10th International Congress on Civil Engineering, 5-7 May 2015
University of Tabriz, Tabriz, Iran

Enhancing the compressive strength of clayey sand soils by using Iron Oxide Nanoparticles II

Y.Moradi[1], M.Arabani[2], A.Khodaparast haghi [3]

1- Master of Civil Engineering, Guilan University
2, 3- Professor, Dept. of Civil Engineering, Guilan University

yaldamrd@yahoo.com

Abstract

Nano oxide ingredients often called ceramic oxide components include a wide range of nanoparticles. Some of these nano scale materials like silica nano-particles have been considered by experiments for enhancing the soil features. In this study, for the first time, we have investigated the usage of iron oxide nanoparticles II to improve the compressive strength of the soil. To do so, using the clayey sand soil and iron oxide nanoparticles II, by the manner of mixing via ball mill, laboratory samples have been afforded and subjected to the axial test. Results of this study showed that by using a mixture of 0.2%, 0.5%, 1%, 2%, 3% weight of iron oxide nanoparticles in the soil by the best procedure of mixing nano ingredients with ball mill, the compressive strength of these kinds of soils will be increased up to almost 50%

Keywords: Iron Oxide, Nano, Compressive Strength, Ball Milling, Clayey Sand Soil.

1. INTRODUCTION

Several considerations have been done regarding to use Nano ingredients for enhancing the soil power parameters. Nano materials are often used for changing the geotechnical attributes which affect the consolidation, permeability indexes and soil power features [1].

In 1992, Yonekura and Miwa utilized silica nanoparticles to increase sand compressive strength. Also, Noll et al. investigated the use of silica nanoparticles in 1992 for enhancing soil's strength against consolidation and permeability. In 2005, silica nanoparticles were utilized by Gallagher for increasing soil's cohesion/adhesiveness and decreasing its viscosity, and behavior of the sand improved by nano-materials was analyzed in cyclic loading conditions. As a result, it was indicated that cohesion/adhesiveness depends on percentage of nanoparticles increase. In 2007, Patricia et al. in the United States used nano-materials practically in a place whose soil was of sand type with high viscosity and reported 40% improvement in settlement after applying artificial earthquake and evaluation of the yielded settlement. To study the effect of silica nanoparticles in dimension range of 5-100 nm, Butrón et al. carried out odometer test, triaxial test, and compressive test, and showed that soil strength increases with time, such that the soil containing nanoparticles is ductile in initial stages and subsequently becomes elasto-plastic [1]. In 2004, Zangh indicated that existence of nanostructure in soil causes an increase in Atterberg limits [2]. Nano-particles influence soil in their specific properties. Generally, when materials get smaller to nanoscale, their properties become remarkably different or have an increase. In the other research- accomplished about the Nano ingredients, Mohammadzadeh Sani et al concluded that the liquid limit and plastic limit of the studies soil mixture with nano ingredients in compared to original soil, in increased. This increase is such that causes the soil plasticity index. The soil shear strength is also intensified at the presence of Nano ingredients. This is due to reaction of nano with other soil ingredients that in this case the cohesion and juncture through among the ingredients will be intensified [3].

In the present research, iron oxide nanoparticles II has been used in several percentages in order to evaluate the increasing of the compressive strength by axial tests of the soil containing 80% sand and 20% clay.

[1] . Master of Civil Engineering
[2] . Professor
[3] . Professor