ABSTRACT

Concrete is most widely used construction material. Traditionally concrete is made up of cement, river sand as fine aggregate, crushed stone aggregate as coarse aggregate and potable water.

Nowadays, river sand is not readily available for use in many places. Instead of natural river sand, crusher sand or manufactured sand obtained from stone aggregate quarries is widely used as fine aggregate in concrete. The advantage of using manufactured sand as fine aggregate is due to the presence of more angular shaped particles compared to river sand which consist of spherical particles. Thus, the bond strength is increased in concrete.

Granite powder is a waste material obtained from granite processing industries. Wet ash or bottom ash is abundantly available in thermal power station as waste material. These two materials have potential application as the replacement of fine aggregate in concrete.

The scope of the present research is to focus the utility of the non-conventional materials as fine aggregate in concrete and study the properties of concrete with partial replacement of fine aggregate (M-sand) with granite powder and bottom ash with varying percentage of superplasticizers.

The granite powder and bottom ash were partially replaced in M-sand separately by various percentages (10%, 20%, 30%, 40% and 50%) and optimum replacement of fine aggregate (M-sand) by granite powder and bottom ash was determined as 10% each by testing the specimens for strength and durability properties in the first part of the investigation.

In the second part of the investigation, the strength properties and the durability properties of the concrete with partial replacement of combined granite powder and bottom ash (20%, 30% and 40%) in fine aggregate (M-
sand) were studied. The combined granite powder and bottom ash replacement by 20% in M-sand was appropriate to produce normal / high strength concrete and also for safe disposal of waste materials. The micro structure of the concrete was also studied by using SEM, XRD and EDS techniques. The analysis results confirmed the important elements present in granite powder and bottom ash which enhance the properties of concrete.

The last part of the investigation was aimed to study the structural behaviour of concrete element incorporating combined granite powder and bottom ash as partial replacement in fine aggregate (M-sand) by conducting flexure tests on RC beams.

Based on the results of the experimental investigation, it was concluded that the desired properties of concrete and behaviour of concrete structural elements could be obtained by incorporating granite powder and bottom ash as partial replacement of fine aggregate (M-sand) in concrete.