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EXPERIMENTAL AND STATISTICAL STUDY OF MECHANICAL AND DURABILITY PROPERTIES OF SELF-COMPACTING CONCRETE USING SEAWATER FOR MAKING AND CURING

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Abstract

We assess the workability, mechanical properties, and durability of self-compacting concrete (SCC) incorporating silica fume (SF) and fly ash (FA) using tap water and seawater for making and curing. Leveraging a three-way ANOVA and Eigen analysis, we analyzed the results. Slump flow measurements, exhibit consistent behavior regardless of water type. The use of seawater instead of tap water leads to increased J-ring values, indicating potential enhancement in viscosity. Elevated SF content within SCC formulations further amplifies J-ring values, irrespective of water type. Air content experiences a minor rise with seawater, well within permissible limits. Optimal compressive strength, attained at 28 and 90 days, emerges from SCC samples containing 8% SF and 27% FA, produced with tap water and cured using seawater. Reversing the water types for production and curing yields comparable strength results. Conversely, SCC specimens produced and cured with seawater exhibit comparatively diminished strengths. Seawater employment for production and curing introduces marginal augmentations in water absorption (below 4%) and water penetration depth (7-33mm). Rapid Chloride Permeability Test values, ranging from 1000 to 2000 coulombs, indicate low chloride permeability across samples. Chloride concentration remains lower when seawater is utilized for production and tap water for curing, compared to the inverse scenario. The most notable chloride concentration (2.7-5% of concrete weight) arises when seawater is employed for both stages. The Rapid Chloride Migration Test manifests migration values of 4 to 7.8 (10-12 m^2/s) for seawater production and tap water curing. Three-way ANOVA and Eigen-analysis provide robust statistical validation to the experimental outcomes.

Key words: mechanical properties, self-compacting concrete, sea water, tap water, workability

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