Proceedings of the Eighteenth (2008) International Offshore and Polar Engineering Conference
Vancouver, BC, Canada, July 6-11, 2008

ISBN 978-1-880653-70-8 (Set); ISBN 1-880653-68-0 (Set)

Comparison and Strength Characteristics of Cements for Cement-Stabilization for Dredged Surface Soil

Min Soo Kang
Samsung Engineering & Construction,
Sungnam, Kyunggi, Korea
Soo Sam Kim
Department of Civil Engineering, Hanyang University,
Ansan, Gyeonggi, Korea
Sang Jae Han
Expert Group for Earth & Environment Co. LTD.,
Anyang, Gyeonggi, Korea
Myung Seok Yoon
Department of Civil Engineering, Hanyang University,
Ansan, Gyeonggi, Korea

ABSTRACT

The purpose of this study was to investigate the applicability of new cement developed to be used for cement-stabilization for surface soil on a ground filled with dredged soil with high water content. In order to do so, ordinary Portland cement (OPC), ordinarily used for cement-stabilization for surface soil, blast furnace slag cement, and a new type of cement were mixed with dredged soil and a uniaxial compression test was performed. Uniaxial compression test results obtained by varying cement types, cement weight per unit volume, and water-cement ratio were analyzed. When the same amount of cement was added and the water-cement ratio was the same, Uniaxial compression strength was stronger for the specimen with the newly developed cement than the specimen with OPC or blast furnace slag cement using the same ratio of additives and water-cement ratio. Also, a test to measure elution of harmful material from the specimen pursuant to the TCLP was performed, and the result showed that Result 6 is environmentally safe as harmful materials including Chrome were not detected.

KEY WORDS:

INTRODUCTION

Recently, reclaiming of seashore land to procure land to build new large-scale harbors, airports, new cities, industrial complexes and agricultural sites, and construction of industrial complexes and roads on the seashore area have been frequently performed. Unlike in the past, due to environmental and economical concerns, it is now more difficult to procure good quality surcharge material, hence dredged soil is actively used. However, even after 10 years, only the surface of a ground created using dredged soil is strengthened by natural drying, and it is impossible for the equipments to improve the ground to enter. Therefore, it is necessary to assure that such equipments can enter the land by strengthening the surface soil by using methods such as cement-stabilization for surface soil.

Cement used for cement-stabilization for surface soil must be strong enough to support construction equipments, but at the same time, the less cement is used, the better it is environmentally and economically. Hence, cements that can provide high strength with the least amount, and that are environmentally less harmful are being developed.

In this study, a laboratory mixing design experiment with cements that are currently being used was performed in order to examine the applicability of A-cement that is developed to strengthen a ground of cohesive soil which has high water content such as seaside cohesive soil-based ground that is filled with dredged soil. Usually, ordinary Portland cement (OPC), blast furnace slag cement, and A-cement were used as a strengthening agent. The characteristics of the uniaxial compression strength from different mixing conditions varying in cement-soil and water-cement ratios were analyzed. Also, in order to examine the environmental harmfulness of A-cement, a test to detect the elution of harmful materials using the TCLP was performed.

STRENGTHENING MECHANISM

Hydration Reaction of OPC

As ordinary Portland cement (OPC) has hydraulicity, it reacts with water instantly to create a hydrate. Hydration usually occurs when chemical compounds such as C_3S, C_2S, C_3A and C_4AF react with water, and hydrates such as C-S-H, C-A-H, and C_2AH_6-C_3FH_6 are created.

Blast furnace slag cement is created by mixing clinker, a partly manufactured OPC, and blast furnace slag, a by-product of iron and steel making, in a fixed ratio. Blast furnace slag powder is a by-product created when pig iron is manufactured. Its chemical composition is almost identical with that of cement. Hydration reaction is also known to be almost identical to that of cement, however it is different in that hydration occurs by "potential hydraulicity."

Since OPC has hydraulicity, once it comes in contact with water,