



## Durability and Microstructural Properties of Metakaolin based Geopolymer Materials Incorporating Untreated Phosphate Washing Sludge

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### Abstract:

In this study, mechanical, visual, and microstructure changes of geopolymer concrete incorporating untreated phosphate washing sludge (Ghantour, Youssoufia) were investigated. This process allows the recycling of a large amount of phosphate washing sludge without heat treatment as a partial replacement of metakaolin, which makes it very attractive from an economic and environmental point of view. Geopolymer concretes which completed curing time were immersed in hydrochloric acid (HCl), sodium sulfate ( $\text{Na}_2\text{SO}_4$ ) and sodium chloride ( $\text{NaCl}$ ) solutions for 12 weeks. The effect of Metal alkali type on the compressive strength values, visual inspections, weight and elevated-temperature exposure of the samples were determined in this investigation. Microstructure studies were conducted using X-Ray diffraction (XRD), Thermogravimetric analysis (TGA/DTG) and Attenuated Total Reflectance Fourier Transform Infrared spectroscopy (ATR-FTIR). In addition, scanning electron microscopy (SEM-EDX) was performed for the microstructure analysis of the samples removed from the solutions and thermal treatment. It is concluded that geopolymer produce develop acceptable mechanical strength and demonstrate high resistance to sulphate and chloride attack. They also showed higher resistance to acid attack than the control mix based on Metakaolin based geopolymer. As the concentration of the alkaline solution in the mixture increases, the loss rate in the strength of the samples exposed to acid, sulfate and salt solutions occurred a slight decreased. While samples exposed to thermal treatment occurred a weight loss and shows falling in the compressive strength. No deterioration occurred on the surfaces of the samples exposed to the solutions for 12 weeks. Here, emphasis is placed on the potential of reusing phosphate sludge with excellent performance and less complicated production geopolymer methods as well as a low carbon footprint.



### Biography:

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