Comparative study on fresh, mechanical, microstructures properties and corrosion resistance of self compacted concrete incorporating nanoparticles extracted from industrial wastes under various curing conditions

Natural pozzolans or industrial wastes are commonly utilized in eco-friendly concrete as a partial replacement for ordinary Portland cement to eliminate carbon emissions and improve mechanical and durability characteristics. Although many experiments have been carried out to investigate the effects of natural pozzolans in concrete, there has been little research into the effects of nano waste glass (NWG) and nano waste ceramics (NWC) as cement replacement materials on the properties of self-compacted concrete (SCC). firstly, this study presents the effects of using NWG and NWC as cement replacement materials on the properties of SCC. This is to overcome the increased need of SCC for a larger amount of cement content, which leads to crack appearance. Secondly, this study aims to analyze the effect of self-curing (SC) using polyethylene glycol (PEG400) on SCC modified using various nanomaterials as a cement replacement (CRM) and compare the obtained results of this type of curing with air curing (AC) and normal curing (NC) to show the positive effect of SC on SCC properties. Several SCC mixes were created and tested utilizing nanoparticles with replacement percentages of cement ranging from 1-So/o. SCC mixtures' fresh characteristics, mechanical properties, microstructure, and corrosion rates were investigated. Results show that the workability of SCC mixtures decreases in the case of SC compared to NC, but it remains within the acceptable limits of EFNARC-2005. By contrast, mechanical properties, microstructure, and corrosion resistance are improved as the percentages of NWC and NWG are increased, except for the So/o replacement ratio. Under SC, there was a significant improvement in SCC mixtures where compressive strength rose by 36% and 32% in NWG and NWC, respectively, and the corrosion rate decreased by 87% and 82% in NWG and NWC, respectively.