Effect of Dumpsite-Contaminated Water on the Strength Development of Concrete Over Time in Ugwuaji, Enugu State, Nigeria

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Abstract

This study assessed the effect of dumpsite-contaminated water on the strength development of concrete over time in Ugwuaji, Enugu State, Nigeria. The objectives were to evaluate the compressive strength of concrete produced with groundwater collected at varying distances from the former dumpsite, determine strength de-velopment at different curing ages, and establish the relationship between curing age and compressive strength. An experimental and analytical research design was adopted. Five groundwater samples were col-lected at locations ranging from the former dumpsite to 1,850 m away. Grade C40 concrete of 1:1:2 mix pro-portion was produced using Ordinary Portland Cement, river sand and crushed granite. Concrete cubes measuring 150 × 150 × 150 mm were cast and tested for compressive strength at 3, 7 and 14 days. The re-sults showed that mean compressive strength increased from 26.26 N/mm² at 3 days to 31.07 N/mm² at 7 days and 34.72 N/mm² at 14 days. At 14 days, individual strengths ranged from 33.30 to 35.60 N/mm². ANOVA re-vealed a statistically significant difference in strength across curing ages ($F = 12.194$; $p = 0.001$), while Pear-son correlation showed a strong positive relationship between curing age and compressive strength ($r = 0.796$; $p < 0.001$). The findings established that although all specimens progressively gained strength, varia-tions in water quality influenced the rate of strength development. The study concludes that dumpsite-impacted groundwater significantly influences concrete strength development and recommends mandatory laboratory testing of groundwater from reclaimed dumpsites before its use for concrete production.

Keywords

Dumpsite-contaminated water, Concrete, Compressive strength, Strength development, Curing age, Ground-water contamination.