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Curing Temperature Dependence Formation, Compressive Strength and Morphological of Fly Ash Geopolymer

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Structured Abstract

Background: Fly ash (FA), a solid waste produced during coal combustion in power plants, is a toxic, corrosive, and radioactive pollutant. However, FA can be used to create fly ash geopolymer (FAG), which is used in construction and building materials to replace Ordinary Portland Cement (OPC). FAG is generally more durable and stronger than OPC, but its strength depends on many parameters. This study aims to determine the effect of curing temperature on the creation of a geopolymer from FA, as well as its chemical bonding, compressive strength, and morphological features.

Methods: FAGs were prepared by mixing the raw FA and alkaline activators, which were a mixture of NaOH and Na₂SiO₃ solutions. The geopolymer pastes were cast into PVC moulds, covered, and rested for 24 hours. Then, FAGs are cured at different temperatures, which are 30°C, 50°C, 70°C, and 90°C, for 1 day, and aged for 7 days before testing. Then, the FAGs were characterized using Fourier Transform Infrared (FTIR) analysis, compressive strength test, and Scanning microscopy (SEM).

Results: The study showed that FAGs were successfully prepared and physically stable at different curing temperatures. The results indicated that as the temperature increased, the FAGs produced had a darker colour. FTIR analysis shows that there are no new peaks found in FAGs compared to FA. The compressive strength increased with the curing temperature, with FAG produced at 50°C having the highest compressive strength (0.181MPa). In relation to the different curing temperature, it also influenced on the morphology of the FAGs, as it showed the difference between FA and FAGs in the presence of agglomeration and particulates.

Conclusion: In conclusion, FAGs formed at various curing temperatures were successfully prepared. The functional group, compressive strength and morphological properties were successfully elucidated using FTIR, compressive strength test and SEM. Thus, FAG prepared at 50°C is the best formation of FAGs compared to other temperatures.

Keywords: Fly ash, geopolymer, alkaline activators, compressive strength

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