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# Development of geopolymer binders based on industrial waste with different treatment methods: A review

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**Abstract**

In recent years, scientific research into new construction materials has focused on the development of geopolymer cement based on industrial waste or by-products such as blast furnace slag, fly ash, rice husk ash, metakaolin, alkaline activators (NaOH /KOH and $Na_2SiO_3$). The aim of manufacturing geopolymer cement is to protect the environment from $CO_2$ emissions, reduce the use of natural raw materials (clay and limestone) and create a new ecological and sustainable material. The synthesis of geopolymers depends on a number of parameters, including the type of raw materials used (chemical composition), the activator content and molarity, and the curing conditions. In this paper, we reviewed the importance of this topic and discussed a group of research such as: a recent study investigated the effect of variations in curing temperature and atmospheric exposure and humidity on the mechanical and microstructural properties of fly ash and steel slag mortars. Their results show that thermal curing at 50 °C and exposure to atmospheric air offer the best strength results for alkali-activated mortars. Nagajothi and Elavenil studied the effect of using ground granulated slag and fly ash to produce geopolymer cement, and their results indicated that a compressive strength of 42 MPa was observed within 40 hours of curing under ambient conditions. Rangan studied the durability and mechanical characterisation of geopolymer concrete with different variables such as alkaline activator concentration, curing method and temperature. Gopalakrishma and Pasla studied the effect of using different Fly-Ash-GGBS-MK materials as a binder in the manufacture of GPC mortars, their results indicated that the compressive strength of the materials varies with the percentage of these materials used in the composition. Finally, the use of alkali-activated binders with diffèrent mode can reduce carbon dioxide emissions by up to 80% compared with portland cement, making it a promising option for reducing environmental impact.

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