EFFECT OF SUPERPLASTICIZER ON SETTING TIME AND STRENGTH OF MORTAR MADE USING RICE HUSK ASH (RHA) AND CALCIUM CARBIDE WASTE (CCW) AS BINDER

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Consequent to the challenge of global warming partly associated to high CO_2 emission and energy consumption from cement production processes, research focus has shifted to sourcing alternatives to Portland cement in concrete and morter production. Incinerated ashes from agro-wastes such as Rice Husk Ash (RHA) at controlled temperature has been found to be pozzolanic with major components been amorphous silica which combines with lime in the presence of water to give cementitious properties. RHA – CCW binder has however been reported to be of high water demand, slow setting rate and strength development. This study incorperates a superplasticizer (Master Glenium ACE 456) – a water reducing agent and set accelerator as an attempt at overcoming the limitations of this new binder. Pastes of 1:3 binder: sand (b:s) and 0.5 water cement (w/c) ratio in accordance to BS EN 197: 2000 made from the different proportion combinations of RHA – CCW were examined for influence of superplasticizer on setting times, degree of hydration and strength development. The study showed that the superplasticizer enhanced early setting and strength development of the mortar. Mortar samples from 60/40 RHA – CCW binder showed superior performance over the other percentage blends with respect to 28 days compressive strength.

Keyword: Calcium Carbide Waste; Mortar; Rice Husk Ash; Setting Time; Strength Development; Superplasticizer

RODUCTION

nd cement (PC) – the major known binder in concrete and mortar production is adjudged non-vironmental friendly due to its carbon dioxide (CO_2) and energy consumption with resultant global warming effect from its production processes. The PC production processes contributes about 5% to global anthropogenic CO_2 emission making the cement industry an important sector of CO_2 emission mitigation strategies (Rubenstein, 2012).

Most research efforts have been on the partial replacement of PC while little has been reported on total cement replacement in concrete/ mortar. Incinerated ashes from agro-wastes such as rice husk ash (RHA) at controlled temperature have been found to be pozzolanic with major components been amorphous silica which combines with lime in the presence of water to give cementitious properties (Habeeb & Mahmud, 2010). RHA, known to be of high silica content (Parande, *et al*, 2011) was combined at varied proportions in this study with oven-dried calcium carbide waste (CCW) – CaC_2, which is known to be mainly calcium oxide (CaO). Yunusa (2015) reported CCW to react with water yielding calcium hydroxide as a by-product as shown in equation 1 below.

$$CaC_2 + 2H_2O \rightarrow C_2H_2 + Ca(OH)_2 \quad (1)$$

The concept of pozzolanic reaction is based on the fact that PC react using tricalcium silicate (C_3S) with water to give calcium-silicate-hydrate (C-S-H) and calcium hydroxide (CH) (Mehta & Monteiro, 2014)

$$C_3S + H \rightarrow C-S-H + CH$$