# Stabilizing Landfill Clays with Phosphorus Treatment; A case study

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**Abstract**

Due to their high buffering potential and very low permeability, cohesive soils are frequently used as water-proof-elements in landfill projects. However, stabilization of such clayey barriers has been a major issue in adapting cost-effective methods to enhance soil stability. Therefore, it was deemed worth investigating the effect of Di-Ammonium Phosphate (DAP) solutions compromised the majority part of phosphorus fertilizers to improve geotechnical properties of Hamedan's clayey landfill barrier (located in the west part of Iran). A series of contaminated specimens were prepared by mixing sampled clays with industrial DAP in concentrations ranging from 0.01 to 0.1mole/l. The conventional geotechnical experiments such as compaction, unconfined compressive strength, and direct shear box were then performed. Findings indicate that: Increasing phosphorus ion concentration in the specimens improves Cohesion (by 24%), and unconfined compressive strength (by 12%), and decrease internal friction angle (by 11.78%) and maximum dry density (by 1.5%). Accordingly it could be deduced that leaching phosphorus ion through landfill blanket has a noticeable effect on the stability of the Hamedan's landfills.
**Keywords: Landfill, Geotechnical properties, Di-ammonium phosphate, Soil stabilization**

## 1. Introduction:

During recent decades considerable attention has been focused upon environmental consequences of industrialization and the so-called sustainable development issues. Waste generation is among the most significant sources that threaten the global environmental health. Accordingly, it is essential to design and construct safe waste disposal facilities which employ the best of the available technologies. The stabilization of contaminated material with cementitious inorganic binders is regarded as an established technique in landfills construction. Recent examples include the ex-situ treatment of lightly contaminated silt dredging with lime and pulverized fuel ash (pfa) on the A13 highway scheme at Rainham Marshes [1] and the in situ treatment of acidic waste in a landfill at Ardeer using a mixture of lime, cement and pfa [2]. The principal advantages of stabilization are economy, flexibility and speed. [3].

Stabilization characteristic of contaminant clays are markedly influenced by factors such as the type of clay minerals, the nature of the exchangeable ions, and the type of clay microstructure present. Clay soils, due to their high buffering capacity and low permeability, are very helpful materials as barriers in waste disposal projects [4-6]. On the other hand, the different microstructures of clay soils, due to their different surface areas and the different quantity of these surfaces exposed to the water cause different contaminant attenuation levels for clay minerals [7]. Even though the dispersive structures of soils might cause some geotechnical problems, in geo-environmental projects they might be of use as an excellent contaminant absorbent due to the fact that their clay particles are well-exposed to the soil pore fluid [8].

Hamedan city located in the west part of Iran has the population equal to 479640 capita [9]. Average waste generation rate of the city is 800, 19 and 74 gr per day per capita in domestic, hospital and industrial wastes, respectively [10]. The objective of this study is to conduct an investigation of the Hamedan landfill clay-phosphorus interaction at various concentrations on the geotechnical properties of natural clay subjected to di ammonium phosphate (DAP) contaminants. The geotechnical performance studied includes shear