THE MECHANICAL PROPERTIES OF CONCRETE CONTAINS PALM OIL CLINKER AS COARSE AGGREGATE REPLACEMENT AND POFA AS CEMENT REPACEMENT

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B. ENG (HONS.) CIVIL ENGINEERING

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SUPERVISOR'S DECLARATION

"I hereby declare that I have checked this project report and, in my opinion this thesis is adequate in terms of scope and quality for the award of the degree of Bachelor of Civil Engineering (Hons)."

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STUDENT'S DECLARATION

"I hereby declare that the work on this thesis is my own except for quotation and summaries, which have been duly, acknowledge in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree."

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ABSTRACT

The usage of agricultural waste in form of ashes as one of the constituent materials in concrete has been done through the years The dumping of POC in growing quantity throughout the years worsen the environmental pollution, consumes larger disposal area and increases the cost spent by the palm oil mill in managing the waste. The main aim of this research is to study the mechanical performance of concrete containing palm oil clinker as partial course aggregate replacement with fix percentage and palm oil fuel ash as cement replacement the increasing aggregate and cement mining activity to due to growth of construction industry in Malaysia, demand toward construction material. In addition, the escalation of palm oil clinker (POC) and POFA disposal from Malaysian palm oil industry have caused negative impact to the environment quality. The objectives of this study are to investigate the effect of palm oil clinker as partial course aggregate replacement and POFA as partial cement on workability, compressive, flexural strength. Generally, there are three different percentages of POFA replacement in concrete mixture, which are 0%, 5%, and 10% respectively of palm oil fuel ash and fix percentage of POC, which is 25% in all mix. For compressive strength test and flexural test, the concrete are tested on 7, and 28 days. The same mixture also, was used to conduct module of elasticity test and tensile test. The concrete mixture was designed according to British standard with water cement ratio of 0.45. For compressive strength test, 24 cubes size 150mm x 150mm x 150mm were tested on 7, and 28 days each. Meanwhile, for flexural test, 24 concrete beam size 100mm x 100mm x 500mm been tested on 7, and 28 days for each test. Not to forget the slump test also was conducted for fresh concrete test. This research reveals the usage of POFA in concrete mixture can improve the compressive strength test and acoustical properties specifically for sound insulation. But the usage of POFA in concrete mixture strictly must not exceed 10% as it will decrease the performance of the concrete strength on the other hand the best percentage for palm oil clinker as course aggregate partial replacement is 25% otherwise will lead to decrease compressive and flexural strength

ABSTRAK

Penggunaan sampah pertanian dalam bentuk abu sebagai salah satu bahan konkrit dalam konkrit telah dilakukan selama bertahun-tahun Pembuangan POC dalam kuantiti yang semakin meningkat sepanjang tahun memburukkan pencemaran alam sekitar, menggunakan kawasan pelupusan yang lebih besar dan meningkatkan kos yang dibelanjakan oleh sawit kilang minyak dalam menguruskan sisa buangan. Tujuan utama kajian ini adalah untuk mengkaji prestasi mekanikal konkrit yang mengandungi klinker minyak kelapa sawit sebagai pengganti agregat kursus separa dengan peratusan penetapan dan abu bahan api kelapa sawit sebagai penggantian simen peningkatan agregat dan aktiviti perlombongan simen disebabkan oleh pertumbuhan industri pembinaan di Malaysia , permintaan terhadap bahan pembinaan. Di samping itu, peningkatan klinker minyak kelapa sawit (POC) dan pelupusan POFA dari industri minyak sawit Malaysia telah memberi impak negatif terhadap kualiti alam sekitar. Objektif kajian ini adalah untuk mengkaji kesan klinker kelapa sawit sebagai pengganti agregat kursus separa dan POFA sebagai simen separa pada kebolehkerjaan, kekuatan mampatan, lenturan. Secara amnya, terdapat tiga peratusan yang berbeza daripada penggantian POFA dalam campuran konkrit, iaitu 0%, 5%, dan 10% masing-masing ash ash minyak sawit dan menetapkan peratusan POC, iaitu 25% dalam semua campuran. Untuk ujian kekuatan mampatan dan ujian lenturan, konkrit diuji pada 7, dan 28 hari. Campuran yang sama juga digunakan untuk menjalankan modul ujian keanjalan dan ujian tegangan. Campuran konkrit direka mengikut standard British dengan nisbah simen air sebanyak 0.45. Untuk ujian kekuatan mampatan, saiz 24 kiub 150mm x 150mm x 150mm diuji pada 7, dan 28 hari setiap satu. Sementara itu, untuk ujian lenturan, 24 saiz rasuk beton 100mm x 100mm x 500mm telah diuji pada 7, dan 28 hari untuk setiap ujian. Tidak lupa ujian kecondongan juga dijalankan untuk ujian konkrit yang baru. Kajian ini menunjukkan penggunaan POFA dalam campuran konkrit dapat meningkatkan ujian kekuatan mampatan dan sifat akustik khusus untuk penebat bunyi. Tetapi penggunaan POFA dalam campuran konkrit secara tegas tidak boleh melebihi 10% kerana ia akan mengurangkan prestasi kekuatan konkrit di sisi lain peratusan terbaik untuk klinker minyak sawit sebagai penggantian sebahagian agregat

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LIST OF SYMBOLS

%	Percent
mm	Millimetre
mm^2	Millimetre square
m^3	Cubic metre
μm	Micro metre
g	Gram
kg	Kilogram
kg/m^3	Kilogram per cubic metre
MPa	Mega Pascal
kN	Kilo newton
C ^{o}	Degree Celsius
$^\circ$	Degree
kN/sec	Kilo newton per second
f_c	Compressive strength of concrete specimen
P	Maximum load carried by the specimen during testing
A	Area
R	Modulus of Rupture
l	Distance between the support
b	Net width
d	Depth

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Since the early age, human civilization has started inventing things for the purpose of survival. However as time passes by, the dynamic human mind made them easily became weary of using the same tools or method in their life and always yearn for improvement. Because of the end user demand, until now researchers is motivated to continuous work industriously leading to design of new material or modification of the existing things to be better than before and at the same time fulfil the current consumer requirement. In the field of building industry, construction material specifically concrete is one of the areas that have be subjected to constant research in order to support the growing industry need besides offering more choices of material for contractors to used in construction project.

Concrete is one of the most important materials in building construction and other infrastructure works. About 2.7 billion m^3 of concrete was generated in 2002 worldwide, which is more than 0.4 m^3 of concrete generated per person once a year (Naik, 2008). It is anticipated that the need for concrete will increase further to almost 7.5 billion m^3 (about 18 billion tons) a year by 2050 (Monteiro, 2015). Such an enormous utilization of concrete calls for higher use of natural aggregates and cement, thus taking toll on the environment. At least three-quarters of the total volume of concrete consists of coarse and fine aggregates (Rafieizonooz, 2016).

At the same time in Malaysia, the government, professional bodies and private companies are beginning to take heed in the necessity to reduce this environmental problem. Construction industry must inevitably change its historic methods of operating with little regard for environmental impacts to a new mode that makes environmental concerns a on the concern previously, centerpiece of its efforts. Environment is relatively a small part of most of construction development. However, with the growing awareness on non-of depletion to protection due environmental the renewable resources, global warming and extremity of destruction to ecology and biodiversity impact, this issue have construction practitioners the by gain wider attention worldwide (Nazirah Zainul Abidin, 2010).

Therefore, man has developed concrete to increase the ability, hardness and durability to create a more economical and environmentally friendly concrete, and the construction of skyscrapers and huge structures. Furthermore, Concrete is one of the most important elements of life and must develop to meet the needs of modern times. Supplementary materials are one of the strategies used to improve concrete performance. After many researches, many materials we discovered that contain pozzolanic molecules that can be partially added to cement to improve the performance of concrete and its mechanical properties and the change properties depend on the type and quantity of the material supplemented.

Palm oil industry is one of the major agro-industries in countries like Malaysia, and this industry produces a large amount of waste in the forms of empty fruit bunches, fibres and kernels. These by-products are normally used as fuel to heat up boiler for generation of electricity in palm oil factories.

The studies has revealed that agricultural waste ashes contained high amount of silica and may been used as a pozzolanic material. Palm oil is one of the agro waste ashes whose chemical composition contains a large amount of silica and potentially used as a cement replacement Due to high silica oxide content in POFA that met the pozzolanic properties criteria, it is potentially utilize as cement replacement or as filler to produce strong and durable concrete

1.2 PROBLEM STATEMENT

The problem of waste accumulation exists worldwide, specifically in the densely populated areas. Most of these materials are left as stockpiles, landfill material or illegally dumped in selected areas. Large quantities of this waste cannot be eliminate. However, the environmental impact can be reduce by making more sustainable use of this waste. This is known as the ''Waste Hierarchy'' as shown in (figure 1.1). Its aim is to reduce, reuse, or recycle waste, the latter being the preferred option of waste disposal (Batayneh, et al., 2007).

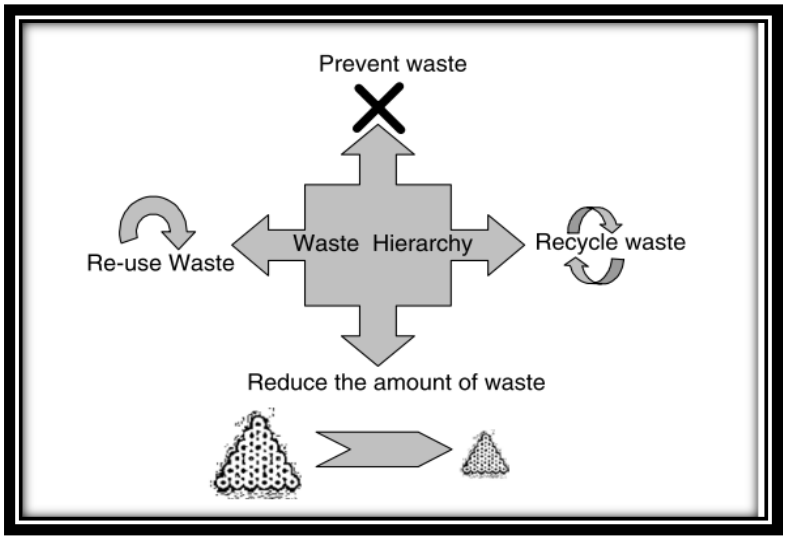

Figure 1.1: Waste Hierarchy

Sources: (Batayneh, et al., 2007).

Large amount of waste generated from palm oil in Malaysia and other Asian-Pacific is commonly use as landfills due to lack of economically attractive use opportunities. Landfilling is detrimental because it causes not only enormous financial burdens to the producer of by-products, but also makes them accountable for the unknown future environmental liabilities. Moreover, due to shrinking of landfill space and increased environmental restrictions, cost of landfilling may be on the high side. Additionally, Malaysia strives to maintain a leading role in palm oil production, thus increased palm oil plantation from 400 hectares in 1920 to about 3.6 million in 2002, with a targeted expansion of 5.2 million by the year 2020 (Basironand Simeh, 2005). Therefore, it

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