

عنوان مقاله:

Evaluation of the Combined Use of Waste Paper Sludge Ash and Nanomaterials on Mechanical Properties and Durability of High Strength Concretes

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خلاصه مقاله:

The paper industry burns or buries a significant amount of waste paper sludge. This issue is not suitable from environmental and economic aspects. In this study, the mechanical and durability properties of high-strength concrete containing waste paper sludge ash (WPSA) were evaluated. The variables were WPSA (۰، ۵، ۱۰، and ۱۵% by weight of cement), silica nanoparticles (۰ and ۲.۵ by weight of cement), and aluminum oxide nanoparticles (۰ and ۲.۵ by weight of cement). Compressive strength, splitting tensile strength, flexural strength, and ultrasonic pulse velocity tests were conducted to evaluate the mechanical properties. The durability properties were also investigated using water penetration depth, water absorption, and electrical resistivity tests. The microstructure of the specimens was analyzed by preparing electron microscopic images. The combined effect of WPSA and nanoparticles on improving the mechanical and durability properties of high-strength concrete are better than using each of them alone. WPSA and nanoparticles react with calcium hydroxide formed due to cement's hydration, and silica produces hydrated calcium, which is the hard material that makes concrete strength. Consumption of calcium hydroxide and production of more hydrated calcium silicate in the presence of nanoparticles and WPSA are among the reasons for water absorption reduction, increased electrical resistance, and water penetration depth reduction in concrete specimens. By replacing part of the cement with WPSA, silica nanoparticles, and aluminum oxide nanoparticles, the transition zone between the aggregates strengthens, and the tensile and flexural strengths increased.

کلمات کلیدی:

Waste paper sludge ash, Aluminum Oxide Nanoparticles, Silica Nanoparticles, Durability properties, Mechanical properties, high strength concrete

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