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## ALKALI-ACTIVATED GEOPOLYMER MORTARS CONTAINING HIGH VOLUME CERAMIC TILE WASTE POWDER AND FLY ASH REPLACING GBFS

**Abstract:** Traditional Portland cement can be effectively substituted by alkali-activated geopolymer binders. Not only can alkali-activated binders save energy and reduce CO<sub>2</sub> emission but they can also augment the durability performance of concrete as well as aid in resolving the landfill problems. It is well-known that extensive quantities of calcined clay waste are created every year by the ceramic industry, of which a significant amount is used in landfills. It is thus more appropriate to reuse this waste efficiently. This study investigated the impacts on sustainability of ceramic tile waste powder (CTWP) based alkali-activated mortars (AAMs) incorporating fly ash (FA) as a replacement of ground blast furnace slag (GBFS), which were exposed to various hostile environments. Binders were prepared by maintaining the CTWP content at 50% in all alkali-activated mortars (AAMs) and FA replacing GBFS by 10%, 20%, 30%, and 40%. Durability properties were evaluated which included elevated temperatures, sulphate and acid attack, drying shrinkage, freezing-thawing and wet-dry cycles, as well as water permeability. The findings suggested that freezing-thawing resistance increased and better durability was displayed by increasing the FA content in AAMs. Furthermore, AAMs with high FA content led to enhance the performance in terms of sulphate and acid environments and elevated temperatures. Apart from the increased durability replacing GBFS with FA and containing 50% CTWP, alkali-activated geopolymer also resulted in a decrease in energy consumption and cost as well as CO<sub>2</sub> emission.