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ASRIC Journal on Engineering Sciences 1 (2021) 40-45

Effect of Sulphate Attack on the Strength of Cement Brands Blended with Cassava Peel Ash

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Received 10 June 2021; revised 17 July 2021; accepted 6 August 2021

***Abstract*— Effect of two sulphate solutions on the strength of blended cassava peel ash (CPA) - cement mortar was investigated. CPA used to replace each brands of the Portland cement at a proportion of 20% by weight. Mortar of mix ratio 1:3 was prepared and 300 small mortar beams were cast and cured in fresh water for 28 days then in 50g/l concentration of sulphate solution of Calcium and Sodium separately for 90 days with the control remaining in fresh water for the periods. The results showed a varying effect of the sulphate solution on the different brands of cement both on the flexural and compressive strength. It was concluded that CPA possessed potential to mitigate effect of sulphate attack on some selected brands of cement.**

***Keywords*— cassava peel ash, concentration, sulphate solution, curing ages**

I. INTRODUCTION

Concrete and mortar are critically important construction materials. While concrete is used as a bulk building material, mortars are used to bind together bricks, stone, or other blocks in masonry-type construction. Concretes and most mortars rely on hydraulic cement binders for their strength and durability (Oss and Padovani, 2003). Over the years, durability issues due to chemical attack on cement-based construction materials have been giving a growing concern. Durability of Portland cement concrete is its ability to resist weathering action, chemical attack, abrasion, or any other process of deterioration according American concrete institute (ACI - Committee 201). Sulfate attack – a form of chemical attack - is one of the primary causes leading to deterioration of concrete. Sulfates from sewage water, industrial effluent, sea water groundwater etc. penetrate into the concrete and react with the hydrated cement paste phases leading to the production of secondary phases like gypsum, ettringite or thaumasite which may lead to cracking, spalling or loss of strength (Van Tittelboom and De Belie, 2009).

Industrial waste pozzolans such as fly ash (FA) and silica fume (SF) are already widely used in many countries (Cisse and Laquerbe, 2000) and attempts are being made to produce and use pozzolanic agricultural by-product ashes such as rice husk ash (RHA) and saw dust ash (SDA) commercially in some countries. Mehta and Pirtz (2000) investigated the use of RHA to reduce temperature in high strength mass concrete and found that RHA is very effective in reducing the temperature of mass concrete compared to OPC concrete. Malhotra and Mehta (2004) found that ground RHA with finer particle size than OPC improves concrete properties, including that higher substitution amounts results in lower water absorption values and the addition of RHA causes an increment in the compressive strength. Cordeiro et. al. (2009) carried elaborate studies of Brazilian RHA, rice straw ash (RSA), and demonstrated that grinding increases the pozzolanicity of RHA and that high strength of RHA, RHA concrete makes production of blocks with good bearing strength in a rural setting possible. The use of pozzolanic materials is found in many ancient civilizations. Pozzolans were used to improve the properties of lime, and many structures are still extant as a testament to the durability of lime – pozzolan mortars and concrete (Salau and Olonade, 2012) and (Raheem et.al., 2015). Many of these pozzolans are industrial by-products and considered as waste, so that the resulting benefits in terms of energy savings, economy, environmental protection and conservation of resources are substantial.

Adesanya et. al. (2008) reported that cassava peel constitutes between 20-35% of the weight of tuber, especially in the case of hand peeling. Based on 20% estimate, they said about 6.8 million tonnes of cassava, peel is being generated annually and 12

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