ABSTRACT

*keywords:* Alternate aggregates; ceramic waste; bottom ash; silica fume; mechanical properties; durability properties; flexural behaviour

It has been assessed that approximately 30 percent of the daily production is discarded as waste in a ceramic industry. The waste disposal has been a major issue for the ceramic industries as the waste piles up every day. This has been discovered as an environmental pollution which needs to be directed by finding ways and means of using this industrial waste for worthwhile purposes in bulk quantity. There has been an unrestricted use of natural resources in concrete-making, resulting in their depletion to an alarming rate. Hence, for the sustainable development of concrete technology as well as for safe environment, the use of industrial waste as an alternative for the conventional ingredients of concrete provides the best possible option. Bottom ash is a byproduct of the combustion of pulverized coal in power plants. Generally power plants produce bottom ash approximately 20 percent of the total ashes. Most of it is disposed in landfills causing environmental and other problems. Therefore bottom ash can be used as a fine aggregate in concrete making to reduce huge consumption of natural resource. Silicafume is a waste by-product of the manufacture of silicon from high purity quartz and coal in a submerged-arc electric fumace. It is a highly reactive pozzolanic material. According to IS: 456-2000, silicafume was added to concrete mix 10 percent by weight of cement, to enhance the impermeability of concrete.

In this study a purposeful attempt is made to find out the suitability and adequacy of the ceramic waste as a possible substitute for conventional crushed stone coarse aggregate and bottom ash as a partial replacement of conventional fine aggregate in the concrete
composition. Concrete using ceramic waste as coarse aggregate and bottom ash as fine aggregate is termed as CWBA aggregate concrete. This investigation has been carried out in four stages:

i. Characterization of ceramic waste and bottom ash for the possible use in concrete as coarse and fine aggregates respectively.

ii. Development of concrete with ceramic waste coarse aggregate and bottom ash fine aggregate (CWBA aggregate concrete).

iii. Comparison of mechanical and durability properties of CWBA aggregate concrete with those of conventional crushed stone aggregate concrete.

iv. Study on the flexural behavior of reinforced CWBA aggregate concrete beam.

The material properties of ceramic waste and bottom ash were determined and compared with conventional crushed stone coarse aggregate. It has been observed that the water absorption and bulk density of ceramic waste aggregate are less than the conventional crushed stone coarse aggregate. Experimental investigation was carried out to determine the properties of fresh and hardened CWBA aggregate concrete and were compared with respective properties of concrete made with crushed stone coarse aggregate. Test results indicate that the workability of CWBA aggregate concrete is comparable and the strength characteristics are superior to those of the crushed stone coarse aggregate concrete. Experiments were carried out to measure the durability properties of CWBA aggregate concrete and the results show that there is no significant change in the basic trend of permeation properties of CWBA aggregate concrete, when compared to the crushed stone coarse aggregate concrete. CWBA aggregate concrete has improved permeability characteristic values than those of the crushed stone coarse aggregate concrete.
Since the CWBA aggregate concrete is intended to be used in the place of conventional reinforced concrete. Reinforced CWBA aggregate concrete beam was cast and tested up to failure to determine the flexural behaviour. Economy can be achieved by using ceramic waste as coarse aggregate and bottom ash as fine aggregate (partially) in concrete making, which will result in bulk utilization of ceramic waste and bottom ash that indirectly control environmental pollution and also preserve the natural resources.