STUDY OF SAND BRICK RATIO 1:6 FOR PARTIAL REPLACEMENT OF SAND WITH PALM OIL CLINKER (5%, 10%AND 15%)

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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 University Malaysia Pahang or any other institutions.

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ABSTRAK

Pada masa kini, industri pembinaan dan sistem pengurusan alam sekitar telah mengalami pembangunan yang pesat. Malangnya, pembangunan pesat industri pembinaan dan pengurusan alam sekitar telah membawa kepada pencemaran alam sekitar dan peningkatan penghasilan sisa daripada pelbagai sumber. Industri kelapa sawit adalah salah satu industri utama di Malaysia. Menurut Lembaga Minyak Sawit Malaysia (MPOB, 2015), pada tahun 2014 industri minyak sawit di Malaysia menghasilkan kira-kira 90 juta tan minyak sawit. Salah satu sisa yang dihasilkan dalam industri kelapa sawit adalah klinker kelapa sawit (POC). Penyelidikan ini adalah bertujuan untuk mengkaji mengenai penggunaan klinker kelapa sawit (POC) sebagai bahan penggantian separa untuk agregat halus dalam campuran bata simen dan pasir. Kajian ini akan memberi manfaat kepada alam sekitar dengan mengurangkan penggunaan pasir semula jadi. Kesan penggunaan peratusan yang berbeza POC untuk LWSB digunakan untuk mengkaji kekuatan mampatan. Terdapat tiga siri formulasi campuran simen pasir bata dengan ketumpatan campuran 1600 kg/m^3 telah disediakan yang terdiri daripada 5%, 10%, 15% sebagai pengganti pasir, separa daripada jumlah isipadu pasir akan digantikan dengan POC. Hasil daripada menggantikan POC telah menunjukkan bahawa kekuatan yang dihasilkan oleh bata tersebut mempunyai nilai kekuatan yang baik dan memenuhi keperluan di dalam standard JKR.

ABSTRACT

Nowadays, the construction industry and environmental management system has experienced a rapid development. Unfortunately, the rapid development of construction industry and environmental management has led to environmental pollution and the increased of waste generation from various sources. The oil palm industry is one of the major industries in Malaysia. According Malaysia Palm Oil Board (MPOB, 2015), palm oil industry in Malaysia produces about 90 million tons of palm oil in year 2014. A massive number of production will results to the massive number of waste produced. One of the waste produced in the oil palm industry is palm oil clinker (POC).This research is to study on the use of palm oil clinker (POC) as partial replacement for fine aggregate in cement sand brick. This study will benefits on reducing the use of natural sand. The effect of using different percentages of POC to LWSB due to compressive strength was investigated. There are three series of mix formulation of cement sand brick with mix density of 1600 kg/m^3 were prepared that comprise of 5%, 10%, 15% as partial sand replacement from the total volume of sand was replaced with POC. The outcomes from replacing POC has resulting a good strength as in per requirement in JKR standard.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

ρ	Density
m	Mass
V	Volume of brick
W	Water absorption rate
N/mm^2	Newton per millimetre square
Kg/mm^3	Kilogram per millimetre cube

LIST OF ABBREVIATIONS

POC	Palm Oil Clinker
MPOB	Malaysia Palm Oil Board
JKR	Jabatan Kerja Raya
PWD	Public Work Department
CTMS	Centre of Technology Management & Services

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Nowadays, the construction industry and environmental management system has experienced a rapid development. Unfortunately, the rapid development of construction industry and environmental management has led to environmental pollution and the increased of waste generation from various sources. The oil palm industry is one of the major industries in Malaysia. According Malaysia Palm Oil Board (MPOB, 2015), palm oil industry in Malaysia produces about 90 million tons of palm oil in year 2014. A massive number of production will results to the massive number of waste produced. One of the waste produced in the oil palm industry is palm oil clinker (POC).

Palm oil clinker (POC) is a waste that are produced after the completion of the incineration process of palm oil shell and palm oil fibre in the boiler under temperature of about 850°C to heat the water until the steam was generated (Ahmmad et al., 2015). Physically palm oil clinker (POC) are porous, grey in colour, irregular in shape and much lighter compare to normal aggregate (Kandasan and Razak, 2015). POC size normally in sizes of 150mm to 200mm and it is easily to be found in Malaysia. Thus, POC has a potential to be used as replacement in construction material and one of the suggested material that can be replace by POC is sand. Sand is one of the material that largely used in construction industry and were obtained from natural resources. Lately, the price of the sand has increase due to the limited resources and demand for the material. Utilizing POC as a partial sand replacement might be a good move for the construction industry since the POC is low-cost compared to ordinary sand and at the same time we are able to preserve the environment from polluted.

1.2 Problem Statement

As the world is moving towards the concept of 3R (Recycle, Reuse, Reduce) and a sustainable environment, the reuse of waste materials not only helps to save the environment but also preserves the reduction of natural resources. Using a waste from the oil palm industry in the construction industry is a smart move towards creating sustainable environment. Palm Oil clinker (POC) is one of the waste produced by oil palm industry. Around 2.6 million tons of solid waste was produced annually by the palm oil industry which mostly composed of POC and palm oil shell (Basri et al., 1999). POC has a potential to be used as partial replacement for the fine aggregate in cement sand brick production after being crushed.

The source of the ordinary sand was from the natural resources and it is not renewable. Thus, reducing the natural sand used is one of the way to sustain the environment. Overuse of natural sand from river can causes river channel degradation and erosion, head cutting, increased turbidity, stream bank erosion and sedimentation of riffle areas (Kondolf,1993). Thus, a study on the use of palm oil clinker (POC) as partial replacement for fine aggregate in cement sand brick with a view of utilization of the resources and to save environment is necessary. In order to examine the effectiveness of POC as a partial sand replacement in cement sand brick and it applicability, few lab testing were conducted and the result will be compare with plain cement sand brick.

1.3 Objective of Study

The objectives of the study are:

a) To determine the optimum ratio of palm oil clinker in cement sand brick.

b) To investigate the characteristics of cement sand brick with palm oil clinker in terms of density, water absorption rate, compressive strength and flexural strength.

1.4 Scope of Study

In this study, the dimensions of the brick are according to the Public Work Department (PWD) Standard Specification for Buildings Works, 2005, Section E – Brickworks, it stated that, all cement sand brick shall comply with MS 27. The nominal size of cement sand brick is, the length is 225 mm (± 3.2), width is 113mm (± 1.6) and depth is 75mm ± (1.6).

The ratio used for the brick mixture is 6 ratio 1 (6:1), 6 parts for sand and 1 part for cement. The percentage of sand brick with palm oil clinker as partial replacement for fine aggregate are limited to percentage of ratio 5% 10% and 15%. The specimen will be examined in detail on the characteristics of the cement sand brick that are brick density, water absorption rate, compressive strength and flexural strength. The laboratory testing for the properties of the sand brick will be conducted at 28 days, 60 days and 90 days.

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