ABSTRACT

High Performance Concrete (HPC) is being widely used all over the world for construction purpose in high rise buildings, long span bridges, mega structures and in repair and retrofitting of existing structures. The increased use of high strength concrete consequently increases the Portland cement consumption. Moreover, the increase of the cement consumption causes more CO$_2$ emission from concrete industry which contributes to global warming. Hence, significant reduction in cement consumption by replacing part of cement using mineral admixtures will be environmentally beneficial. The use of high performance concrete in structures is observed to be technically and economically advantageous. The high performance concrete is characterized by low water/ cement ratio and greater cement content when compared to ordinary concrete. The low workability of HPC by virtue of reduced water content is overcome by addition of either mineral or chemical admixtures. The commonly used pozzolanic mineral admixtures include fly ash, rice husk ash and metakaolin, to achieve the desired workability.

In this research, three type mineral admixtures, Alcocine 1203 (AF), Metakaolin (MK), Ground Granulated blast furnace slag (GGBS), and three type of fibres, i.e. Strongcrete, Nokrack, Flat crimped steel fibres were used in concrete at different percentages and mechanical and durability properties of high-performance concrete has been studied. Measurements were carried out after first 24 hour warped curing and after that water curing. Assessment of the mechanical properties of concrete mixes was based on compressive strength, split tensile strength, flexural strength and durability tests like water absorption, seawater test, sulphate attack test, sorptivity test and water permeability test of concrete. In addition, the microstructural and chemical composition of the optimum mix using the Scanning Electron Microscopy (SEM) and X-Ray Diffraction (XRD). The results, in general, showed that mineral admixtures and fibres improved the properties of high-performance concretes, but at different rates depending on the binder and fibre type.