INFLUENCE OF VOLCANIC ASH CALCINATION ON THE COMPRESSIVE STRENGTH OF VOLCANIC ASH BLENDED LATERIZED CONCRETE

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ABSTRACT

This paper investigated the effect of volcanic ash (VA) calcination on the compressive strength of volcanic ash blended laterized concrete (VALC). The effect was studied using VA in VALC at two levels of treatment: natural and calcinated. Laterite and VA contents were varied between 0-30% in steps of 10% with a design mix for 28-day target strength of 25 MPa using the British Method. A total of ninety six concrete cubes of 100 mm were testedafter curing in water for 3, 7 and 28 days. Chemical analysis showed that $SiO_2 + Al_2O_3 + Fe_2O_3$ content for natural and calcinated VA were 71% and 74% respectively which met the requirement of ASTM C618:2008 for pozzolanic materials. VALC cast with calcinated VA at 800 °C for all replacement levels (10-30%) of cement with VA gave higher compressive strength than those cast with natural VA. The increases in the compressive strength of VALC were pronounced in day 3 and 7 than on the 28-day. However, increases in the contents of both VA and laterite in VALC reduced the compressive strength.

Keywords: *blended cement, calcination, compressive strength, laterized concrete, volcanic ash*

INTRODUCTION

In the last few decades, there has been growing call for the research and development of materials that can be used for the partial replacement of cement in concrete. Materials such as silica fumes, fly ash, ground granulated blast furnace slag and natural pozzolans have been successfully used over the years in replacing Portland cement for the production of concrete. Their use is necessitated as a result of technical and environmental reasons such as reduction of the energy consumptionduring the manufacturing process of cement and reduction in CO_2 emission [1, 2].

The drive to source and utilise locally available materials to reduce the cost of concrete production and ultimately, the total construction cost has led to the use of materials such as laterite, erosion sand, saw dust and volcanic ash (VA) amongst others [3]. The use of laterite (LAT) to replace natural sand, partially or wholly in concrete led to the production of laterized concrete. VA addition as a cement replacement material in laterized concrete thereby result in volcanic ash blended laterized concrete (VALC). Earlier studies [3] reported the abundant deposit of volcanic ash in Kerang, Mangu local government area of Plateau State. The chemical analysis confirmed that the VA, a pozzolan, in the natural state conforms to the minimum total of $SiO_2+Fe_2O_3+Al_2O_3$(70%) specified by the ASTM C618-2008 [4].Though the VA met the ASTM requirement for a pozzolan, however, Neville [5] reported improvement in the activity of some natural pozzolan in concrete when they are calcinated to a temperature between 550 to 1100 °C.

This paper therefore reports on the effect of calcinated volcanic ash (CVA) on the compressive strength of volcanic ash blended laterized concrete.

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