

# Mechanical Properties of Oil Palm Shell Lightweight Aggregate Concrete Containing Palm Oil Fuel Ash as Partial Cement Replacement

K. Muthusamy, N. A. Zamri

*Faculty of Civil Engineering and Earth Resources, Universiti Malaysia Pahang, 26600 Pekan, Pahang, Malaysia*

## ABSTRACT

The increasing in greenhouse gas emissions, as well as solid waste disposal from the cement manufacturing industry and the Malaysian palm oil industries respectively contributes towards the undesirable 6°C Scenario envisioned by the International Energy Agency. The utilization of Palm Oil Fuel Ash (POFA) as partial cement replacement in the production of Oil Palm Shell (OPS) Lightweight Aggregate Concrete (LWAC) would significantly reduce cement consumption and amount of disposed landfill waste. In this investigation, the effect of POFA content as partial cement replacement towards the compressive strength of OPS lightweight aggregate concrete has been conducted. A total of six OPS LWAC mixtures were prepared with varying the percentages of POFA viz. 0%, 10%, 20%, 30%, 40% and 50% to determine the best replacement of POFA as partial cement replacement. The ashes were ground to enhance their pozzalanicity. The best replacement of POFA-20 was then used to investigate the mechanical properties of OPS LWAC such as compressive strength, flexural strength and modulus of elasticity. The concretes containing POFA were placed in different types of curing regimes namely water, air, sprayed and natural weather curing before subjected to compressive strength test and flexural strength test at the age of 28, 60, 180, 270 and 365 days. The compressive strength was conducted in accordance with the BS EN12390-3 whilst the flexural strength test was carried out in accordance with the BS EN 12390-5. It was found that water curing is the best method amongst others. OPS LWAC with POFA exhibits the highest results of compressive strength, flexural strength and modulus of elasticity. The production of extra C-S-H gel resulting from better pozzolanic reaction for water cured OPS LWAC with POFA has contributed to the densification of the internal structure that in turn enhances the concrete strength.

**KEYWORDS:** Oil palm shell; Palm oil fuel ash; Partial cement replacement; Different curing regime compressive strength; Flexural strength

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