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Geopolymerization Methods for Clay Soils Treatment

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Abstract : Most of the clay soils are known as problematic soils due to their water content, which varies greatly over time. It is observed that they are used to be subject to shrinkage and swelling, thus causing a problem of stability on the structures of civil engineering construction work. They are often excavated and placed in a storage area giving rise to the opening of new quarries. This method has become obsolete today because to protect the environment, we are leading to think differently and opening the way to new research for the improvement of the performance of this type of clay soils to reuse them in the construction field. The solidification and stabilization technique is used to improve the properties of poor quality soils to transform them into materials with a suitable performance for a new use in the civil engineering field rather than to excavate them and store them in the discharge area. In our case, the polymerization method is used for bad clay soils classified as high plasticity soil class A4 according to the French standard NF P11-300, where classical treatment methods with cement or lime are not efficient. Our work concerns clay soil treatment study using raw materials as additives for solidification and stabilization. The geopolymers are synthesized by aluminosilicates materials like fly ash, metakaolin, or blast furnace slag and activated by alkaline solution based on sodium hydroxide (NaOH), sodium silicate (Na2SiO3) or a mixture of both of them. In this study, we present the mechanical properties of the soil clay (A4 type) evolution with geopolymerisation methods treatment. Various mix design of aluminosilicates materials and alkaline solutions were carried at different percentages and different curing times of 1, 7, and 28 days. The compressive strength of the untreated clayey soil could be increased from simple to triple. It is observed that the improvement of compressive strength is associated with a geopolymerization mechanism. The highest compressive strength was found with metakaolin at 28 days.

Keywords : treatment and valorization of clay-soil, solidification and stabilization, alkali-activation of co-product, geopolymerization
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