

Improving the Mechanical Properties of Dunes Soils in Southern Iraq by Adding Carboxymethyl cellulose

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Abstract. Due to climate change, resultant dunes zones have increasingly been a severe issue for the environment and people. Its impacts turn out on land degradation and reduction of surface moisture. This research aims to experimentally analyse the mechanical behaviour of desert Dunes soils by adding Polymer type Carboxymethyl cellulose (CMC) resin. The collected soil samples were from a site adjacent to Nasiriya–Baghdad highway in Thi-Qar province. The experimental design was set up into two groups with different percentages of the polymer material (5%, 10%, 15%, and 20%) and different weight percentages of water added to the natural soil (dunes soil). Compaction, classification, and shear strength tests are the essential measurements of the samples in this study. The analysis shows that the natural dunes soil is low plasticity sandy silt with a friction angle of about 31.40. Both groups, PNS and POM, reveal nearly the same changes in PHI angles. They increase at the first Polymer addition (5%) and decrease at the third addition (15%) and return to increase at the fourth addition (20%). This means that the best polymer addition is at 5%, and the worst addition is at 15% even though the change in PHI angle adequately is not high.

Keywords. Dunes soils, CMC, Polymer, Mechanical behavior, Shear strength.

1. Introduction

Desertification is a global environmental phenomenon in most arid, semi-arid, and sub-humid areas causing soil degradation. Due to climate change, resultant dunes zones have increasingly been a severe issue for the environment and people. Its impacts turn out on land degradation and reduction of surface moisture, in addition, to being a problem of the highway roads crossing areas prone to desertification. The movement of the particles of the Dunes soils across the highway caused several deadly accidents, requiring urgent, practical solutions. In Iraq, this risky natural event takes place over several months a year, usually starting at the end of the spring season till mid-summer. The motion of dunes sediments causes severe problems for most constructions nearby, such as roadways, airports, bridges, factories and others.

In Iraq, the desert lands cover almost two third of the country [1]. The dunes sediments extend on both sides of the highway road segment between Nasiriya and Samawa to Diwania provinces, Figure 1. The challenge then is how to stop and stabilize the creeping of the dunes sediments. Various practical studies

