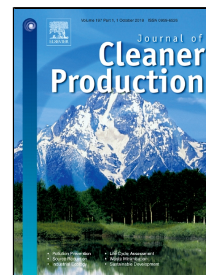


Accepted Manuscript

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PII: S0959-6526(18)32356-4
DOI: 10.1016/j.jclepro.2018.08.025
Reference: JCLP 13809
To appear in: *Journal of Cleaner Production*
Received Date: 21 March 2018
Accepted Date: 02 August 2018

Please cite this article as: Kien T. Tong, Raffaele Vinai, Marios N. Soutsos, Use of Vietnamese rice husk ash for the production of sodium silicate as the activator for alkali-activated binders, *Journal of Cleaner Production* (2018), doi: 10.1016/j.jclepro.2018.08.025

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Word count: 11,227

Use of Vietnamese rice husk ash for the production of sodium silicate as the activator for alkali-activated binders

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ABSTRACT

Geopolymer and Alkali-Activated Binders (AAB) has recently emerged as a new, green material with the potential to replace Portland cement in several applications. They can reduce the CO₂ footprint of concrete by up to 80% and this is in addition to being more durable in certain aggressive environments. However, commercial alkaline activators contribute significantly to the cost and CO₂ footprint of AAB concrete mixes. This research investigates the production of a low cost, low environmental impact sodium silicate solution (waterglass) from Rice Husk Ash (RHA) and more specifically RHA from Vietnam. A hydrothermal process for the dissolution of RHA in sodium hydroxide solution was developed. Sodium hydroxide solution concentration, process temperature and duration were studied. Optimised procedure parameters were found to be: NaOH concentration 3M, heating temperature 80 °C and heating duration 3h. The obtained solution was used for the production of AAB mortar made with a blend of fly ash and ground granulated blast furnace slag. Obtained compressive strength of mortar was in the range of 60 MPa at 28 days, matching the strength obtained from control samples produced with commercially available activators. Microstructural investigation (isothermal calorimetry, infrared spectroscopy, X-ray diffraction and thermogravimetric analysis) on pastes confirmed the equivalence between the solution produced with the optimised method and commercially available options. Cost analysis indicated that the proposed method could allow a reduction of almost 55% of the cost for the activation of AAB. Results from a simplified preliminary environmental analysis suggested increased sustainability of the RHA-derived solution when compared with commercially available waterglass.

Keywords: Alkali-activated binder, Alkaline activators, Rice Husk Ash, Fly Ash, Ground Granulated Blast Furnace Slag, simplified environmental analysis.

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