The College of Graduate Studies and the College of Engineering Cordially Invite You to a

Master Thesis Defense

Entitled

Reuse of Sewage Sludge Ash in Producing Self Compacting Concrete

by

Siham S. AlShanti

Faculty Advisor

Amr S. El-Dieb, Department of Civil & Environmental Engineering

College of Engineering

Date & Venue

1:00 pm

Thursday, 11 Feb 2021

Via Microsoft Teams

Click here to join the meeting

Abstract

Rapid growth of self-compacted concrete (SCC) marks a significant milestone in enhancing the product quality and effectiveness of the construction industry. This special type of concrete is known for its high flowability characteristics and surface finish without the tendency for segregation. Recently, due to the current innovations and development worldwide, the rate of producing solid waste has increased considerably. Therefore, examining the potential applications for recycling and reusing such waste is a significant step towards sustainable development. Incorporation of solid by-products materials, produced by thermal power plants and metallurgical industries, as partial replacement of Portland cement, played a major role in enhancing the properties of SCC, besides it reduces the cost and heat of hydration. The main aim of this study is to investigate the viability of utilizing sewage sludge ash (SSA) produced from wastewater treatment plants (WWTP) in the mixture composition of SCC. These ashes can lead to serious economic and environmental issues, hence their utilization in the construction sector will be of great benefit in mitigating their negative impact. This research includes a series of experimental procedures divided into two phases; in the first phase it is essential to burn the organic compounds that comprise a large fraction of the raw sewage sludge. Therefore, the raw sludge was incinerated at different temperatures and for different burning periods, resulting in a powder material what is known as SSA. The morphology, chemical and mineral composition of the produced material of the produced ash were evaluated using scanning electron microscopy (SEM), X-ray fluorescence (XRF), and X-ray diffraction (XRD). Moreover, strength activity index and Frattini tests were conducted to assess the pozzolanic activities of the produced ash. In addition to the effect of SSA as replacement of OPC in terms of workability, workability retention, pore size distribution, and heat of hydration were assessed. In the second phase, SSA was used as a partial replacement of ordinary Portland cement (OPC) at different ratios to produce SCC mixtures. Fresh concrete properties hardened concrete properties and durability characteristics of the produced SCC were examined. It was concluded that SSA can be used to successfully produce SCC mixtures with minor modification in the mix design to achieve satisfactory fresh properties. SCC mixtures contained SSA as OPC replacement exhibited considerable strength gain with age and represented good durability characteristics. SSA is a promising addition considering its feasibility in producing SCC with acceptable fresh and hardened properties and potential environmental benefits.

Keywords: Self-compacted concrete, sewage sludge ash, characterization, durability, recycling.