Soil Improvement by New Chemicals of PET (Polyethylene terephthalate) and UF (Urea Formaldehyde)

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Abstract

Soil improvement is referred to evolve physical and engineering characteristics of soil. Recently, new chemicals like polymers are used to speed the operation of soil improvement and ease the access instead old soil stabilizers such as cement, lime and etc. there are not so many information, however, about operation of these materials within the soil. This study attempts to give more information about these soil stabilizers and to show their affects within the soli. In this study, effects of two polymers namely PET and UF are studied in improvement of a problematic sandy soil. In which it is resulted that with usage of PET and UF resins CBR value increased by 713% and 677% in dry state, and increased by 1044% and 750% in saturated state, respectively.

Keywords: CBR, PET Resin, Soil Improvement, UF Resin

1. Introduction

More and more suitable lands are demanded for engineers to construct their giant constructions, lands, bridges and other huge structures. Unfortunately many construction sites are not provided suitable physically and mechanically characteristics and that's why they need to be improved by some techniques. These techniques evolve mechanical and physical aspects of the soil. The aim of this process is as follows:

- Increase the load-bearing capacity and/or the shear strength
- Reduce both absolute and differential settlements
- To mitigate or remove the risk of liquefaction in the event of an earthquake

In previous techniques chemicals such as: cement [1], lime, fly ash [2] and bitumen were used widely for loose and expansive soil improvement. Since 1980, soil improvement with new chemicals has begun and in 1990 has revolutionized [3]. For instance, in some investigations, conducted by Mahdavian et al. [3], effects of an enzyme were studied on CBR value of the soil. They founded that presence of enzyme in such a soil which comprises more than 30% of fine aggregates, CBR value increase by 160%. Liu et al. examined a type of organic polymer stabilizer, STW, to improve some characteristics of soft soil, strength, stability and erosion resistance; they asserted that STW soil stabilizer dramatically increased the unconfined compression strength, shear strength, water stability and erosion resistance of clayey soil [4]. Park studied on a sandy specimen mixed with cement and randomly distributed PVA fibers, and finally figures out a significant increase in the strength of the FRCS (fiber reinforced cemented sand) [5]. Li et al. reported that there were notable increase in shear strength, toughness and plasticity of a cohesive soil after reinforcement with discrete Poly Propylene (PP) fiber [6]. It seems that Polypropylene fibers were employed to soil improvement because of its excellent acid and alkali resistance. Moreover, it is founded that interfacial shear strength between soil and PP fibers depends on soil particles, effective interface contact area, and fiber surface roughness [7]. Tang et al. determined the strength and mechanical behavior of randomly distributed short PP-fiber (12mm long) reinforced un-cemented soil and cemented soil [8]. Accordingly, it was found that the inclusion of fiber reinforcement within un-cemented and cemented soil caused an increase in the unconfined compressive strength (UCS), shear strength and axial strain at failure. Increasing fiber content could increase the peak axial stress and decreases the stiffness and the loss of post-peak strength, weakens the brittle behavior of cemented soil. Crowly et al. used PVAc resins to contain soil moisture and soil improvement in the fields with more than 60 degree gradient against raining and produce dust [9].