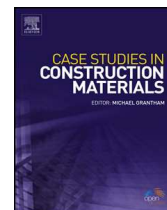




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Case study

Development of unfired earthen building materials using muscovite rich soils and alkali activators



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ABSTRACT

Most studies have focused on the alkali activation of thermally activated kaolinitic clays for the production of innovative building materials. Whilst the widespread use of these minerals may be hindered due to geographical availability; a combination of thermal activation and alkali activator solutions yields a material with high embodied energy with implications on eco-friendliness. This study presents an eco-friendly approach for the development of a low environmental impact building material using a low molarity alkali activator solution for the stabilisation of uncalcined muscovite rich soil. Influence of curing conditions on the physical, mechanical, microstructural and mineralogical properties were evaluated. Results show that alkali activation of uncalcined muscovite in the soil significantly improved the physical and mechanical properties of extruded earthen materials. Samples tested yielded compressive strength values between 9–11 MPa for varying curing regimes. The binding was mainly attributed to the formation of amorphous sodium aluminosilicate gels as a result of the partial dissolution of muscovite. These results show that low environmental impact building materials may be developed with uncalcined muscovite rich soils in developing regions around the world where these minerals are predominant for the provision of sustainable low-cost housing solutions.

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1. Introduction

Owing to environmental challenges associated with the production of cement, significant research has focused on alkali activated materials as alternative binders in construction materials [1,2]. Presently, extensive studies have demonstrated the improved properties of alkali activated aluminosilicates over conventional Portland cement in concrete [3–5]. However, very little work has been conducted to harness this technology for the development of earthen construction building materials. In a practical sense, 65% of the earth crust comprises of natural aluminosilicates and this triggers the interest to determine if alkali activation can be harnessed for the production of building materials from soils containing these minerals. Such information will enhance the adoption and commercialisation of a new promising technology for the development of construction materials. In theory, any material composed of silica and aluminium can be alkali activated. This has been

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