AN EXPERIMENTAL STUDY OF THE STRUCTURAL CAPACITY OF RECTANGULAR CONCRETE BEAM WITH RICE HUSK CONCRETE (RHC) UNDER FLEXURAL TEST- 5% AND 15% RICE HUSK REPLACEMENT

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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this project 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 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.

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ABSTRAK

Objektif kajian ini adalah bertujuan untuk mengkaji dan menganalisa tentang kapasiti maksimum bebanan, kapasiti momen maksimum dan tindak balas lanturan yang boleh ditampung oleh konkrit bertetulang dengan penggantian peratusan pasir halus dan sekam padi. Peratusan penggantian antara sekam padi dan pasir di dalam kajian ini ialah 5% dan 15% dengan gred konkrit C25/30. Jumlah sampel rasuk konkrit bertetulang yang telah disediakan adalah sebanyak 9 sampel yang berukuran 1500 mm x 150 mm x 300 mm bagi ujian lenturan dan 9 sampel kiub berukuran 150 mm x 150 mm x 150 mm bagi ujian kekuatan kompresif. Diantara 9 sampel tersebut, 3 daripadanya disediakan sebagai sampel contoh bagi tujuan rujukan dan 6 sampel selebihnya masing-masing dengan 5% dan 15% penggantian sekam padi. Hasil keputusan daripada kajian ini, nilai kapisiti maksimum bebanan bagi 5% penggantian sekam padi di dalam rasuk dan sampel rasuk rujukan menunjukkan tiada perbezaan yang ketara. Walau bagaimanapun, nilai kapasiti maksimum bebanan berkurang apabila penggantian sekam padi di dalam rasuk meningkat sebanyak 15%. Tambahan pula, lenturan rasuk bagi 5% penggantian sekam padi dan rasuk rujukan menunjukkan hasil yang positif dimana nilai lenturan kedua-dua sampel tiada perbezaan yang ketara. Bagi 15% peggantian sekam padi, graf lenturan menunjukkan lenturan terjadi lebih awal berbanding kedua-dua sampel yang lain. Nilai momen maksimum juga semakin berkurangan apabila sekam padi digantikan sebanyak 15% berbanding dengan 5% dan rasuk rujukan. Tujuan kajian ini dilakukan adalah bagi menyumbang alternatif dalam industri pembinaan dengan tujuan menghasilkan bangunan yang lebih murah tetapi mempunyai kekuatan dan kualiti yang sama, membantu menyelamatkan sumber alam semula jadi dan membantu negara dalam masalah kekurangan tempat pelupusan sampah. Kesemua ujian dan kajian telah dilakukan oleh staf yang mahir dan data telah dikumpul dan dianalisa.

ABSTRACT

The purpose of this study is to investigate the ultimate loading capacity, maximum moment capacity and deflection that can withstand by a reinforced concrete with the replacement of certain percentage of fine aggregate or sand with raw rice husk. The percentage replacements of the raw rice husks involve in this study are 5% and 15% mixed with concrete grade C25/30. The total of sample that had been prepared is 9 reinforced concrete beams with dimensions of 1500mm x 150mm x 300mm for flexural test and 9 cube samples which dimension size is 150mm x 150mm x 150mm for compressive strength test. Within the 9 beam samples, 3 of it is for controlled sample as references and another 6 beam samples is for 5% and 15% of rice husk replacement respectively. The results from this study indicates that, the ultimate loading capacity between 5% raw rice husk replacement beam and controlled beam show no huge differences. However, the ultimate loading capacity decrease when the rice husk replacement increase up to 15%. In addition, the deflection of 5% testing sample and controlled beam sample shows positive outcome where both deflection value is quite same. For the 15% sample, the curve of deflection shows that the deflection occurs faster than other two samples. The maximum moment also keep decreasing when the 15% replacement of rice husk in the beam while no big gap between the controlled beam and 5% beam samples. The aim of this experimental study is to contribute the idea to construction industry in order to produce economical buildings with same quality of strength, help in saving the natural sources and also help the government on the issues of constraint landfill area. All the testing is conducted in laboratory by the competent technical staff and the result is gathered and analyse precisely.

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LIST OF SYMBOLS

%	Percentage
Kg	Kilogram
mm	Millimetre
N	Newton
kN	Kilo Newton
Mpa	Mega Pascal
ε_y	Steel Strain
ε_c	Concrete Strain
RHC	Rice Husk Concrete

LIST OF ABBREVIATIONS

%	Percentage
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CHAPTER 1

INTRODUCTION

1.1 Background Of Study

Shelter is reffered to any architectural structure or building that provides cover to the mankind or living organisms. World population currently 7.3 billion is expected to reach 8.5 billion by 2030 and 9.7 billion in 2050 according to new UN DESA report, "World Population Prospects: 2015 Revision". Increasing the population will also lead to the increasing of buildings such as shelter, workplace and infrastructural. Generally know that, every structural building is bulit using concrete. The environmental impact of concrete whether it application or production become serious issues nowadays. Many researches all around the world struggle in their study to overcome this issue and come out with several solutions. The biggest problem from this issue is, concrete will only produce by mixing of several natural resources which are cement, aggregate and water. As the time goes by, production of concrete cannot only depend on these resources all the time because sooner or later, the natural resources decreasing by time. Nowadays, there are so many researcher and scientist come out with innovative ways to enhance the production of concrete using alternative resources.

This research is focuses on how a structure react when the fine aggregate is partially replace with some percentage of raw rice husk in concrete mixing. Some must be asked why fine aggregate and why rice husk. The main reason for replacement of fine aggregate or commonly called sand is due to intensively used of this raw material not only in construction industries to make cement, mortar, ceramics and glass but also being used in other industries such as in water filtration, in chemicals and metals processing and in plastic industry. The United Nations Environment Programme stipulates that" the use of sand greatly exceed their natural renewal rates". One can imagine that the problem will solve easily due to desert covered almost 20% of Earth

with sand. The truth is not all type of sand is suitable for the market demand. The facts is several countries from Middle East that surrounded by desert imported large quantities of sand. As an example, Qatar imported sand and gravel around $6.5B in 2012 (Schoof, J, 2016). Meanwhile in Malaysia now, about 0.48 million tonne of rice husk (UNDP,2002) still not fully utilized. Rice husk or rice hulls are the coatings of seeds, or grains of rice. It function is to protects the seed during growing season since it formed from hard materials which are opaline silica and lignin. General knows, Malaysian staple food is rice. Therefore, Malaysia's agriculture department is targeting to expand the output of paddy sector to 9 to 10 tons per hectare in 2020 (NCER,2007). Increasing of paddy residue will lead to the waste management problem if cannot be manage in good condition. The burning of it will cause serious air pollution (Singh,2015). Besides the excess amount of rice husk in Malaysia, it is chosen as byproduct due to the price also far cheaper than sand that surely can give positive impact of the concrete price in the future.

The concrete containing agriculture product such as rice husk is categorized as light weight concrete. The advantages of the lightweight concrete are larger strength-to-weight ratio, greater strain capacity, lower changes of the size of object with a change in temperature and better heat and sound insulation (Chen 2008). However, lightweight concrete also has its correlated disadvantages such as lower indirect tensile strength and lower workability.

1.2 Problem Statement

The conventional reinforced concrete design method seem to lead several issue in term of environmental and cost whether it production or application. It is time to confidently consider the other alternative of making it such as partial replacement of main material with by-product or unutilized agriculture material in order to minimize the negative impacts. The main problem that led to this alternative is limited of natural resources which are used in production of concrete structure. One of the raw materials for concrete mixing is fine aggregate or also known as sand. This study try to find solution by replacing some percentage of find aggregate with raw rice husk obtain from paddy factory.

Second is environmental issue. The fine aggregate will only get by sand mining from terrestrial deposits like river channel, flood plain alluvial and marine deposits such as at the shore and offshores deposits (Gelabert, 1997) . River sand mining can causes the destruction of aquatic habitats by bed degradation, lower water levels and channel degradation. The physical disturbance of sediment while dredging the sand affects the suspended solids and the turbidity of water increasing. The turbidity will degraded water quality and reduce light penetration within river affect the photosynthesis rates and fish population in the river. The most dangerous effect of sand mining is the water quality will drop drastically according to Water Quality Index (WQI). If the WQI shows the quality of river in Class 3, it will need extensive treatment before it can be used by people.

Third issue is cost of sand as raw material in concrete production. We are living in era that cost of building are too expansive that people cannot afford to buy their own houses especially in Malaysia. Any alternative of concrete production that can reduce the cost of building surely welcoming in this industry for the benefit of all people as long as it can promise that the new method ensure the structure safety.

Last but not least, constraint of landfill area is one of the problems that need to take into account (Shafie, 2015). Uses of unutilized rice husk may give a bit positive solution to the problem. Landfill area in Malaysia also limited to domestic waste. The addition of agriculture waste may lead to the lack of landfill area. Moreover, if these unutilized agriculture dispose by burning them, surely it will cause serious haze pollution not only in Malaysia but may be dispersed to our neighbour surround us like Indonesia, Thailand and Singapore. One way as what is proposed in this research paper is to use the rice husk as by-product or partial replacement of fine aggregate. This may help a lot to reduce the few problems that related to concrete environmental issue, cost of structure and maintaining environmental health.

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