EXPERIMENTAL STUDY OF PROPERTIES FOR SAND BRICKS WITH PALM OIL CLINKER AS PARTIAL REPLACEMENT FOR FINE AGGREGATE WITH RATIO OF 10% WITH RICE HUSK OF 10%, 20% AND 30%

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I hereby declare that I have checked this thesis and in my opinion, this project is adequate in terms of scope and quality for the award of the Bachelor Degree of Civil Engineering

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STUDENT’S DECLARATION

I hereby declare that the work in this project is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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EXPERIMENTAL STUDY OF PROPERTIES FOR SAND BRICKS WITH PALM OIL CLINKER AS A PARTIAL REPLACEMENT FOR FINE AGGREGATE WITH RATIO OF 10% WITH RICE HUSK OF 10%, 20% AND 30%

SYAHIRA WAHIDA BINTI SHAKRANI

Project submitted in fulfillment of the requirements for the award of the Bachelor Degree in Civil Engineering

Faculty of Civil Engineering and Earth Resources
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By the name of Allah, Most Gracious, Most Merciful.

On the completion of this thesis, Experimental Study of Properties for Sand Bricks with Palm Oil Clinker as a Partial Replacement for Fine Aggregate with Ratio of 10% with Rice Husk of 10%, 20% and 30%. I would like to present my highest gratitude to Allah S.W.T for His love and mercy. Praise and peace be upon Prophet Muhammad S.A.W, his family, and his companions.

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Lastly, special thanks to my family for giving me spiritual support and greatest caring along the way to complete this dissertation.
ABSTRAK

ABSTRACT

Nowadays construction industry such as material industry continues to emerge significantly in the domestic as well as global market due to increase the population in Malaysia. The brick has been around for centuries and it is the one of the most important component in construction material industry that have highly demand and required more consumption of sand in brick making process. Besides that, there are issues related to waste material such as palm oil clinker and rice husk that have being dumped in landfills without being used. Thus, this experimental study are carry out in concrete laboratory at University of Malaysia Pahang to determine the effectiveness of sand brick production that based on utilization of palm oil clinker and rice husk. The control brick are made from mixture of cement, sand and water. Meanwhile for alternative brick the percentages of sand are replaced by 10% palm oil clinker with rice husk of 10%, 20%, and 30%. The size of the sand brick produced are based on JKR Standard Specifications for Building Works (2005) which is 225 mm X 113 mm X 75 mm. This study is important to analyze the potential of palm oil clinker and rice husk as partial replacement for fine aggregate in sand brick production. Furthermore, this research more focusing on eco-friendly material that can contribute towards sustainability green material. This is because by using this material as replacement of fine aggregate can help reduction of waste. From this research, the test that involved are density test, water absorption test, compressive strength test and flexural strength test. This experimental studies were conducted for 3 days, 7 days, 14 days and 28 days after undergone water and air curing process. Hence, the result testing obtained from alternative brick are compared with control brick. After considering result and discussion all the main objectives are achieved. Therefore, from this research it can summarize that palm oil clinker and rice husk is one of waste material that suitable to be as partial replacement for fine aggregate in sand brick production. The replacement of 10% C + 10% RH is recommended as the best ratio in increases the strength and density of sand bricks compared to replacement of 20% and 30% RH.
TABLE OF CONTENT

DECLARATION ii
TITLE PAGE iii
ACKNOWLEDGEMENTS iv
ABSTRAK v
ABSTRACT vi
TABLE OF CONTENT vii
LIST OF TABLES viii
LIST OF FIGURES ix
LIST OF SYMBOLS x
LIST OF ABBREVIATIONS xi

CHAPTER 1 INTRODUCTION 1
1.1 Background of Study 1
1.2 Problem Statement 3
1.3 Objective of Study 4
1.4 Scope of Study 5
1.5 Significant of Study 6

CHAPTER 2 LITERATURE REVIEW 7
2.1 Introduction 7
2.2 Types of Brick 8
   2.2.1 Sand Brick 8
   2.2.2 Clay Brick 9
   2.2.3 Common Brick 9
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2.4 Facing Brick</td>
<td>9</td>
</tr>
<tr>
<td>2.2.5 Engineering Brick</td>
<td>10</td>
</tr>
<tr>
<td>2.3 Material</td>
<td>10</td>
</tr>
<tr>
<td>2.3.1 Cement</td>
<td>10</td>
</tr>
<tr>
<td>2.3.2 Sand</td>
<td>11</td>
</tr>
<tr>
<td>2.3.3 Water</td>
<td>11</td>
</tr>
<tr>
<td>2.3.4 Palm Oil Clinker</td>
<td>11</td>
</tr>
<tr>
<td>2.3.5 Rice Husk</td>
<td>13</td>
</tr>
<tr>
<td>2.3 Properties of Brick</td>
<td>13</td>
</tr>
<tr>
<td>2.3.1 Density</td>
<td>13</td>
</tr>
<tr>
<td>2.3.2 Water Absorption Rate</td>
<td>14</td>
</tr>
<tr>
<td>2.3.3 Compressive Strength</td>
<td>14</td>
</tr>
<tr>
<td>2.3.4 Flexural Strength</td>
<td>15</td>
</tr>
</tbody>
</table>

**CHAPTER 3 METHODOLOGY**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Introduction</td>
<td>16</td>
</tr>
<tr>
<td>3.2 Work Flow of Research</td>
<td>16</td>
</tr>
<tr>
<td>3.3 Sand Brick Design</td>
<td>18</td>
</tr>
<tr>
<td>3.4 Selection and Preparation of Material</td>
<td>19</td>
</tr>
<tr>
<td>3.4.1 Sand</td>
<td>19</td>
</tr>
<tr>
<td>3.4.2 Cement</td>
<td>21</td>
</tr>
<tr>
<td>3.4.3 Water</td>
<td>21</td>
</tr>
<tr>
<td>3.4.4 Palm Oil Clinker</td>
<td>22</td>
</tr>
<tr>
<td>3.4.5 Rice Husk</td>
<td>23</td>
</tr>
<tr>
<td>3.4.6 Preparation of All Material</td>
<td>24</td>
</tr>
<tr>
<td>3.5 Formwork Making Process</td>
<td>24</td>
</tr>
</tbody>
</table>
3.6 Mixing and Casting Process 26
3.7 Curing Process 28
3.8 Testing Process 29
  3.8.1 Density Test 30
  3.8.2 Water Absorption Test 30
  3.8.3 Compressive Strength Test 31
  3.8.4 Flexural Strength Test 32

CHAPTER 4 RESULTS AND DISCUSSION 34

4.1 Introduction 34
4.2 Density Test 34
  4.2.1 Comparison of Density of Sand Bricks for Water Curing 35
  4.2.2 Comparison of Density of Sand Bricks for Air Curing 36
  4.2.3 Discussion of Density Test 37
4.3 Water Absorption Test 38
  4.3.1 Comparison of Water Absorption Rate of Sand Bricks for Water Curing 38
  4.3.2 Comparison of Water Absorption Rate of Sand Bricks for Air Curing 39
  4.3.3 Discussion of Water Absorption Rate 41
4.4 Compressive Strength Test 41
  4.4.1 Comparison of Compressive Strength of Sand Bricks for Water Curing 42
  4.4.2 Comparison of Compressive Strength of Sand Bricks for Air Curing 44
  4.4.3 Discussion of Compressive Strength 45
4.5 Flexural Strength Test 45
  4.5.1 Comparison of Flexural Strength of Sand Bricks for Water Curing 46
  4.5.2 Comparison of Flexural Strength of Sand Bricks for Air Curing 47
  4.5.3 Discussion of Flexural Strength 48
LIST OF TABLES

Table 1  Estimated demand for major construction material in Malaysia  2
Table 2.1 Nominal size of sand bricks  9
Table 2.2 Physical properties of sand  12
Table 2.3 Physical properties of palm oil clinker  12
Table 3.1 Size of cement sand bricks  18
Table 3.2 Ratio of mix design required for the production of sand brick  19
Table 3.3 The amount of material used for sand brick production  24
Table 4.1 The density of sand bricks for water curing  35
Table 4.2 The density of sand bricks for air curing  36
Table 4.3 The percentage of water absorption for water curing  38
Table 4.4 The percentage of water absorption for air curing  39
Table 4.5 The compressive strength of sand bricks for water curing  42
Table 4.6 The compressive strength of sand bricks for air curing  44
Table 4.7 The flexural strength of sand bricks for water curing  46
Table 4.8 The flexural strength of sand bricks for air curing  47
LIST OF FIGURES

Figure 3.1 Flowchart of research 17
Figure 3.2 Dimension of sand bricks 18
Figure 3.3 River sand 20
Figure 3.4 Sieve analysis process 20
Figure 3.5 Portland Cement Cap Orang Kuat 21
Figure 3.6 Tap water 22
Figure 3.7 Palm oil clinker 22
Figure 3.8 Filtration of rice husk 23
Figure 3.9 The plywood are marked according to the dimension of sand bricks 25
Figure 3.10 The marked plywood were cutting using band saw machine 25
Figure 3.11 The formwork after the piece of plywood installed together 26
Figure 3.12 All weighted material mixed together into the mixer 26
Figure 3.13 The formwork are painted using oil 27
Figure 3.14 Process compaction of brick samples 27
Figure 3.15 Brick samples after finishing process 28
Figure 3.16 Water curing process 29
Figure 3.17 Air curing process 29
Figure 3.18 Sand brick condition after undergone compressive strength test 32
Figure 3.19 Flexural strength test 33
Figure 4.1 Comparison of density of sand bricks for water curing 35
Figure 4.2 The comparison of density of sand bricks for air curing 36
Figure 4.3 The comparison of density of sand bricks for both curing 37
Figure 4.4 The comparison of water absorption of sand bricks for water curing 39
Figure 4.5 The comparison of water absorption of sand bricks for air curing 40
Figure 4.6 The comparison of water absorption of sand bricks for both curing 41
Figure 4.7 The comparison of compressive strength of sand bricks for water curing 43
Figure 4.8 The comparison of compressive strength of sand bricks for air curing 44
Figure 4.9 The comparison of flexural strength of sand bricks for water curing 46
Figure 4.10 The comparison of flexural strength of sand bricks for air curing 47
LIST OF SYMBOLS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>Mass</td>
</tr>
<tr>
<td>V</td>
<td>Volume</td>
</tr>
<tr>
<td>N</td>
<td>Maximum load at failure (N)</td>
</tr>
<tr>
<td>F</td>
<td>Load at a given point on the load deflection curve (N)</td>
</tr>
<tr>
<td>L</td>
<td>Support Span (mm)</td>
</tr>
<tr>
<td>B</td>
<td>Width of sand brick (mm)</td>
</tr>
<tr>
<td>d</td>
<td>Depth or thickness of tested brick (mm)</td>
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</table>
# LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>JKR</td>
<td>Jabatan Kerja Raya</td>
</tr>
<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
</tr>
<tr>
<td>RH</td>
<td>Rice husk</td>
</tr>
<tr>
<td>C</td>
<td>Clinker</td>
</tr>
<tr>
<td>BS</td>
<td>British Standard</td>
</tr>
<tr>
<td>CIDB</td>
<td>Construction Industry Development Board</td>
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</table>
CHAPTER 1

INTRODUCTION

1.1 Background of Study

The construction field is a vital and productive field of the Malaysia economy. As a developing country, Malaysia has realized the crucial role of the construction field is not only in economic growth but also important in improving the quality of life and living standard of Malaysian community. Nowadays Malaysian construction industry such as material industry continues to emerge significantly in the domestic as well as global market due to increases the population every year. According to the Statistics Department, Malaysia it projected that the Malaysia’s population will grow to 38.6 million in 2040. The population increase may be caused to increase the demand in many industry production.

Figure 1.0 Population projection and annual population growth rate in Malaysia

Sources: (Department of Statistics, Malaysia, 2014)
Table 1 Estimated demand for major construction material in Malaysia

<table>
<thead>
<tr>
<th>Construction Material</th>
<th>Unit</th>
<th>Material Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel reinforcement</td>
<td>tonne</td>
<td>1.5 million</td>
</tr>
<tr>
<td>Ready mixed concrete</td>
<td>m&lt;sup&gt;2&lt;/sup&gt;</td>
<td>19.1 million</td>
</tr>
<tr>
<td>Plywood</td>
<td>piece</td>
<td>49.5 million</td>
</tr>
<tr>
<td>Bricks</td>
<td>pallet</td>
<td>12.8 million</td>
</tr>
<tr>
<td>Paint</td>
<td>5 litre</td>
<td>12.7 million</td>
</tr>
<tr>
<td>Sand (finishes)</td>
<td>tonne</td>
<td>25.5 million</td>
</tr>
<tr>
<td>Glass</td>
<td>m&lt;sup&gt;2&lt;/sup&gt;</td>
<td>28.4 million</td>
</tr>
<tr>
<td>Cement (finishes)</td>
<td>tonne</td>
<td>2.6 million</td>
</tr>
</tbody>
</table>

Sources: (CIDB Malaysia, 2018)

Table 1 represent the 8 types of materials such as steel reinforcement, ready mixed concrete, plywood, bricks, paints, sand, glass and cement that has emerged as the main construction material that have highly demand and most frequently required for any project. From the demand, the materials such as bricks and sand is highly get attention to increase research in order to develop another alternative to create more advantages toward construction material industry.

The brick has been around for centuries and it is the one of the most important component in construction material industry that contributes to high cost. It is widely used in various constructions such as wall, pole, floors, stairs and street. Bricks are define as a building material in the form of rectangle and made of major raw material types such as clay, sand, and cement. Usually brick size are based local standards which is normal dimensions is about 215mm x 102.5mm x 65mm which if mixed with a mortar layer size of 10mm (Polytechnic Module, 2012). An interesting thing about bricks is dimension and size has not changed. Generally, there are two types of bricks produced and used in local construction of houses and building which are clay brick and sand brick.

However, in this study sand brick are selected to be main subject. Sand bricks are made from a mixture of sand, cement, and water. In addition, in this research palm oil clinker and rice husk will be replace fine aggregate in the mixture of sand brick. Palm oil clinker is a by-product waste produced from burning of palm oil fibre and palm oil shell.
inside the boiler under high temperatures. Generally these wastes are being dumped near the palm oil mill thus resulting environmental pollution (Arunima, 2016). Meanwhile rice husk is an agriculture waste material abundantly available in rice-producing countries. The utilization of palm oil clinker and rice husk as partial replacement for sand in sand brick production can be one of option to reduce the amount of products that should be disposed in landfills and possibly eliminate the environmental impacts.

1.2 Problem Statement

In the 21st century, the introduction of sustainable development in the construction industry as well building materials has received considerable attention. The world is increasingly aware of that brick production costs are rising due to high demand, lack of resources non-renewable natural and high energy cost. In addition, for production sand bricks required the more usage of sand as it is one of the main ingredient in the mixture. Based on (Ali, 2017) it said that the raw sand in Malaysia is increasing from year 2014 which is about 29,862,000 tonnes to 34,341,300 tonnes on 2015 respectively. This increment shows that the demand of sand is quite high as well as the mining activities also increasing that may lead to the serious environmental problem such as channel degradation and erosion, head cutting, increased turbidity, stream bank erosion and sedimentation of riffle area. Besides, according to (Gabir, 2017) it state that there is a shortage of sand due to high demands for construction material even it is not the level of panic.

Meanwhile according to (Abutaha, 2016), Malaysia is the second largest material palm oil producing country that generates palm oil clinker as waste which projected to grow because increasing demand for consumption of palm oil. This material is dump at the landfill without any utilization and estimated around 2.6 million tons of solid waste was produced annually by the palm oil industry. Besides, (Habeeb & Mahmud, 2010) revealed that rice husk is an agricultural residue that accounts for 20% of the 649.7 million tons of rice produced annually worldwide without being used. Hence, to overcome the issues related with the disposal waste material in landfill without any utilization the efforts can make by utilize this material as partial replacement in sand brick


Norhayati binti Mohd Nor, K. b. (n.-d). *Civil Engineering Laboratory Manual (3rd Edition)*. Faculty of Civil Engineering & Earth Resources.


