

## Effects of nano-palm oil fuel ash and nano-eggshell powder on concrete

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### ABSTRACT

Palm oil fuel ash (POFA) is a by-product from palm oil manufacturing and is currently disposed to open areas and landfills without treatment, thereby causing environment pollution. Grinding POFA to nanoparticles called NPOFA results in increased pozzolanic activity. Meanwhile, eggshells (ESs) are a biowaste from restaurants. They are disposed to landfills, thus generating undesirable gases and causing environmental damages. ES powder (ESP) has a large amount of calcium oxide, which is essential for hydration in concrete production. In this study, ESP was used to induce low calcium content in NPOFA. Cement was replaced with NPOFA at ratios of 0%, 10%, 20%, and 30% to produce green concrete, and the ESP proportions constituted 2.5% and 5% of the total binders. The curing ages were 7, 14, and 28 days. The results showed that NPOFA exhibited a significant improvement in strength of developed green concrete. ESP improved concrete durability by reducing water absorption. Therefore, this concrete may have high resistance to environmental attacks, such as those involving sulfates and acids.

### KEYWORDS

Nano palm oil fuel ash (NPOFA); Environment pollution; Supplementary cementitious material; Nano eggshell powder (NESP); Green concrete

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