

Utilization of Rice Husk Ash with Clay to Produce Lightweight Coarse Aggregates for Concrete

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Abstract : Rice Husk Ash (RHA) is one of the agricultural waste byproducts available widely in the world and contains a large amount of silica. In Bangladesh, stones cannot be used as coarse aggregate in infrastructure works as they are not available and need to be imported from abroad. As a result, bricks are mostly used as coarse aggregates in concrete as they are cheaper and easily produced here. Clay is the raw material for producing brick. Due to rapid urban growth and the industrial revolution, demand for brick is increasing, which led to a decrease in the topsoil. This study aims to produce lightweight block aggregates with sufficient strength utilizing RHA at low cost and use them as an ingredient of concrete. RHA, because of its pozzolanic behavior, can be utilized to produce better quality block aggregates at lower cost, replacing clay content in the bricks. The whole study can be divided into three parts. In the first part, characterization tests on RHA and clay were performed to determine their properties. Six different types of RHA from different mills were characterized by XRD and SEM analysis. Their fineness was determined by conducting a fineness test. The result of XRD confirmed the amorphous state of RHA. The characterization test for clay identifies the sample as "silty clay" with a specific gravity of 2.59 and 14% optimum moisture content. In the second part, blocks were produced with six different types of RHA with different combinations by volume with clay. Then mixtures were manually compacted in molds before subjecting them to oven drying at 120 °C for 7 days. After that, dried blocks were placed in a furnace at 1200 °C to produce ultimate blocks. Loss on ignition test, apparent density test, crushing strength test, efflorescence test, and absorption test were conducted on the blocks to compare their performance with the bricks. For 40% of RHA, the crushing strength result was found 60 MPa, where crushing strength for brick was observed 48.1 MPa. In the third part, the crushed blocks were used as coarse aggregate in concrete cylinders and compared them with brick concrete cylinders. Specimens were cured for 7 days and 28 days. The highest compressive strength of block cylinders for 7 days curing was calculated as 26.1 MPa, whereas, for 28 days curing, it was found 34 MPa. On the other hand, for brick cylinders, the value of compressing strength of 7 days and 28 days curing was observed as 20 MPa and 30 MPa, respectively. These research findings can help with the increasing demand for topsoil of the earth, and also turn a waste product into a valuable one.

Keywords : characterization, furnace, pozzolanic behavior, rice husk ash

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