | 7 days | 2.63 | 2.94 | 3.35 | 2.97 |
| | 14 days | 3.93 | 4.62 | 3.64 | 4.06 |

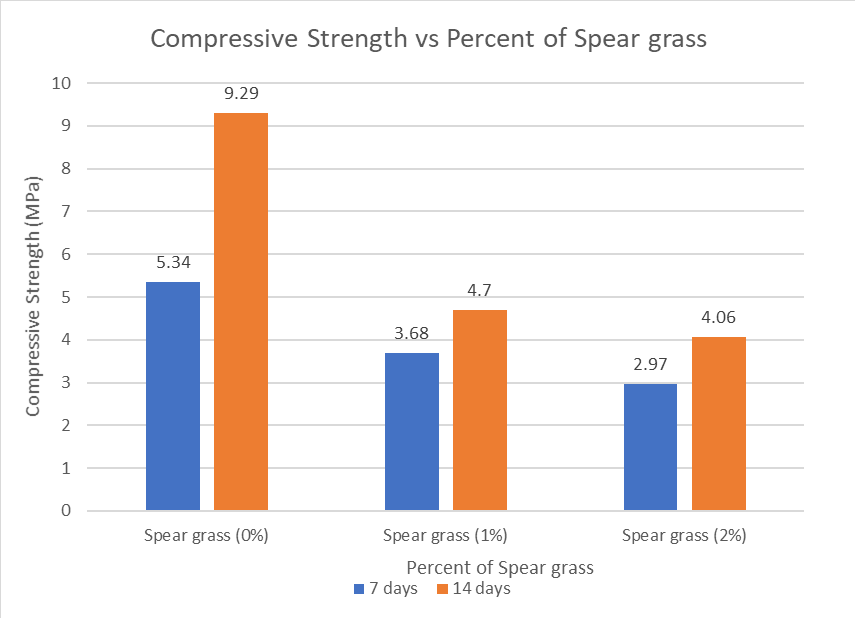


**Figure 2: Compressive Strength Test Bar Chart**

4.2 Water absorption result

Water absorption result are shown in table 4 below:

**Table 4: Water Absorption Result**

| | **Sample** | | **1** | **2** | **3** | **Average weight (Kg)** |
|---|---|---|---|---|---|---|
| **Ordinary (0%)** | 7 days | Dry sample ($M_1$) | 2.37 | 2.23 | 2.21 | 2.27 |
| | | Wet sample ($M_2$) | 2.90 | 2.80 | 2.80 | 2.83 |
| | | $w = \frac{2.83 - 2.27}{2.27} \times 100 = 24.67\%$ | | | | |
| | 14 days | Dry sample ($M_1$) | 2.25 | 2.25 | 2.27 | 2.26 |
| | | Wet sample ($M_2$) | 2.80 | 2.80 | 2.80 | 2.80 |
| | | $w = \frac{2.80 - 2.26}{2.26} \times 100 = 23.89\%$ | | | | |
| **Spear grass (1%)** | 7 days | Dry sample ($M_1$) | 2.15 | 2.19 | 2.06 | 2.13 |
| | | Wet sample ($M_2$) | 2.75 | 2.80 | 2.65 | 2.73 |
| | | $w = \frac{2.73 - 2.13}{2.13} \times 100 = 28.17\%$ | | | | |
| | 14 days | Dry sample ($M_1$) | 2.14 | 2.18 | 2.18 | 2.17 |
| | | Wet sample ($M_2$) | 2.70 | 2.80 | 2.65 | 2.77 |
| | | $w = \frac{2.77 - 2.17}{2.17} \times 100 = 27.65\%$ | | | | |
| | | Dry sample ($M_1$) | 2.17 | 2.17 | 2.28 | 2.17 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Spear grass (2%)** | 7 days | Wet sample ($M_2$) | 2.82 | 2.76 | 2.78 | 2.79 |
| | | $w = \frac{2.79 - 2.17}{2.17} \times 100 = 28.57\%$ | | | | |
| | 14 days | Dry sample ($M_1$) | 2.33 | 2.43 | 2.20 | 2.31 |
| | | Wet sample ($M_2$) | 2.90 | 2.90 | 2.80 | 2.87 |
| | | $w = \frac{2.87 - 2.31}{2.31} \times 100 = 24.24\%$ | | | | |

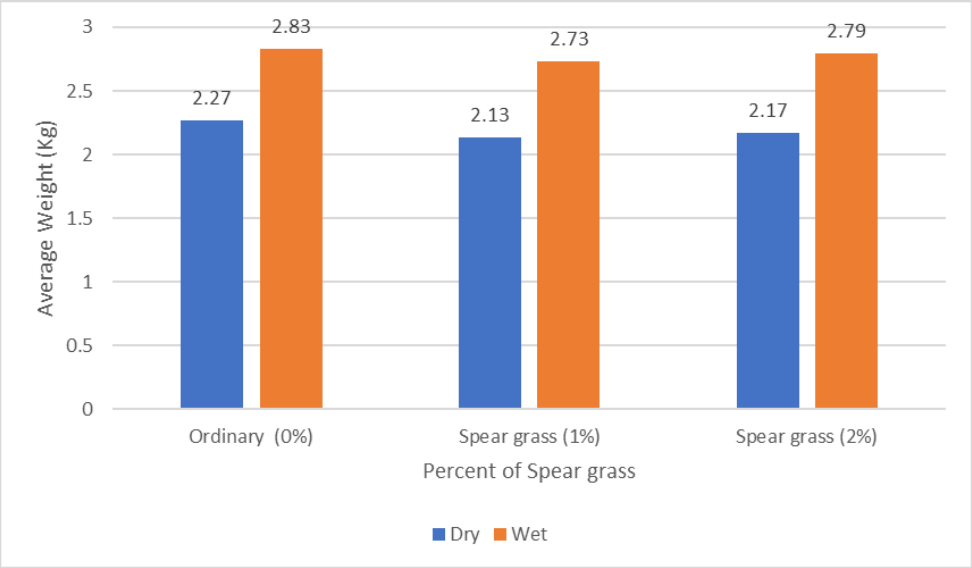


**Figure 3: Water Absorption Bar Chart for 7 days**

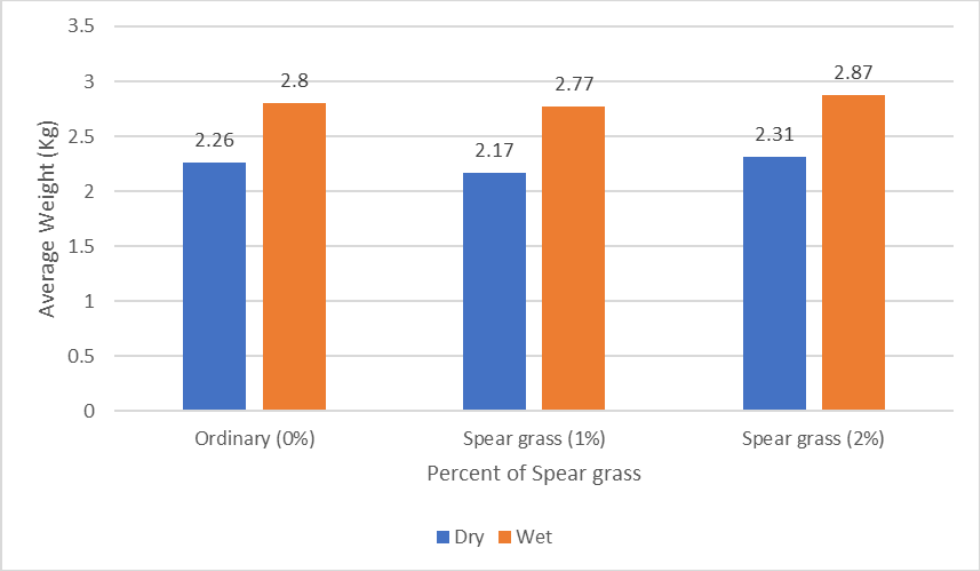


**Figure 4: Water Absorption Bar Chart for 14 days**

4.3 Dimension test result

**Table 5: Dimension Test Result**

| **Length** | **width** | **Depth / Height** |
|---|---|---|
| 4312mm | 2063mm | 1308mm |
| **Average** | Average | Average |
| $\boldsymbol{l = \frac{4312mm}{20} = 215.6mm}$ | $w = \frac{2063mm}{20} = 103.15mm$ | $h = \frac{1308mm}{20} = 65.4mm$ |

## 5.0 Discussion

Overall, the method used does not follow the real standard, because each brick sample does not contain the exact ratio of spear grass. This data and result is based on the mixture of the three ratios of spear grass in one mixture of ingredients to be made into three samples. however, the data and results have shown the influence of spear grass in the brick mix. The result of compressive strength test for spear grass mix brick is decreased compare to 0% mix. This is because there were not suitable tools and machine to be use to produce the samples. The percent of water absorption increase because the material that used are not fully dry and it lead to higher water contain in the brick. Spear grass are type of natural fibre that easily absorbs water. The tolerance of mix brick dimension are almost achieved the standard of requirement ordinary brick, the result are acceptable. Size of spear grass cut are not suitable and related to the failure in testing the mix brick.

## 6.0 Conclusion

Based on the result and analysis, some of the the objectives of the project stated early phase have not been achieved that cause from some reason and explanation, but it also have pros and cons. The conclusion had been made as below:

1. The result of compressive strength test for spear grass mix brick is decreased compare to 0% mix. This is because there were not suitable tools and machine to be use to produce the samples.
2. The percent of water absorption increase because the material that used are not fully dry and it lead to higher water contain in the brick. Spear grass are type of natural fibre that easily absorbs water.
3. The tolerance of mix brick dimension are almost achieved the standard of requirement ordinary brick, the result are acceptable.
4. Size of spear grass cut are not suitable and related to the failure in testing the mix brick.
5. Even though the spear grass mix brick are fail to achieved the standard requirement, it still can be use as non-loading purpose component like decoration and other purpose.

## 7.0 Recommendation

From the result obtained, there were some recommendations for this project:

1. The mould should use from steel and also machine should be involve such as compactor mechanism
2. The spear grass must inform of ash or have been treat with some chemical to preserve the properties and prevent the spear grass from decay.
3. Other testing can involve such as efflorescence, soundness, hardness and impact structures test to study more characteristic of the spear grass mix.

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