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Influence of Initial Curing Time, Water Content and Apparent Water Content on Geopolymer Modified Sludge Generated in Landslide Area

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Abstract : As being lack of sufficient strength to support the loading of construction as well as service life cause the clay content and clay mineralogy, soft and highly compressible soils (sludge) constitute a major problem in geotechnical engineering projects. Geopolymer, a kind of inorganic polymer, is a promising material with a wide range of applications and offers a lower level of CO_2 emissions than conventional Portland cement. However, the feasibility of geopolymer in term of modified the soft and highly compressible soil has not been received much attention due to the requirement of heat treatment for activating the fly ash component and the existence of high content of clay-size particles in the composition of sludge that affected on the efficiency of the reaction. On the other hand, the geopolymer modified sludge could be affected by other important factors such as initial curing time, initial water content and apparent water content. Therefore, this paper describes a different potential application of geopolymer: soil stabilization in landslide areas to adapt to the technical properties of sludge so that heavy machines can move on. Sludge condition process is utilized to demonstrate the possibility for stabilizing sludge using fly ash-based geopolymer at ambient curing condition (± 20 °C) in term of failure strength, strain and bulk density. Sludge conditioning is a process whereby sludge is treated with chemicals or various other means to improve the dewatering characteristics of sludge before applying in the construction area. The effect of initial curing time, water content and apparent water content on the modification of sludge are the main focus of this study. Test results indicate that the initial curing time has potential for improving failure strain and strength of modified sludge with the specific condition of soft soil. The result further shows that the initial water content over than 50% total mass of sludge could significantly lead to a decrease of strength performance of geopolymer-based modified sludge. The optimum apparent water content of geopolymer modified sludge is strongly influenced by the amount of geopolymer content and initial water content of sludge. The solution to minimize the effect of high initial water content will be considered deeper in the future.

Keywords : landslide, sludge, fly ash, geopolymer, sludge conditioning
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