POLITEKNIK MELAKA

DEVELOPMENT OF COLORED BLOCKS BASED ON RICE HUSK ASH (RHA) WITHOUT CEMENT FOR PLANTER BOX APPLICATIONS

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STATEMENT OF AUTHENTICITY AND OWNERSHIP

DEVELOPMENT OF COLORED BLOCKS BASED ON RICE HUSK ASH (RHA) WITHOUT CEMENT FOR PLANTER BOX APPLICATIONS

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3. I agree to release ownership of the intellectual property of 'the said Project' to 'the said Polytechnic' to fulfil the requirements for the award of **Diploma in Civil Engineering** to us.

Made and truly acknowledged
by the said:

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Before may, PN. ERAWATI BINTI MAHRILAR (IC [redacted])
as project supervisor on date …….

…….	…….
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CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION

We have been using concrete products made from cement on our constructions almost since time began. But, the construction industry has also increasingly become a culprit when it comes to carbon dioxide (CO_2) emissions, just because of the process of making cement. It is not a problem that is unique to Malaysia but one that has long been a problem everywhere. According to the data from my findings, this industry is presumed to emit about 8% of the world's total CO_2 emissions, which negatively impacts the environment in the forms of global warming and variations in climate (Andrew, 2019).

One alternative material that I want to highlighted is Rice Husk Ash (RHA). RHA is produced from the burning of rice husks and contains a high silica content, making it suitable as a binding agent in concrete. Its not only use to reduces dependence on cement but also helps in minimizing agricultural waste, which is continuously increasing in Malaysia (Mehta & Monteiro, 2014). One study suggest that RHA can increase the strength and durability of concrete, making it an ideal material for sustainable development (Zhang et al., 2019).

Besides that, in the context of urban landscaping and horticulture, planter boxes have gained popularity as a method of increasing greenery in the built environment. Planter boxes not only serve as a medium for planting in limited spaces like high rise buildings, but also help reduce the impact of urban heat (Lee & Tan, 2020). However, most planter boxes nowadays are made from less environmentally friendly material, such as conventional cement based concrete or synthetic plastics that are difficult to decompose or dispose of.

Therefore, this project aims to evaluate the feasibility of using colored RHA blocks with zero cement in planter box applications. In short, this project will evaluate the durability, material efficiency and environmental impact of using these blocks as a more sustainable alternative material. With this innovation to be developed, planter boxes can be produced with a more environmentally friendly approach without compromising on their aesthetics, as well as supporting greener and more sustainable urban development.

1.2 BACKGROUND OF THE STUDY

The construction industry is, in this age of rapid development, one of the most environmentally stressing industries. Cement is used for making many of the building blocks that make up our world. But the cement industry is a significant producer of carbon dioxide (CO_2), a greenhouse gas that is a leading cause of climate change. Cement production process needs high temperatures burning of about 1400 to 1500°C that use more fossil energy such as coal or natural gas and emissions more gas of greenhouse. Hence, there is an urgent demand to explore more environmentally and sustainable alternative to reduce the use of cement in construction industry (Mehta & Monteiro, 2014).

Meanwhile, Malaysia is abundant with the agriculture waste, such as rice, which generating the high volume of rice husk waste every year. Rice husk is a widely available, but frequently underutilized agriculture waste product which is either dumped in the landfill or burnt openly, resulting in air pollution and loss of a valuable resource. Rice Husk Ash (RHA) is rich in silica and it is a proven fact that can be used either partially or completely in substitute of cement in the construction materials (Ganesan et al., 2008). It has been reported in earlier studies that RHA incorporated in construction materials decreases carbon dioxide (CO_2) emissions as well as improves the durability and strength of the materials.

Additionally, most planter boxes that are use in landscape development and green city concepts right now are made from materials for example concrete, plastic, or wood. Eventhough these materials are chosen for their durability and stability, but it negatively impact the environment**.** Concrete planter boxes contribute to higher carbon emissions**,** plastic planter boxes generate waste pollution, and wood based planter boxes contribute to deforestation, reducing natural resources. Hence, developing planter boxes using blocks made from RHA without cement offer a more sustainable approach, aligning with green technology principles in construction (Chandra & Berntsson, 2003). This project aims to develop colored RHA blocks without cement as the primary building material for eco-friendly planter boxes. By replacing cement with RHA and clay in block mixtures, this initiative can reduce carbon emissions and also take advantage of agricultural waste that has been underutilized. This study not only decrease the environmental impact of the construction industry but also promotes innovation in alternative building materials that are more sustainable in Malaysia.

1.3 PROBLEM STATEMENT

The building materials industry is one of the biggest purchasers of cement globally. Cement is an important component of structural strength, but overuse has produced disturbing environmental consequences. A lot of heat is needed for the production of cement. This implies reliance on an abundant supply of natural gas as well as oil and coal. That is going to dump massive amounts of CO_2 into the atmosphere and further accelerate warming and climate change. Because of the movement towards sustainability, new alternative materials to reduce cement use are necessary.

Meanwhile, among agricultural waste, rice husk ash (RHA) is an abundant byproduct in rice producer countries like Malaysia. If not properly managed, rice husk may be a source of environmental pollution, such as open field burning of the husk which can emit detrimental compounds. But the high silica content of RHA indicates that it can be used as a type of supplementary material in construction. The use of RHA as a pozzolanic replacement for cement can assist in limiting waste, coupled with the reduction of carbon emission linked to cement production.

What's more, planters are also vital elements for beautifying urban landscape and paving the way for greener living and urban regeneration. Traditional planter boxes, however, are typically constructed from non biodegradable materials. For instance, wooden planter box encourage logging, and hence, destruction of habitats of flora and fauna. Meanwhile, synthetic planter box is hard to biodegrade and wasted to landfill. Hence making planter box with alternate material like based RHA can be an ecofriendly solution with structural integrity as well as aesthetic value.

Therefore, this study hopes to fill the gap by investigating the potential of using colored RHA with zero cement blocks as a sustainable choice in planter box construction.

1.4 OBJECTIVES OF THE PROJECT

This study is conducted to identify the potential of using rice husk ash (RHA) as an alternative binder to cement in the production of colored blocks for decorative planter boxes. The study focuses on developing an eco-friendly construction material that can reduce environmental pollution caused by cement production while utilizing agricultural waste effectively. Based on this purpose, the objectives of the study are as follows:

1. To develop colored blocks without the use of cement by utilizing raw rice husk ash (RHA) as the main binder for planter box applications.
2. To determine the physical and mechanical properties of the RHA based colored blocks, specifically focusing on density and water absorption rate.
3. To compare the performance of RHA based blocks and cement mix concrete blocks in terms of density and water absorption.

Overall, these objectives aim to ensure that the colored blocks without cement that produced are not only environmentally friendly in terms of materials and production process but also possess sufficient physical and technical properties for real construction applications.

1.5 SCOPE OF THE PROJECT

The aim of this project was to design the environmentally friendly building material that can be applied in urban greening project and green engineering project. The study scope includes:

1. **Cement free construction** – This project will test the effectiveness of blocks without cement by replacing it entirely with alternative materials which is RHA and clay.
2. **Blocks mixed with rice husk ash and clay** – The mix composition will be tested to determine the best ratio for ensuring workability and durability comparable to conventional concrete.
3. **Application in buildings** – The product is intended for use in landscaping elements such as planter boxes, which can be implemented in urban environments, public parks, and green buildings.

1.6 IMPORTANCE OF THE PROJECT

This is a key project for the realization of sustainable building and the saving of resources. It is an important added value for it helps to cut down carbon emissions from construction activity. Cement is a primary construction material and its production leads to large amounts of CO_2 emissions, which can be diminished by replacing cement with rice husk ash in block mix design. This project is environmentally sustainable, and it also contributes to global efforts to mitigate greenhouse gas emissions.

What's more the project is contributing to the economical and beneficial usage of agricultural waste. Rice husks, namely the byproducts made from rice processing, are in the control byproducts that can be based from this industry. The project helps to reduce landfill waste and supports the idea of a circular economy in the construction and agricultural industries by reusing these materials.

The planter boxes made from this project can help in creating more eco-friendly urban landscaping from an urban green development viewpoint. Green urban elements are important for improving air quality, mitigating urban heat island effects and beautifying urban areas. When planter boxes are made using coloured RHA based blocks, cities can bring in more durable, long lasting and very much eco-friendly option in landscaping.

Ultimately, this work proposes a novel strategy to engineer sustainable alternative building materials. By lowering the dependence on such traditional materials which is ecologically harmful, such research can facilitate the wider acceptance of eco-friendly construction materials. It is advantageous not only for the construction field but also for the national as well as the global sustainable development programs.

1.7 SUMMARY

This study is centered on the production of environmentally efficient colored planter box blocks with rice husk ash (RHA) as predominant binder but excluding the use of cement. The goal of this effort is to reduce reliance on cement, a major carbon emitter, and to make use of agricultural waste, including rice husks, that are often not being put to appropriate use. Block making of these are expected to have good physical and mechanical properties for urban landscaping application. The blocks are casted with a combination RHA and clay. The work also includes other significant tests such as density and water absorption to examine the quality of these construction materials. It is expected that this project can help in promoting the developments towards sustainable building, by introducing new, more environmentally friendly and innovative construction materials.