Workability and heat of hydration of self-compacting concrete incorporating agro-industrial waste

Abstract

This paper presents an experimental study on the workability and the heat of hydration in Self-compacting concrete (SCC) incorporating agro-industrial waste and blended aggregates. The control mixture contained only Ordinary Portland Cement (OPC) as the binder while the remaining mixtures incorporated binary and ternary cementitious blends of OPC, palm oil fuel ash (POFA) and fly ash. The replacement of waste was from 10% to 40% by mass of the total cementitious material of the concrete for workability test and limited to 30% and 40% replacement for the heat of evaluation test. Workability i.e. passing ability, filling ability and segregation resistance was determined and semi-adiabatic temperature rise during the initial stage of hydration was measured by thermocouples. It was observed that fly ash mixes required the least amount of super-plasticiser (SP) to obtain a workable SCC, however, POFA mixes had the reverse effect. The ternary use of POFA and fly ash had better workability properties than the POFA mixes and performed the best in terms of segregation resistance. The ternary mixes also had the lowest amount of heat dissipation with peak temperatures occurring earlier than the fly ash mixes. The experimental studies indicate that ternary blend SCC with POFA and fly ash has significant potential when considering a sustainable construction material hence also providing a cleaner production solution for the palm oil industry.