

Alkali-activation of rice husk ash to make building components

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Abstract

This work studied the development of geopolymer components with rice husk ash (RHA), which was used to make an alternative sodium silicate by the aqueous solution with NaOH. The mortars were produced using metakaolin as aluminosilicate source. The resulting mortars show compressive strength (cured at room temperature) in the range of 27-32 MPa, showing the sodium silicate with RHA had good performance. Such results suggest that geopolymer mortar and concrete can be made with waste materials and also replace Portland cement-based mixtures, minimizing social, economic and environmental impacts associated with its production.

Key words: geopolymers, rice husk ash, components

Introduction

The term 'geopolymer' was first used by Davidovits, describing the reaction of an aluminosilicate powder (metakaolin, e.g.) with an alkaline solution (silica source and NaOH)¹. This work aims to employ the RHA in geopolymer production. The use of waterglass (alkali activator) is very common in geopolymer production and it is responsible for a great environmental impact². This experimental work used a solution with the agricultural waste (RHA) and NaOH to make the sodium silicate to be used in place of waterglass.

Results and Discussion

Materials: alkaline solution³ (RHA and NaOH), metakaolin and natural sand. Preliminary mixtures yielded geopolymers with a high degree of efflorescence, but this was minimized with the study of the sodium silicate production with the RHA and NaOH solution. The optimum dissolution time (reflux) was 30 min according to the compressive strength results (Figure 1).

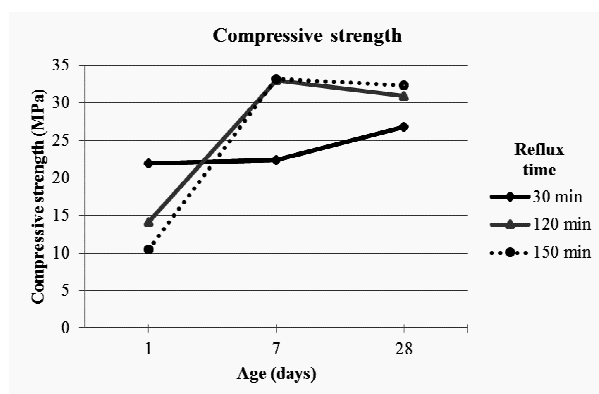


Figure 1. Compressive strength versus mortar age and RHA dissolution (reflux) times.

Results showed compressive strengths of 27-32 MPa (Figure 1) and flexural strengths of 9-10

MPa, which were similar to Portland cement mortars found in practice.

Consistency (flow table test) of 182 mm was obtained in the geopolymer mortar with this new sodium silicate (Figure 2a).

Initial and final setting times by Vicat needle were 42 min and 72 min, respectively (Figure 2b).

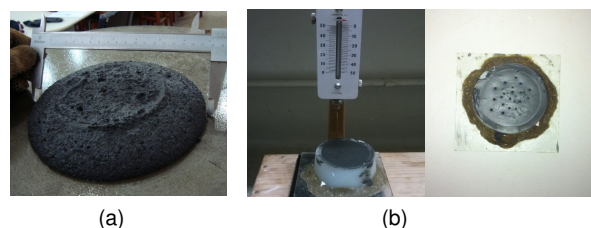


Figure 2. Consistency (a) and setting time (b)

Conclusions

The production of geopolymer mortars from metakaolin and RHA may yield high-performance components in short periods of time. Results are similar to commercial Portland cement. These results suggest the possibility of applying those materials in the production of alkali-activated cements, minimizing social, economic and environmental impacts of cement production.

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