



SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis 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 thesis 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.

A handwritten signature in black ink, appearing to read 'Syarifah', is written above a horizontal line.

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MECHANICAL PROPERTIES OF ADOBE BRICKS USING SAWDUST AS
PARTIAL SAND REPLACEMENT

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ABSTRAK

Adobe telah secara tradisinya dihasilkan dengan mencampurkan tanah, pasir dan air sehingga mencapai konsisten plastik. Ia adalah bahan yang digunakan untuk membuat dinding, laluan pejalan kaki dan lain-lain komponen dalam pembinaan bangunan. Bata yang disebut adalah bata yang terdiri daripada tanah liat. Sejak beberapa dekad yang lalu, permintaan untuk batu-bata telah meningkat dengan cepat untuk perumahan. Bahan buangan industri akan memberikan kesan yang berbahaya kepada alam sekitar dan rakyat kerana, walaupun sisa ini dibakar, mereka melepaskan karbon monoksida ke atmosfera yang boleh habis lapisan ozon. Oleh itu, terdapat keperluan untuk menyiasat penggunaan bahan binaan alternatif tempatan sedia ada seperti habuk kayu, ia merupakan bahan buangan yang paling banyak yang telah dibuang di kawasan tapak pelupusan. Hari ini, banyak alternatif yang digunakan untuk memperbaiki sifat-sifat adobe bata. Salah satu pilihan yang terbaik adalah dengan menambah bahan buangan ke dalamnya untuk menggantikan pasir yang mendapat permintaan yang tinggi. Habuk kayu yang dijana daripada kayu di kilang papan biasanya berakhir dengan dijadikan makan binatang ternakan atau yang dibuang di tapak pelupusan. Yang mengejutkan, ciri-ciri kedua-dua bahan-bahan yang pasir dan habuk kayu adalah yang hampir sama. Dengan menggantikan pasir dengan habuk papan, masalah perlombongan pasir dan pelupusan sampah dapat dikurangkan serta bata adobe yang menjimatkan boleh dihasilkan. Kajian ini bertujuan untuk mengkaji kesan habuk kayu menggantikan separa pasir keatas ciri-ciri mekanikal bata adobe. Bidang kajian juga meliputi parameter penting termasuk kekuatan mampatan dan kekuatan lenturan dalam menentukan sifat-sifat kejuruteraannya. Ujian mampatan dan lenturan untuk parameter yang diperlukan ini akan dijalankan 3 minggu selepas bata adobe menjalani pengawetan udara.

ABSTRACT

Adobe were traditionally produced by mixing soil, sand and water to plastic consistency. It is building material used to make walls, pavements and other components in masonry construction. Customarily, the term brick referred to a unit composed of clay, yet it is presently used to denote any rectangular units laid in mortar. Over the past several decades, the demand for bricks has been increasing rapidly for the housing. Industrial wastes will gives the hazardous impact to environment and people because, although these waste are burnt, they release the carbon monoxide to atmosphere which can depletes the ozone layer. So, there is need to investigate the use of alternative building materials which are locally available such as sawdust, the most abundant waste that have been dumped in landfill area. Today, many alternatives are use in order to improve the properties of adobe brick. One of the best options is by adding the waste material into it to replace sand which in high demand. The sawdust that generate from the wood at sawmill usually end up at will be feed to the livestock or being dumped at landfill. Surprisingly, the characteristics of both materials which are sand and sawdust are almost identical. By replacing sand with sawdust, sand mining and waste disposal problems can be reduced as well as economical adobe brick can be produced. This study aims to investigate the effect of sawdust as partial sand replacement on the properties of adobe brick. The field of studies also covers important parameters including compressive strength and flexural strength in determining the engineering properties. The compressive and flexural tests for these required parameters will be conducted on 3 weeks after the adobe bricks undergo air curing.

TABLE OF CONTENT

DECLARATION	
TITLE PAGE	
ACKNOWLEDGEMENTS	ii
ABSTRAK	iii
ABSTRACT	iv
TABLE OF CONTENT	v
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF ABBREVIATIONS	x
CHAPTER 1 INTRODUCTION	1
1.1 Background	1
1.2 Problem Statement	1
1.3 Objective	2
1.4 Significance of Research	2
1.5 Scope of Study	3
1.6 Layout of Thesis	3
CHAPTER 2 LITERATURE REVIEW	5
2.1 Introduction	5
2.2 Types of Brick	6
2.2.1 Clay Brick	6
2.2.2 Sand Lime Brick	7

2.2.3	Adobe Brick	8
2.3	Size of Brick	9
2.4	Classification of Brick	10
2.4.1	Unburnt bricks	10
2.4.2	Burnt Bricks	10
2.5	Properties of Brick	11
2.5.1	Compressive Strength	11
2.5.2	Flexural Strength	12
2.6	Sawdust as Waste Material	12
2.7	Issues of Sand	15
CHAPTER 3 METHODOLOGY		18
3.1	Introduction	18
3.2	Material Preparation	18
3.2.1	Clay Soil	18
3.2.2	Fine Aggregate	19
3.2.3	Sawdust	20
3.2.4	Water	21
3.2.5	Sawdust Adobe Mix Design	21
3.3	Preparation of Sawdust Adobe	22
3.3.1	Mixing of Adobe	22
3.3.2	Casting of Adobe	23
3.4	Experimental Procedure	24
3.4.1	Compressive Strength Test	24
3.4.2	Flexural Strength Test	26

CHAPTER 4 RESULTS AND DISCUSSION	27
4.1 Introduction	27
4.2 Compressive Strength Test	27
4.3 Flexural Strength Test	28
CHAPTER 5 CONCLUSION	30
5.1 Introduction	30
5.2 Recommendation	31
REFERENCES	32

LIST OF TABLES

Table 2.1	Size of Clay Brick	9
Table 3.1	Table 3.1 Mix Design for Sawdust Adobe	22

LIST OF FIGURES

Figure 2.1	Clay brick	7
Figure 2.2	Sand lime brick	8
Figure 2.3	Adobe brick	9
Figure 2.4	Dimension of brick	10
Figure 2.5	Export of Major Timber Products, June 2016 in Malaysia	13
Figure 2.6	Variety type of particleboard	14
Figure 2.7	Sawdust made with hand saw	14
Figure 2.8	Wood waste product: bark	15
Figure 2.9	Grading limits for fine aggregates	16
Figure 2.10	Sand mining activities	17
Figure 2.11	Quarries	17
Figure 3.1	Sand	19
Figure 3.2	Sawdust	20
Figure 3.3	Sawdust from the sawmill	21
Figure 3.4	Mixer	23
Figure 3.5	Compacted the adobe brick	23
Figure 3.6	Experimental Programme	24
Figure 3.7	Compressive strength machine	25
Figure 4.1	Compressive strength result	28
Figure 4.2	Flexural strength result	29

LIST OF ABBREVIATIONS

ASTM	American Society for Testing and Materials
BS	British Standard
kg/m ³	Kilogram per meter cube
MPa	Mega pascal
NATIP	National Timber Industry Policy

CHAPTER 1

INTRODUCTION

1.1 Background

Adobe was one of the first materials ancient humans used to create buildings, dating as far back as the 8th century B.C. The word "adobe" is Spanish, but etymologists trace its origins to an old Arabic word, al-tob or al-tub, meaning "brick." (Linda, 2014). Adobes were traditionally produced by mixing soil, sand and water to plastic consistency. The mixture was cast into the moulds and was allowed to dry in natural environmental conditions, preferably in the shade. In the past, adobe bricks were extensively and continuously used for the construction of masonry structures. Today, many alternatives are used in order to improve the properties of adobe brick. One of the best option are by adding the waste material into it.

One of the waste material is sawdust. The sawdust that generate from the wood at sawmill usually end up at will be feed to the livestock. Wood preparing ventures basically incorporate saw milling, plywood, wood panel, furniture, building segment, flooring, particle board, molding, jointing and craft industries. Wood squanders for the most part are gathered at the handling manufacturing plants, e.g. plywood plants and sawmills. The uses of sawdust as the partial replacement to the sand also can decrease the shortage of sand problem.

1.2 Problem Statement

The disposal of sawdust brings many harms to the environment. At sawmills, unless reprocessed into particleboard, smoldered in a sawdust burner or used to make warm for other processing operations, sawdust may gather in piles and include destructive leachates into neighborhood water frameworks, making an ecological danger. The larger concern, are substances such as lignin and fatty acids that protect

trees from predators while they are alive, but can leach into water and poison wildlife. They cause toxicity and are toxic to a broad range of organisms. (Singer, 2005). For thousands of years, sand and gravel have been utilized as a part in the construction of roads and structures. Today, demand for sand and gravel keeps on expanding. The current demand for sand for building construction within the country is approximately 7 – 7.5 million cubic meters per year (Ranjana,2009). Therefore, alternative of replace the sand with waste material will reduced the problem of excessive river sand mining.

1.3 Objective

The objectives of this study are as follows:

1. To investigate the effect of sawdust as partial sand replacement on compressive strength and workability of adobe brick.
2. To determine the effect of sawdust as partial sand replacement on flexural strength of adobe brick.

1.4 Significance of Research

The main purpose of this research is to discuss the issue of excessive river sand mining in this country. Mining pits are responsible for river channel shifting as well as degradation of land, bringing on loss of properties and degradation of landscape. Instream mining lowers the stream bottom, which may lead to bank erosion. Sand, essentially, is the soil of the stream, giving and maintaining for all intents and purposes all life that exists in the river itself. Due to this problem, civil engineer has found the way to overcome it. One of it is by use the waste material to replace the fine aggregate. This research use the byproduct of timber which is sawdust. Sawdust can easily obtain and can overcome the dumping of sawdust in this country.

1.5 Scope of Study

The main purpose of this study is to investigate the mechanical properties of adobe brick containing sawdust as partial sand replacement. Two type of mix will be prepared in this research which is sawdust adobe brick and plain adobe brick as comparison purposed. Plain adobe will be prepared as a control and for sawdust adobe brick, five samples will be casted.

The raw soil sample was sieved to obtain particles with a size less than 5 mm. Two main areas were addressed in the investigation, which are methods for preparing and testing abode specimens and the mechanical properties of abode.

1.6 Layout of Thesis

Chapter one consist of information of information that give the general idea about the research. It included the background and problem statement of the study. This chapter also included objective of the research that need to be carried out and the significance of study. Scope of study is the last topic described in this chapter.

Next, in chapter two, it is about literature review on mechanical properties of adobe containing sawdust as partial sand replacement. First, history of sand regarding to the shortage of adobe materials and the characteristics of fine aggregate has been briefly discussed. Then, it continues to review the methodology of mix design and adobe properties have been discussed. Lastly, the properties of sawdust and development of research on utilization of sawdust has been presented.

After that, chapter three is discussed about the methodology of this research paper. At first, the materials that need to be used and procedures need to be clearly stated. Next, the process of mix adobe is elaborated and at the end the testing procedures is conducted to determine mechanical properties of the adobe.

Chapter four consists of results of the test. The data of all the tests have been analyzed and presented in graphical analysis to describe the mechanical properties of adobe. The properties of sawdust concrete and plain adobe are compared and discussion of the results is made to justify the results obtained. Lastly, chapter five includes the

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