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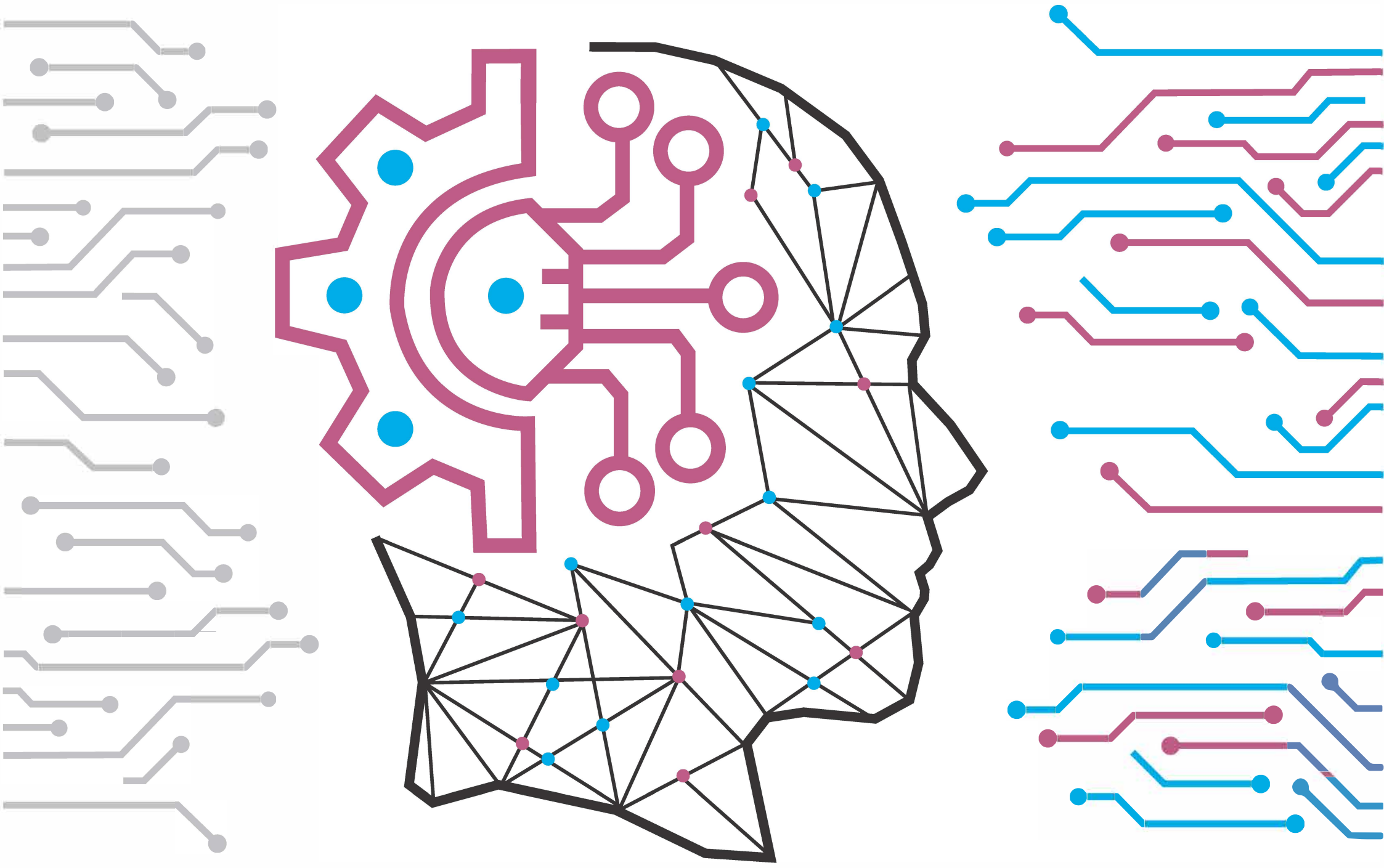

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INNOVATION, INVENTION &
DESIGN COMPETITION 2024

Organized by:
Office Of Research, Industry,
Community & Alumni Network
UiTM Perak Branch

Perpustakaan Negara Malaysia Cataloguing in Publication Data

No e- ISBN: 978-967-2776-31-4

Cover Design: Dr. Mohd Khairulnizam Ramlie
Typesetting : Zarinatun Ilyani Abdul Rahman

EDITORIAL BOARD

UTILIZATION OF PALM KERNEL AND COCONUT SHELLS AS PARTIAL REPLACEMENT OF AGGREGATES INCORPORATING ALUM SLUDGE AS PARTIAL REPLACEMENT FOR CEMENT

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ABSTRACT

The construction industry plays a significant role in resource consumption and environmental impact. This study explores the potential of creating sustainable lightweight wall panels by incorporating waste materials such as coconut shell and palm kernel shell, coupled with alum sludge as a partial replacement for cement. The aim is to reduce the environmental footprint of traditional construction materials while promoting the efficient utilization of agricultural and industrial by-products. Coconut and palm kernel shells, both abundant agricultural waste products, are chosen for their lightweight and durable characteristics. These natural fibres offer an eco-friendly alternative to traditional construction materials, contributing to resource conservation and reducing the demand for conventional building components. Alum sludge, a by-product of water treatment processes, is introduced as a partial replacement for cement in the composite material. This not only minimizes the environmental impact of alum sludge disposal but also enhances the material's mechanical properties. The inclusion of alum sludge aims to improve the compressive strength and durability of the lightweight wall panels, making them a viable and sustainable option for construction applications.

Keywords: Alum sludge, Coconut shell, and Palm Kernel shell

1. INTRODUCTION

The utilization of coconut and palm kernel shells in concrete is made by replacing partly or whole of the coarse aggregate content to produce coconut shell concrete (CSC) and palm kernel shell (PKS). CSC and PKS can be classified as lightweight aggregate concrete (LWAC) since the density was found less than 2000 kg/m3. LWAC is beneficial in self-weight reduction and easy to handle; thus, reduce the construction costs and less inertia force will be activated due to dynamic loading (Misnon et al., 2017). Comprehensive studies on CSC as structural elements were conducted to reveal the potential of coconut shells and palm kernel shells to be used as alternative materials for building construction. Olanipekun et al. (2005) reported that CS is better than palm kernel shells to replace the crushed aggregate when considering the cost and strength ratio.

A significant amount of greenhouse gas is emitted by the cement industry. The use of additional cementing materials is therefore important in considering global sustainable development in order to minimize both environmental emissions and construction costs. Alum sludge is widely used as sustainable cementing materials. The properties of concrete are improved by the incorporation of the example of pozzolans mentioned earlier as a substitute for cement to reduce the amount of CO_2 emissions.

2. METHODOLOGY

Phase 1: Determination of mechanical properties of CSC using pozzolans as cement replacement.
A design mix of CSC and PKS using pozzolana as cement replacement will be developed with different types of pozzolans such as alum sludge. Different percentages of pozzolans i.e., will replace cement content in the conventional CSC and PKS mix. A series of experiments will be conducted to determine the mechanical properties (compressive strength, splitting tensile strength and flexural strength) of the samples. The tests will be carried out according to BS EN 12390.

Phase 2: Determination of the optimum percentage of pozzolan to be used as cement replacement.
Results collected from Phase 1 will be analysed to obtain the optimum percentage of pozzolans used as cement replacement in the CSC and PKS mix.

Phase 3: Determination of durability of CSC and PKS with pozzolans as cement replacement.
A series of experiments will be carried out to determine the durability of the samples. The durability tests consist of water absorption, surface absorption, water permeability and chloride permeability.

3. FINDINGS

The utilization of palm kernel shell and coconut shell as partial replacement of aggregates incorporating alum sludge as partial replacement for cement in concrete production, when incorporating superplasticizer, the following findings:

I. Compressive Strength: Coconut shell and palm kernel shell can improve the compressive strength of concrete, particularly at a replacement level of 10%.
II. Workability: The use of a superplasticizer can improve the workability of the concrete, allowing for a reduction in the water-to-cement ratio.
III. Water Absorption: The addition of palm kernel shell powder can reduce the water absorption of concrete.

Figure 1 Innovation Use Palm kernel and Coconut shells

4. CONCLUSION

The outcome of this study has the potential to contribute to the development of eco-friendly construction materials, offering a sustainable solution for the building industry. The utilization of agricultural waste and industrial by-products not only reduces the environmental impact but also promotes a circular economy by transforming waste into valuable resources. The incorporation of coconut shell, palm kernel shell, and alum sludge into lightweight wall panels represents a step towards a more sustainable and responsible approach to construction practices. The research involves a comprehensive analysis of the mechanical, thermal, and environmental properties of the lightweight wall panels. Testing and characterization methods include compressive strength tests, thermal conductivity measurements, and life cycle assessments. The findings will provide valuable insights into the feasibility and sustainability of this innovative construction material.

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