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Investigating the Effect of Using Amorphous Silica Ash Obtained from Rice Husk as a Partial Replacement of Ordinary Portland Cement on the Mechanical and Microstructure Properties of Cement Paste and Mortar

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Abstract : This research is aimed at investigating the effect of using amorphous silica ash (ASA) obtained from rice husk as a partial replacement of ordinary Portland cement (OPC) on the mechanical and microstructure properties of cement paste and mortar. ASA was used in partial replacement of ordinary Portland cement in the following percentages 3 percent, 5 percent, 8 percent and 10 percent. These partial replacements were used to produce Cement-ASA paste and Cement-ASA mortar. ASA was found to contain all the major chemical compounds found in cement with the exception of alumina, which are SiO2 (91.5%), CaO (2.84%), Fe2O3 (1.96%), and loss on ignition (LOI) was found to be 9.18%. It also contains other minor oxides found in cement. Consistency of Cement-ASA paste was found to increase with increase in ASA replacement. Likewise, the setting time and soundness of the Cement-ASA paste also increases with increase in ASA replacements. The test on hardened mortar were destructive in nature which include flexural strength test on prismatic beam (40mm x 40mm x 160mm) at 2, 7, 14 and 28 days curing and compressive strength test on the cube size (40mm x 40mm, by using the auxiliary steel platens) at 2,7,14 and 28 days curing. The Cement-ASA mortar flexural and compressive strengths were found to be increasing with curing time and decreases with cement replacement by ASA. It was observed that 5 percent replacement of cement with ASA attained the highest strength for all the curing ages and all the percentage replacements attained the targeted compressive strength of 6N/mm2 for 28 days. There is an increase in the drying shrinkage of Cement-ASA mortar with curing time, it was also observed that the drying shrinkages for all the curing ages were greater than the control specimen all of which were greater than the code recommendation of less than 0.03%. The scanning electron microscope (SEM) was used to study the Cement-ASA mortar microstructure and to also look for hydration product and morphology.

Keywords : amorphous silica ash, cement mortar, cement paste, scanning electron microscope
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