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# Combined effects of mineral additions and curing conditions on strength and durability of self-compacting mortars exposed to aggressive solutions in the natural hot-dry climate in North African desert region

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## HIGHLIGHTS

- The effect of mineral additions and curing on strength and durability is investigated.
- SCM needs a minimum water-curing period of 7 days under hot-dry climate.
- SCM mixture incorporating Metakaolin possesses better hardened properties.
- Using mineral addition higher than 15% and 25% improves the resistance to sulfate.
- Mineral additions reduce slightly damage due to acid attack.

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## ABSTRACT

The long-term behavior of self-compacting concrete (SCC) or mortar (SCM) in standard climate is relatively well studied. However, the performance of SCM under hot-dry climate is little investigated. In fact, strength and durability of SCM can be affected by climatic conditions and can be enhanced by the use of the mineral additives. The present paper analyses the combined effects of both mineral additions and curing conditions on the properties of self-compacting mortar exposed to natural hot-dry climate. Ten mixtures were prepared using blended binder containing three types of mineral additives (marble powder (MP), brick powder (BP) and metakaolin (MK)) in various proportions. In order to evaluate compressive and flexural strengths and ultrasonic pulse velocity (UPV), mortar specimens were stored in water for an initial curing period of 0, 1, 3, 7 and 28 days (T = 20 ± 2 °C and RH = 30%–50%), before being exposed to natural hot-dry climate in a North African desert region (T = 25–48 °C and RH = 8%–33%) until 28 days. The durability against sulfate and acid attacks was assessed by curing mortar specimens in water for seven days, followed by immersion-drying cycles for 56 days and then total immersion in $MgSO_4$, $Na_2SO_4$, HCl and $H_2SO_4$ solutions until 360 days. The results showed an enhancement in hardened properties of SCM with increasing water-curing period. A water-curing period for a minimum 7 days appears to be necessary in hot-dry climate to achieve acceptable mechanical performances. Metakaolin seems to exhibit the best performance regarding mechanical properties and durability in sulfate mediums. Mineral additions show little influence in reducing damage due to acid attacks.