Investigation of the effect of Bentonite and Seryshum on the resistance parameters of fine dust-producing soils in Varamin region

Shiva Aazami[1*], Seyed Mahmoud Fatemi Aghda[1], Mehdi Talkhablou[1], Seyed Badredin Ahmadi[2]

1. Faculty of Earth Sciences, Kharazmi University

2. Faculty of Earth Sciences, Tarbiat Modares University

Received: 26 Aug. 2020 Accepted: 13 Dec. 2020

(Paper pages 379-392)

Extended Abstract

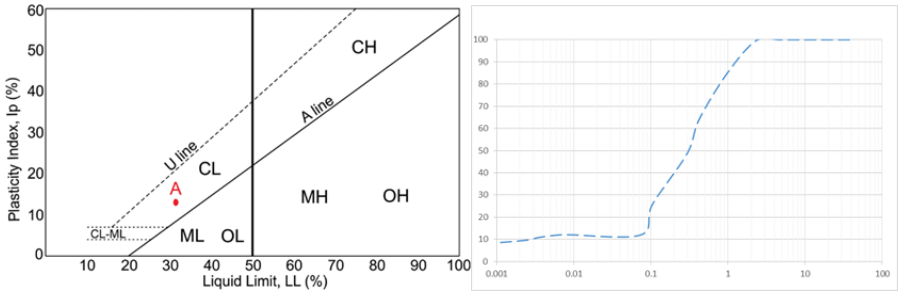
Introduction

Today, dust is one of the serious environmental problems in arid and semi-arid regions that affects air quality and pollution, human health, soil fertility, vision, economy and many social and environmental aspects of society. Dust is a mass of fine particles of soils and sometimes smoke that is dispersed in the atmosphere and restricts horizontal visibility. Tehran the capital of iran somtimes is facing the phenomena of fine dust. The southeastern region of Tehran, including the cities of Varamin, Pakdasht and Pishva are, have the characteristics of desert areas and are the site of constructed waste depot in Tehran. Therefor, these areas are prone to the production of fine dust. Conventional methods for reducing dust storms (especially in arid and semi-arid regions) have been to stabilize the dust generation areas using chemical polymers and petroleum products; each of which is prepared in emulsion, liquid or solid powder types. But in the current situation, due to their high cost and disagreement about environmental effects, their use is not cost effective. For this reason, in this research, natural materials such as bentonite and sershum have been used to stabilize dust-producing soils.

materials and methods

In this research, the 4 disturbed samples were taken from the study areas. Then the soil classification test, direct shear tests and standard compaction tests were done on the reconstructed samples. As is shown in figure 1 and the soil physical properties test results that is given in table 1, the soil type is classified as a CL soil. In order to laboratory testing, sampling was performed using

shebli sampler. The disturbed samples were reconstructed in the laboratory on the basis of ASTM standard by using the result of standard density test of soils, such as optimum water cotent and maximum dry density.



Figur 1. Grading diagram of the studied soil

Table 1. Physical properties of the studied soil

ϕ [deg]	C [kPa]	W [%]	$\gamma_{d_{max}}$ $[kN/m^3]$	PI [%]	PL [%]	LL [%]	Gs	Soil class	Appearance color
25/14	16/59	12	1/83	14/25	19/77	34/02	2/5	CL	Brown

Results and discussion

As shown in figure 2, that the maximum shear strength of stabilized samples is obtained with 3% by weight of bentonite. According to the laboratory results, when different weight percentages of bentonite are added to samples, more increases in adhesion occurred. The highest incearses in adhesion is at 3% by weight, which was accompanied by a decrease in the internal friction angle. when the bentonite is add to samples mechanical behavior of the soil was changed. It is controlled by the fine-grained part of soil.

By reducing the grain efficiency, the internal friction angle parameter, which is one of the characteristics of granular soils, is reduced. In confirmation of this research in previous studies, Hadi et al, 1394 and Gododa et al, 2008 have been given the Similar results, which with increasing the weight percentage of bentonite, the internal friction angle decreases and the soil adhesion increases.

The effect of Sershum

According to laboratory results, when different weight percentages of Sershum are added to the sample, the highest adhesion and the lowest internal friction angle occurs at one weight percent, which is similar to bentonite due to the increase. The fine-grained part of the soil and its dominance over the coarse-grained part is more, with which the mechanical behavior of the soil is more controlled; by decreasing the grain efficiency, the internal friction angle parameter, which is a characteristic of granular soils, is reduced.

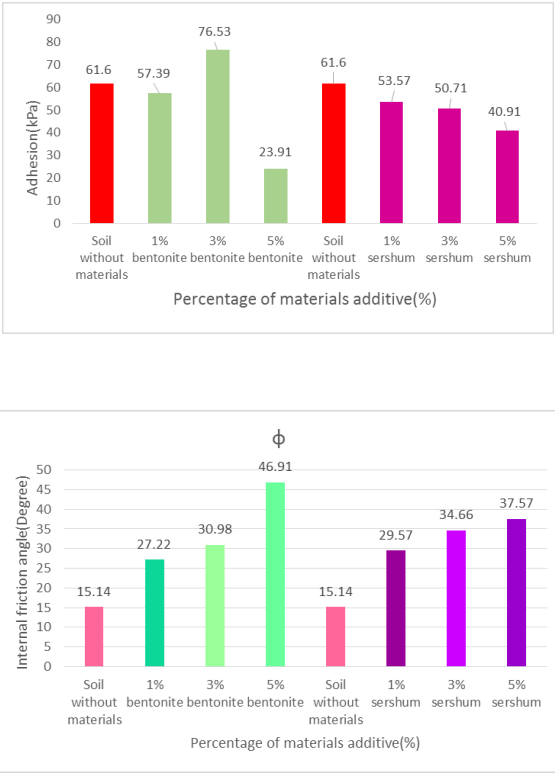


Figure 2. The effect of different weight percentages of bentonite and Sershum on the adhesion and internal friction angle of clayy soil

Conclusion

In this research, the effect of adding bentonite and Sershum stabilizers materials on the resistance parameters of fine dust-producing soils in Varamin region was investigated by adding different percentages of bentonite and Sershum and without increasing these materials. According to their laboratory test results, the following results can be extracted:

At 3% by weight of bentonite, as a stabilizers the results show the highest adhesion for tested samples. At one percent by weight of bentonite and Sershum as a stabilizer the soils adhesion reaches to the maximum value. Then:

1- In the case of increasing of the fine-grained part of the soil and its dominance over the coarser-grained part the mechanical behavior of the soil is more controlled by this part. Then, the internal friction angle parameter, which is a characteristic of granular soils, decreasing.

These changes are due to the replacement of bentonite particles in the clay pores. Having been present in these pores, it causes more adhesion between the soil grains in addition to increasing the density of the samples and soil shear strength.

*Corresponding Author: shiva.azaami@gmail.com