PHYSICAL AND MECHANICAL PROPERTIES OF GREEN CEMENTLESS MORTAR INCORPORATING WASTE PAPER SLUDGE ASH

By Jamaluddin, AN (Jamaluddin, Aida nabila) ; Saad, SA (Saad, Siti asmahani) ; Masjuki, SA (Masjuki, Siti aliyyah) ; Hassan, WNFW (Hassan, Wan nur firdaus wan) ; Deraman, SNC (Deraman, Siti Noratikah Che) ; Husain, NM (Husain, Nadiah md)

Source IIUM ENGINEERING JOURNAL
Volume: 26 Issue: 1 Page: 57-68
DOI: 10.31436/iiumej.v26i1.3015

Published JAN 2025

Indexed 2025-02-26

Document Type Article

Abstract As an alternative to conventional construction material such as normal concrete, waste paper sludge ash (WPSA) based geopolymer is seen as a promising and viable option in construction material selection due to its high amount of aluminum (Al) and silicon (Si) content. This research aims to determine the microstructure and mechanical characteristics of WPSA in geopolymers. The alkaline solution that contains 6 M of sodium hydroxide (NaOH) and sodium silicate (Na_2SiO_3) was used to activate the geopolymer. The hardened 50 mm-sized mortars were prepared and underwent a heat-cured process for day at various temperatures at 24 degrees C, 60 degrees C, and 90 degrees C, respectively. Then, the mortar cubes were placed in the laboratory until the testing days. A compression test was conducted to identify the strength development of the WPSA-based geopolymer mortar at 7, 14, and 28 days, respectively. Chemical composition was analyzed using X-ray fluorescence (XRF). Furthermore, Fourier-transformed infrared spectroscopy (FTIR) was conducted to ascertain the structural elucidation and scanning electron microscope (SEM) analysis was done to provide microstructural observations of the geopolymer. Based on the XRF analysis, the WPSA has the highest amount of calcium oxide (CaO) instead of aluminum oxide (Al2O3) and silicon dioxide (SiO2), and it reduces the performance of WPSA as a cement replacement material. The ratio of SiO2 and Al2O3 is recorded as 1.1:1. Therefore, it is suitable for bricks and ceramics production instead of concrete production. As for the curing process, the heat- cured method is evident in accelerating strength development in the WPSA-based geopolymer mortar compared to the ambient curing method due to the rapid polymerization process in the geopolymer system. It is proven that 60 degrees C is the optimum temperature for the curing process for geopolymer mortar.

Keywords

Author Keywords: Geopolymer; Waste Paper Sludge Ash; NaOH; Na2SiO3
Keywords Plus: GEOPOLYMER CONCRETE; STRENGTH

Addresses

[1] Int Islamic Univ Malaysia, Dept Civil Engn, Gombak, Malaysia

Categories/ Classification

Research Areas: Engineering

Web of Science Categories

Engineering, Multidisciplinary

+ See more data fields

Citation Network

Use in Web of Science

In Web of Science Core Collection

This record is from:

Web of Science Core Collection

- Emerging Sources Citation Index (ESCI)

Suggest a correction
If you would like to improve the quality of the data in this record, please **Suggest a correction**