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TECHNICAL NOTE

Alsidqi Hasan,[1] Fauzan Sahdi,[2,3] Norsuzailina Mohamed Sutan,[2] Nurul Asikin Mijan,[4] and Sinin Hamdan[5]

Strength Behavior of Sedimented Gypsum Slurry

Reference

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ABSTRACT

Rapid increases in the production of gypsum waste from the Flue Gas Desulphurization process necessitates that proper impoundments be built with an adequate understanding of the strength behavior of the sedimented gypsum slurry. This article presents laboratory experimental results that describe its physical characteristics and strength behavior. The physical characterization includes a particle size analysis and specific gravity of solids, which conform to ASTM standards. The strength behavior is described from a series of consolidated isotropically undrained triaxial compression tests that is performed at six levels of effective confining stress with two tests for each effective confining stress. The results and parameters are presented via critical state analyses in *q-p'* and *e-p'* spaces as well as a Mohr-Coulomb model. The analysis reveals two distinguishable regimes during shearing, which are classified as structured and destructured regimes, at which the sediment undergoes a change in strength behavior from being an intact structure to becoming a broken structure. A unique critical state line is found to be unparalleled with the isotropic compression line.

Keywords

gypsum, slurry, sediment, flue gas desulphurization, triaxial test, Mohr-Coulomb, critical state, structured soil

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[1] Department of Civil Engineering, Universiti Malaysia Sarawak, Jalan Datuk Mohammad Musa, Kota Samarahan, Sarawak 94300, Malaysia (Corresponding author), e-mail: halsidqi@unimas.my, https://orcid.org/0000-0001-7543-096X

[2] Department of Civil Engineering, Universiti Malaysia Sarawak,, Jalan Datuk Mohammad Musa, Kota Samarahan, Sarawak 94300, Malaysia

[3] Centre for Offshore Foundation Systems, University of Western Australia, 35 Stirling Highway Crawley, Perth, Western Australia 6009, Australia

[4] Centre of Excellence for Catalysis Science and Technology (PutraCAT), Fakulti Sains, Universiti Putra Malaysia, Jalan Upm, 43400 UPM Serdang, Selangor Darul Ehsan, Malaysia

[5] Department of Mechanical and Manufacturing Engineering, Universiti Malaysia Sarawak, Jalan Datuk Mohammad Musa, Kota Samarahan, Sarawak 94300, Malaysia

Introduction

Increased population and industrial development are reflected in the demand for more energy from power plants, particularly in the fossil fuel production sector, which contributes to critical environmental problems associated with solid wastes. Gypsum waste is a type of solid waste that accumulates over the years. It is produced as a liquid mixture (slurry) from the Flue Gas Desulphurization (FGD) process. The FGD is widely used to remove the sulfur dioxide (SO_2) contents from exhaust flue gases of fossil fuel power plants as well as from other SO_2-emitting processes. Even though the FGD technology is found to be successful in removing SO_2, it leads to excessive production of waste in the form of gypsum.

FGD gypsum is chemically expressed as calcium sulfate ($CaSO_4$), which is theoretically obtained via forced oxidation of calcium sulfite ($CaSO_3$) during the FGD process as follows: