

Author's Accepted Manuscript

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PII: S2352-7102(18)30226-2
DOI: <https://doi.org/10.1016/j.job.2018.07.013>
Reference: JOBE537

To appear in: *Journal of Building Engineering*

Received date: 28 February 2018
Revised date: 20 June 2018
Accepted date: 15 July 2018

Cite this article as: Hossein Mohammadhosseini, Mahmood Md. Tahir and M.I. Sayyed, Strength and transport properties of concrete composites incorporating waste carpet fibres and palm oil fuel ash, *Journal of Building Engineering*, <https://doi.org/10.1016/j.job.2018.07.013>

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Strength and transport properties of concrete composites incorporating waste carpet fibres and palm oil fuel ash

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Abstract

The use of industrial wastes in the production of green and sustainable concrete has attracted much attention in recent years because of the low-cost of waste materials along with saving a significant place for landfill purposes and also enhance the performance of concrete. In this study, the strength and transport properties of concretes comprising waste carpet fibre and palm oil fuel ash (POFA) were investigated. The VeBe time and slump tests on fresh concrete in addition to compressive strength, tensile strength, flexural strength, sorptivity, and chloride penetration of hardened concrete were tested. The combined effect of carpet fibres and POFA was investigated using microstructural analysis in terms of scanning electron microscopy (SEM) and X-Ray Diffraction (XRD). Six concrete mixes containing 0-1.25% fibres with a length of 20 mm were cast for ordinary Portland cement (OPC). Further, six concrete batches with the same fibre content were made, where 20% POFA substituted OPC. The incorporation of waste carpet fibres and POFA decreased the workability of concrete. The inclusion of carpet fibres to both OPC and POFA mixtures reduced the compressive strength values. The positive interaction amongst carpet fibre and POFA lead to greater splitting tensile and flexural strengths. Also, sorptivity and chloride penetration of the OPC and POFA-based mixtures were significantly decreased by the inclusion of carpet fibre up to 0.75%. The influence of POFA on the transport properties of concrete composites was noticed to be more considerable along with the curing periods.

Keywords: Concrete Composites; Waste carpet fibres; Palm oil fuel ash; Strength; Transport properties.

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