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ABSTRACT

INTERNATIONAL AGROTECHNOLOGY INNOVATION SYMPOSIUM (i-AIS)

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19 June 2023

Faculty of Plantation and Agrotechnology UiTM Cawangan Melaka Kampus Jasin

Published 2023
Faculty of Plantation and Agrotechnology
Universiti Teknologi MARA Cawangan Melaka Kampus Jasin
77300 Merlimau Melaka.

E-EXTENDED ABSTRACT of the INTERNATIONAL AGROTECHNOLOGY INNOVATION SYMPOSIUM (i-AIS) (1st EDITION)

Mode of access Internet

https://sites.google.com/view/ais2023/publication

Perpustakaan Negara Malaysia Cataloguing -in – Publication Data

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ABOUT FACULTY OF PLANTATION AND AGROTECHNOLOGY

The Faculty of Plantation and Agrotechnology was established in 2010 at Universiti Teknologi MARA (UiTM). The mission of the faculty is to play the vital role of producing well-trained professionals in all areas of plantation and agriculture-related industries at national and international levels.

Bachelor of Science (Hons) Plantation Technology and Management is a three-year program that strongly emphasizes the various aspects of Production Technology, Management, and Information Technology highly sought after by the agricultural and plantation sectors. Students in this program will be fully trained to serve as professionals in the plantation sector and related industries. They will have ample opportunities to fulfill important positions in the plantation industry such as plantation executives. This program provides a strong balance of technology and management courses essential for the plantation industry such as management of plantation crops, soil fertility, plantation management operation, plantation crop mechanization, and agricultural precision. As an integral part of the program, students will be required to undergo industrial attachment to gain managerial skills in the plantation industry.

The faculty is highly committed to disseminating, imparting, and fostering intellectual development and research to meet the changing needs of the plantation and agriculture sectors. With this regard, numerous undergraduate and postgraduate programs have been offered by the government's intention to produce professionals and entrepreneurs who are knowledgeable and highly skilled in the plantation, agriculture, and agrotechnology sectors.

PREFACE

International Agrotechnology Innovation Symposium (i-AIS) is a platform to be formed for students/lecturers/ staff to share creativity in applying the knowledge that is related to the world of Agrotechnology in the form of posters. This virtual poster competition takes place on the 1st of December 2022 and ends on the 8th of January 2023. This competition is an assessment of students in determining the level of understanding, creativity, and group work for the subject related to agrotechnology and being able to apply it to the field of Agrotechnology. The i-AIS 2022 program takes place from December 1, 2022, to January 8, 2023. The program was officiated by the Dean of the Faculty of Plantation and Agrotechnology, namely Prof. Madya Ts. Dr. Azma Yusuf. The program involves students from faculties of the Faculty of Plantation and Agrotechnology (FPA)and HEP participating in i-AIS 2022, namely, the Faculty of Education and Pre-Higher Education. This program involves the UiTM student and some of the non-UiTM students which come from the international university and the local university. Two categories are contested, namely UiTM and non-UiTM. To date, students from these programs have shown remarkable achievements in academic performance and participation in national as well as international competitions.

This competition is an open door for the students and lecturers to exhibit creative minds stemming from curiosity. Several e-content projects have been evaluated by esteemed judges and that has led to the birth of this E-Poster Book. Ideas and novelties are celebrated, and participants are applauded for displaying ingenious minds in their ideas.

It is hoped that such an effort continues to breed so that there is always an outlet for these creative minds to grow.

Thank you.

Dean
On behalf of the Organizing Committee
Conference Chair
Universiti Teknologi MARA
Faculty of Plantation and Agrotechnology
http://fpa.uitm.edu.my

TABLE OF CONTENTS

BIO – BRICKS

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ABSTRACT - Building construction is currently one of every nation's industry with the quickest rate of growth, and it significantly strains the nation's finite natural resources. One of the main building materials is fired clay brick, which generates a significant amount of greenhouse gases. Bio-brick, a new mixture from chopped agro waste which been compacted and dried become a brick. The goal of this study is to draw attention to the usage of unique or alternative materials and how these materials might be modified to fit the needs of the global building industry. One such material that has the potential to be a viable and affordable option is bio-brick or agro-waste-based brick. It has a low overall carbon footprint and serves as an excellent insulator against heat and sound. It lessens dead load in high rise constructions because of its low density. Another key goal of this research is to stimulate and support the development of such environmentally conscious and sustainable materials in the construction sector by inspiring and motivating architects, designers, researchers, and builders. This Bio- brick is useful not only in construction but also in lowering agricultural waste. It is preferable to use this trash as effectively as possible rather than burning it or tossing it away and contributing to pollution.

Keywords: Bio-bricks, Agro-waste, Building, Wall

INTRODUCTION

Due to such population's exponential rise and fast urbanization, there has been a severe lack of conventional construction materials due to the enormous requirement for housing and some other housing-related goods and services. Conventional construction materials are manufactured with a significant amount of energy and lands, water, including air pollution. New sustainable components are therefore required to satisfy the growing demand for construction material (Madurwar et al., 2013)[1]. During the same period, there has been a rising problem with organic agricultural waste that is becoming a major cause of air pollution in practically all emerging nations (Awasthi et al., 2010)[2]. Finding a practical way to transform organic waste product into usable construction materials seems to be the major goal of the study discussed in this paper, which simultaneously addresses two urgent problems. The current study investigates its possible use of agricultural waste, such as hay or straw stubbles, unused timber as an element for ecological innovative construction materials in the shape of brick. Those bio-bricks can also be changed to fit local marketplace and construction projects models based mostly on components that can be made from agro-waste. The use of agro-waste as a building material has the potential to reduce both the utilization of energy and natural resources. In addition, selling those remaining stubbles rather of destroying them can increase the farmer's profit and minimize pollution levels. When mixing the agro-waste using lime, stone dust, and water to create useful brick, the method of up-cycling which involves turning waste materials towards innovative products with more increasing environmental awareness than in their past use could be employed to accomplish this goal (Oyenuga et al., 2017)[3]. Therefore, the purpose of our research article is to examine the prospective applications and opportunities for bio bricks inside the construction sector.

MATERIAL AND METHOD

To produce bio-bricks, the dried agro-waste is carefully picked and then chopped to the suitable dimensions. To generate a slurry with a lime base, slake lime $Ca(OH)_2$, binder, stone dust, and water are mixed together. The shredded agro-waste is added to the slurry and vigorously stirred by hand or with a mechanical mixer to create a homogenous mixture. The 150mm x 150mm x 150mm moulds are filled with this slurry, which is then compressed with wooden blocks to remove any extra water or voids and produce a solid brick. Before the sides of these moulds are removed and the brick is allowed to dry for fifteen to twenty days, they are given one or two days to dry. Before they are ready for use, these bio-bricks must air dry for about a month. These bio-bricks can be used for construction after a month of air drying. (Rautray et al., 2019)[4].

RESULTS AND DISCUSSION

Bio-bricks seem to be more environmentally friendly than burned clay bricks because they repair greater carbon dioxide throughout their lifetime since they were produced. For example, 900 mg of sugarcane bagasse was applied to create the bio-brick prototypes which were produced from this material. In contrast, burning 1 kilogram of bagasse from sugar cane results in about 710 grams of carbon dioxide (Kulkarni and Rao, 2016)[5]. Furthermore, a single block of sugarcane bagasse-based bio-brick may hold about 639 g of carbon dioxide. Additionally, the carbonation procedure repairs carbon dioxide in the atmosphere, averaging about 28.55 kg per useful unit (1 m x 1 m x 0.3 m) wall. The study led to the development of bio-bricks that can trap 322.2 grams of carbon dioxide per brick (Ip and Miller, 2012)[6].

As a result, every bio-brick block emits a net of -1.015 kg of carbon dioxide throughout its lifetime, a lower figure indicating an overall favorable impacts on the environment. Although these bio-bricks cannot be utilized to create huge pile structures directly but may be used to create low-cost houses by combining them using metal or wood structural frame components, as shown in Figure 11. Those bio-bricks could be utilized in walls because of their low temperature conductivity (about 0.27 W/mK) (Son et al., 2017)[7], which allows them to efficiently insulate against heat and noise. This bio-bricks' porous and low-density aid to control its buildings' moisture levels, giving the homes suited for hot, humid conditions like India (Walker and Pavía, 2014)[8]. Burnt clay brick or concrete blocks can be substituted by using bio-brick, which has a significantly low density of 423.7 kg/m3, for partition walls in columns beam constructions. This is greatly advantageous for tall buildings, as shown in Figure 12, because the total weight on the structural frame would be considerably lower compared

to that of conventional walls. This could lead to developing lightweight frame structures, which would use less steel and concrete and cost less to build.
To make the entire process sustainable and lower its carbon footprint, this approach does not employ controlled or drying machines. The time taken to manufacture bio-bricks is comparable to air dried (naturally dried) fired clay bricks. The total strength of bio-bricks is increased after a month of drying when a hard skin, primarily composed of carbonate lime (calcination), is applied. These bio-bricks are lighter in weight around 1.43 kg per block the size 150mm³ or about 1/8 of fired clay bricks and 1/10 of concrete blocks of same volume. However, Bio-brick having less compressive strength than fired clay bricks or concrete blocks due to it materials and weight. Hence, they can be effectively used in framed structure as non-load bearing walls with excellent heat and sound insulation with minimal dead load on the structure.

Figure 1: Bagasse From Dry Sugarcane was Minced into Small Pieces

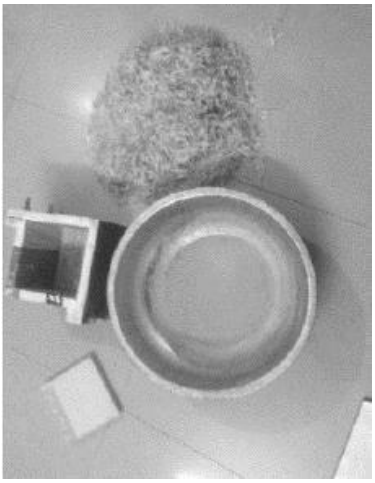

Figure 2: Lime, stone Dust, and Water are Utilised as Basic Tools

Figure 3: Stone dust, Lime, Water, and Chopped Bagasse Were Appropriately Combined

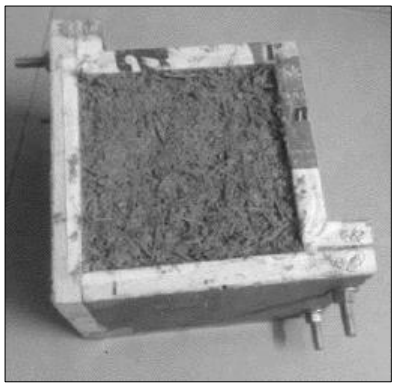

Figure 4: In the mould, the mixture is appropriately pressed down.

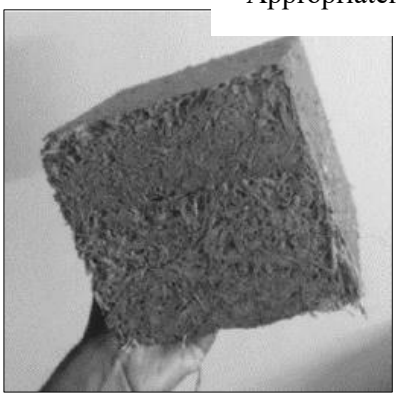

Figure 5: The Bio-Brick Was Given a Month to Dry in The Air

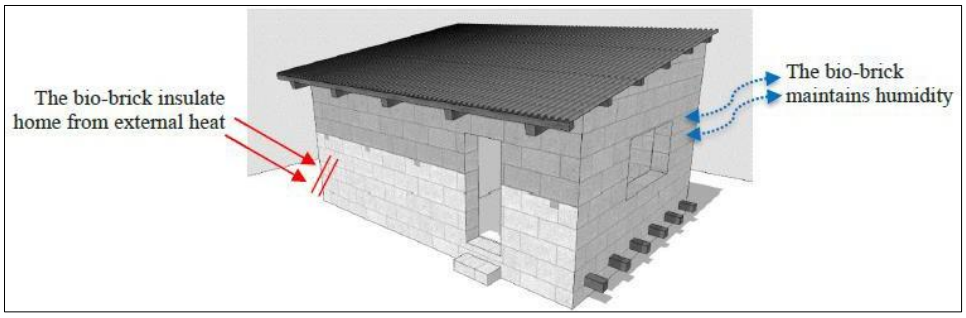

Figure 6: Budget-friendly load bearing housing

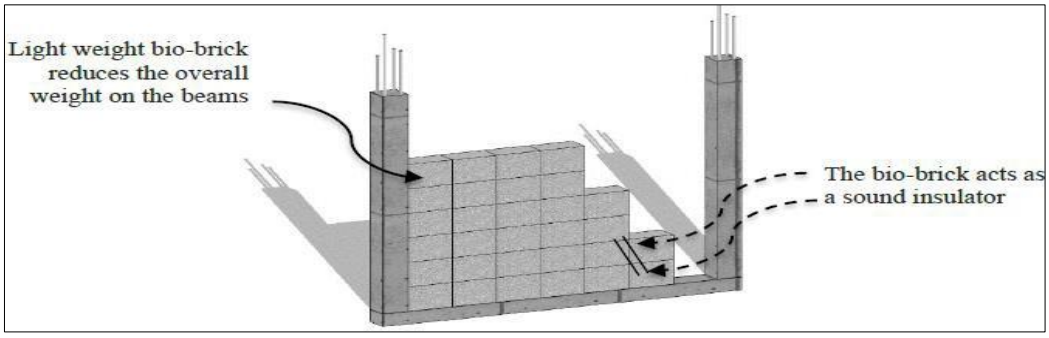

Figure 7: Material for column-and-beam structures' filler walls

CONCLUSION

Malaysia produces a sizable amount of agricultural waste and food waste, and if the problem is not resolved, it might get more problematic. Malaysia produces 168 million tonnes of biomass annually, including wood, oil palm waste, rice husks, fibre from coconut trunks, municipal waste, and sugarcane wastes. Each year, 1.2 million MT of agricultural waste are sent to landfills. The outcomes of research on the conversion of food scraps and other agricultural wastes into other usable things are encouraging. Regular agro waste was used to generate bio bricks, which are substantially more affordable and simpler to make than standard building materials and emit significantly fewer net carbon emissions (Sadi, 2021)[9].

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E-EXTENDED ABSTRACT of the INTERNATIONAL AGROTECHNOLOGY INNOVATION SYMPOSIUM (i-AIS) (1st EDITION)

e ISBN 978-629 -97220-3-8

9 786299 722038

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