

The effect of using nano rice husk ash of different burning degrees on ultra-high-performance concrete properties

This work aims to highlight the effect of seven different types of nano rice husk ash (NRHA) on the mechanical, ultrasonic pulse velocity, and durability of ultra-high-performance concrete (UHPC), whereby two different scenarios were applied. Rice husk ash (RHA) was manufactured by calcining rice husk at temperatures of 300, 500, 700 and 900 °C at a constant time of burning (for 3 h). Then, it was kept for cooling with a constant rate of 10°/min and different burning hours of (9, 7, 5, and 3 h, respectively). After that, the product was milled to nano size. The final nano-sized product was added by different dosages (1–5%) with a 2% step to the UHPC mixture. Compressive, splitting tensile, and flexural strength were measured accordingly. Permeability was assessed by the sorptivity test; the ultrasonic pulse velocity test was also conducted. The results showed that the addition of NRHA enhanced the compressive strength and impermeability of UHPC due to the refined pore structure. For a constant burning duration, a significant improvement in compressive strength was observed at a burning temperature of 900 °C and 700 °C for 1% NRHA and at 500 °C and 300 °C for 3% and 5% NRHA. However, for a different burning duration, a significant improvement in compressive strength was recorded at a burning temperature of 700 °C and 500 °C for 3% NRHA, which was burnt for 5 h and 300 °C for 5% NRHA, which was burnt for 9 h. Sorptivity and ultra-sonic pulse velocity confirmed the results. Therefore, the advisable condition is burning at 700 °C for 5 h for more amorphous silica with medium energy compared to other mixes.