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SILICA AEROGEL WITH RICE HUSK ASH PRECAST WALL PANEL

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ABSTRACT

The goal of this research is to create a high-quality toilet wall made of long-lasting materials that can address the issue of odour in student hostel restrooms. In this project, Silica Aerogel with Rice Precast Wall Panel in the toilets of hostels is considered as a solution to the problem of dampness that contribute to health problems among students. Innovation Design Framework consisting of the research flow from empathy, definition, ideate, prototype and test of the innovation concept was employed. It was found that the increase of Rice Husk Ash (RHA) content contributed to increased concrete strength. RHA concrete also has lower water absorption rate. In conclusion, the innovation of sustainable materials for wall panels in the toilet of student hostels will enable better indoor air quality and filter any hazardous illnesses efficiently.

Keyword: *Wall, Moisture, Silica Aerogel, Rice Husk Ash, Precast*

1. INTRODUCTION

A wall is a structural element that divides a space (room) into two different locations (rooms), as well as providing protection and shelter. In general, there are two sorts of walls: outer walls and inner walls. The exterior walls offer protection, while the interior walls help divide the enclosure into the required number of rooms. While the fundamental structural component of a structure is the wall, which bears the weight, it also serves as sound and heat insulation. While wall materials increase the overall cost of building, they save a lot of money when used in a green method. This section examines load-bearing wall materials in two ways: green cement reinforcing materials and recycled waste construction materials (Wang et al., 2018). The materials used to construct walls include bricks, blocks, stones, concrete, timber, mud, grass, aluminium, steel, and polymers. Building defects are prevalent in construction projects. This is due to structures being exposed to severe weather, particularly in hot climate countries such as Malaysia. Construction errors can occur because of faulty design, construction workmanship, or a lack of upkeep. The faults in a building project may get worse because of an unseen defect that the builder or tenants are unaware of. Construction defects can have a detrimental influence on the occupant, the builder, and the building. As a result, it may have an impact on the building's look, the occupants' health and safety, the economy of the country, its reputation, and so on. Thus, this issue may eventually make the occupants dissatisfied (“Causes of the”, 2018). In this study, Kolej Melati, UiTM Perak Seri Iskandar Campus was surveyed, and it was found that dampness of wall, improper joint sealant, mould attack, and cracks on the wall are four common issues and problems that can be seen in the residential college.

Renderings get discoloured when exposed to dirt and moisture. Several wall problems are caused by rainwater. If there are leaks or seepages, the paint will become discoloured, flaky, and scorched. Materials that are not compatible, bacteria, pollution, exposure to the elements, moisture intrusion, and chemical reactions all contributed to the corrosion of metal and aluminium. Mould thrives when it has the right conditions: spores, wood, carpet, moisture, and temperature. Mould, fungus, and bacteria are created when there is too much moisture in building components, which may harm indoor air quality and pose a health hazard. Mould often grows on the ceilings, floors, and walls of these places, as well. As a result of moisture issues, hostel students have reported peeling paint, discoloured paint, blistering wallpaper, stains, sweat on the wall, and water marks or fungus.
The issues and problems were explained in detail to gain information and supporting reasons to solve the problems in the hostel by referring to the Sustainable Development Goal (SDG) requirements to enhance sustainability using the proposed technology.

1.1 Research Objectives

a. To identify the common issues related to the wall.
b. To propose wall with high performance materials.
c. To identify the marketability of Silica Aerogel with Rice Husk Precast Wall Panel in the Malaysia's construction industry.

2. METHODOLOGY

This chapter discusses about a green campus, which is one that combines sustainable and environmentally friendly activities with education, to encourage sustainable and environmentally friendly practices on campus. Innovation design framework which consists of flow of study from these processes: empathize, define, ideate, prototype and test, have been described. Data collection methods were applied which are divided to 3 phases; literature review, lab test and simulation, and data analysis which contains summary of measurements and data interpretation.

3. FINDINGS

3.1 Performance of Concrete

3.1.1 Compressive strength result

The table below shows the result of the compressive strength for Rice Husk Ash (RHA) concrete and Normal concrete. For RHA, it shows that the compressive strength is higher when 7% of RHA was added when compared to normal concrete on 7 days and 28 days. This increase was due to the increase of RHA content which contributed to increase in strength. This is because adding it while keeping the water binder ratio constant, enhanced the fluidity of the mix, thus improved the workability.

Type of concrete	7 days (N/mm^2)	28 days(N/mm^2)
RHA Concrete	21.3	33.9
Normal Concrete	19.25	30.0

Table 1 Compressive Strength of RHA Concrete and Normal Concrete

3.1.2 Water absorption result

The table below records the percentage by weight of water absorbed for each concrete. From the table, RHA concrete gave lower water absorption than normal concrete. The possible reason is due to higher water binder ratio of the RHA mix, in which water occupies the space in concrete and as it evaporates, it leaves voids, thus increases the absorption value. This enhances the fluidity of RHA concrete mix and maximizes the compaction, which subsequently results in high impermeable RHA concrete.

Type of concrete	7 days (%)	28 days (%)
RHA Concrete	2.91	2.65
Normal Concrete	4.21	3.93

Table 2 Water Absorption of RHA Concrete and Normal Concrete

3.2 Marketability of Silica Aerogel with Rice Husk Precast Wall Panel in the Malaysia's Construction Industry

3.2.1 Long lasting and high-quality wall panel

According to KLAY Enersol (n.d.), one of Malaysia manufacturers of aerogel technologies, silica aerogel is hydrophobic yet breathable. Super-hydrophobic materials are gradually applied to the inner and outer walls, glass surfaces and the surfaces of metal frames of buildings due to their unique hydrophobicity and self-cleaning functions, to achieve the effects of rain, snow, stain resistance. However, at present, the products of superhydrophobic materials in building mainly consist of surface coating and protective liquid.

3.2.2 Reduction cost on supplementary cementitious material

The waste can be used as a supplementary cementitious material (SCM), a replacement for natural aggregate, and as an addition in concrete to improve crack resistance. Based on the previous research conducted toward RHA, the waste can be used as a partial replacement for cement and natural aggregate in concrete. Previous researchers focused

on utilizing waste from single sources only. The use of RHA will not only contribute to better quality and low-cost concrete production, but also reduce carbon dioxide (CO2) emissions from cement production. The partial replacement of cement by RHA will result in lower energy consumption associated with cement production.

3.2.3 Achieve sustainability and Green Technologies

The production of Green Concrete (GC) has been increasing due to the drawbacks of conventional concrete that create many environmental problems. In Malaysia, the amount of waste generated from agricultural and construction industries are increasing every year. Hence, one of the solutions to reduce the impact of conventional concrete and limited landfill spaces due to excessive waste is by utilizing it in concrete. The main idea is to produce a GC that is eco-friendly and harmless to the environment, and this can be accomplished by combining waste in some concrete. Prevention of environmental interferences and reduction of pollutants are issues attributed to cement replacements, which leads to more comprehensive framework environmental-based issues.

4. CONCLUSION

Silica Aerogel with Rice Husk is a suitable material to tackle issues of moisture problems in students' toilets. Theoretically it will boost material efficiency of the building and protect the building's occupants. The concerns of moisture and health difficulties from wall disease is a major subject as it impacts the comfort, safety, and wellbeing of the building inhabitants. The inhabitants not only relate to humans, but also animals too. An inventive solution must be devised to accomplish this. Sustainable materials that can serve the demands of the residents to live comfortably and securely in the structure must be considered. It is anticipated that an invention of sustainable materials for wall panels in student hostel toilet will allow for better indoor air quality and filters any hazardous illnesses efficiently to ensure that the occupants of the building feel comfortable. Thus, materials of the construction that have IBS system and are sustainable must be verified. For this study, data collection approach to gain information about the innovation concept may include qualitative research was included. Marketability of the innovation idea should be taken into consideration. This is to ensure that the proposed innovation idea can be materialized and utilized in real world. The target market for Silica Aerogel with Rice Husk Precast Wall Panel is clients of hostel building who aim to join the wave of Green Building and SDG. This answered the third objective which is "To suggest the marketing potential of the proposed design". As a conclusion, this research proposal has achieved all its objectives successfully.

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Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"

Saya yang menjalankan amanah,

SITI BASRIYAH SHAIK BAHARUDIN
Timbalan Ketua Pustakawan

nar

Setuju.

27.1.2023

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