THE EFFECT OF PALM OIL CLINKER POWDER & COCKLE SHELL POWDER AS CEMENT REPLACEMENT TO CONCRETE MECHANICAL PROPERTIES

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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 degree of Bachelor 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 University Malaysia Pahang or any other institutions.

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Thesis submitted in fulfillment of the requirements

for the award of the degree of

Bachelor of Civil Engineering

Faculty of Civil Engineering and Earth Resources

UNIVERSITI MALAYSIA PAHANG

JANUARY 2019

ACKNOWLEDGEMENTS

First and foremost, praises be to Allah, the Almighty, who has given me the strength to complete this final year project as a requirement for graduation and successful award of the bachelor's degree (Hons.) Civil Engineering from University Malaysia Pahang (UMP).

Secondly, I would like to thank a number of people, to whom I am greatly indebted. Without them, this research might not have been successfully accomplished. I wish to express my gratitude to my supervisor, Dr. Fadzil Bin Mat Yahaya for his hard work and guidance throughout this study. Thank you for believing in my abilities and for giving me the foundation to explore further in this area. I would also like to thank to technical member staffs of Civil Engineering Concrete Laboratory UMP for helping and guiding me during conducting the lab tests.

To my family members who have always been supporting me through thick and thin, no words can describe how grateful I am to be a part of my family. Thank you for all the support and prayers which have helped me to remain strong and focused for completing this research.

Lastly, to all my friends, thank you for those who helped me directly or indirectly, both in my study and in my personal life. I wish you all the best in your future.

ABSTRAK

Bahan-bahan konkrit merupakan satu kebimbangan yang ketara melalui tahun yang lalu dan terdapat penyelidikan yang besar kepada mencari alternatif kepada bahan-bahan tradisional. Antara bahan-bahan yang paling biasa untuk digantikan adalah sawit sisa klinker minyak pada bentuk serbuk disebabkan oleh kehadiran silika (bahan pozzolanic) yang membantu menegakkan kekuatan konkrit dan boleh didapati di Malaysia juga serbuk shell kerang yang terdiri daripada kalsium karbonat dalam bentuk aragonite dan calcite. Objektif kajian ini adalah untuk mengkaji kekuatan mampatan konkrit dan lenturan menggunakan Cockleshell dan klinker kelapa sawit sebagai pengganti simen dengan kadar yang berbeza. Untuk kajian ini, terdapat enam peratusan yang berbeza klinker kelapa sawit dan penggantian Cockleshell dalam campuran konkrit. Untuk ujian kekuatan mampatan dan ujian lenturan, konkrit diuji pada 7, dan 28 hari. Campuran konkrit telah direka mengikut ASTM C 109 / C 109M standard dengan nisbah air simen daripada 0,485. Untuk ujian kekuatan mampatan, 36 kiub bersaiz 50mm x 50mm x 50mm telah diuji pada 7 dan 28 hari setiap satu. Selain itu, untuk ujian lenturan, 36 saiz rasuk konkrit 160mm x 40mm x 40mm telah diuji pada 7 dan 28 hari bagi setiap ujian. Kajian ini mendapati bahawa kekuatan mampatan dan lenturan adalah penurunan dengan meningkatkan serbuk klinker kelapa sawit dan peratusan serbuk kerang shell sebagai pengganti simen.

ABSTRACT

Concrete materials have been of a significant concern through the past years and there has been a huge research on finding alternatives to the traditional materials. Among the most common materials to be substituted are palm oil clinker waste on form of powder due to a presence of silica (pozzolanic material) which helps uphold the strength of concrete and is available in Malaysia also cockle shell powder which consists of calcium carbonate in the form of aragonite and calcite. The objective of this research is to examine the concrete compressive strength and flexural using cockleshell and palm oil clinker as cement replacement with different proportion. For this research, there are six different percentages of palm oil clinker and cockleshell replacement in concrete mixture. For compressive strength test and flexural test, the concrete is tested on 7, and 28 days. The concrete mixture was designed according to ASTM C 109/C 109M standard with water cement ratio of 0.485. For compressive strength test, 36 cubes size 50mm x 50mm x 50mm were tested on 7, and 28 days each. Moreover, for flexural test, 36 concrete beam size 160mm x 40mm x 40mm were tested on 7 and 28 days for each test. This study found that the compressive and flexural strength were decrease by increasing palm oil clinker powder and cockle shell powder percentage as cement replacement.

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LIST OF ABBREVIATIONS

POCP	Palm oil clinker powder
CSP	Cockle shell Powder
PCC	Portland composite cement
$CaCO_3$	Calcium carbonate
SiO_2	Silicon dioxide
H_2S	Hydrogen Sulfide
CO_2	Carbon dioxide
CaO	Calcium oxide
Fe_2O_3	Ferric oxide
MgO	Magnesium oxide
K_2O	Potassium oxide
P_2O_5	Phosphorus pentoxide
TiO_2	Titanium dioxide
Al_2O_3	Aluminium oxide
SO_3	Sulfur trioxide
LOI	Loss of ignition
CPC	Composite Portland cement
OPC	Ordinary Portland Cement
Na_2O	Sodium oxide
SrO	Strontium oxide

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Concrete nowadays is considered by some to be the most important element used in construction, due to its strength, moldability, and price. Concrete is cheap, and the maintenance costs for concrete are rather low, which makes it an economical solution in the long run. These benefits make concrete the most preferable choice for any designed structure, and the alternatives cannot provide the same features for the same price and strength.

Sustainability is a major criterion that is being developed currently in construction engineering, to achieve some environmental goals, and to aid in developing lasting structures that do not rely cement or other specific materials. One of the main aspects of sustainable development is to encourage the use of materials that do not cause -or reduce- the hazardous impacts generated from the materials mainly used in the industry, as well as reducing the large demand on those specific natural resources. When this large demand and consumption decreases, there will be an accompanying environmental benefit (Rafieizonooz, 2016).

Nowadays, there is an approach to add some variability to the main components of concrete, and researches are conducted to look for an optimal solution that can be used to substitute ordinary cement -or Portland Cement- or to reduce its proportion in concrete without affecting its strength, and in some cases, adding other benefits that aren't provided in regular concrete. This trend has provided some substitutes that are used now in the industry that provide real life benefits to the concrete's strength. Materials such as fly ash and blast-furnace slag are used currently in some proportions in concrete, which leads to the reduction in emitting toxic gasses, while also encouraging the use of such materials that were usually considered as "waste".

Researches are done now on cement replacements and their effect on concrete properties to test the practicality of these replacements, as well as the benefits that they can provide to concrete, and to the industry in general. One of the weak points in ordinary concrete is its weakness in tension. Concrete is a brittle material, and that brittleness results in cracks. Corrosion in another disadvantage in concrete that is studied nowadays, and researchers are looking for substitute materials that can provide an improvement to these forms of weakness, which will result in better concrete overall.

The use of partial cement replacements can provide some significant benefits to the properties of concrete, as well as enhancing its strength. With this advancement, there has been an increase in use of agricultural waste in for of ashes, and this has led to the introduction to the use of Palm Oil Clinker (POC) as a partial cement replacement. POC is a waste material obtained from the burning of palm oil husk and palm kernel shell as fuel in palm oil mill boilers.

Agricultural wastes have been studied by researchers, and actual benefits have been discovered when used as partial cement replacements, while also generating reducing the generated amount of carbon dioxide, which results in negative environmental impacts, whilst also reducing energy consumption.

POC's use as partial cement replacement could provide some benefits to the end-product. A large volume of POC is dumped annually, which can be used in this field to aid sustainable development and reduce waste materials in landfills. The use of POC in concrete will also reduce energy consumption and will reduce the total cost of transportation and production.

Another waste material that can be used for this purpose is waste seashells. Since they have a large amount of calcium (Azmi & Johari, 2013), they can be used to compensate for the lack of calcium in POC which will partially replace with cement. There are many different types of waste seashell available, such as oyster shells, scallop shells, periwinkle shells and cockle shells. Large amounts of seashells are thrown as waste each year, with minimal amount being used for other purposes. Re-use of seashells is limited mainly because of restrictions on the amount that can be used, the problem of soil solidification, and economic problems.

1.2 PROBLEM STATEMENT

Nonbiodegradable waste materials are challenging to disposal and consequently pose a big hazard to the environment. Hence, there is a steady in realizing for higher percentage the sustainability of concrete manufacturing the utilization of recycled waste materials as substitutes for conventional materials in concrete. POC is main disposed in landfills, which effects in the improved extent of substances deposits every 12 months and now has emerge as a burden. POC one of the elements ensuing from the burning of waste materials such as palm kernel shell and palm oil husk. With the accelerated in urbanization, population and industrialization, kinds of the extent and stable waste materials have also increased. non-biodegradable waste substances will continue to be in the surroundings for hundreds, perhaps lots of years. This purpose, various research has been carried out to utilize wastes originating from awesome sources, most of these wastes are reachable in large extent in positive countries, and hence, have the viable to be reused in huge scale concrete production. supplies of the utilization of waste in concrete among to average the trouble of excessive consumption of normal elements as great to reduce the amount of waste generated. In addition, there are troubles with illegal dumping of waste seashells into public waters and reclaimed land. These waste

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