Amirkabir Journal of Civil Engineering

Amirkabir J. Civil Eng., 52(12) (2021) 793-796
DOI: 10.22060/ceej.2019.16402.6211

Soil Stabilization by Nano Polymer Polylatice (Case Study: Hossein Abad Area of Qom Province

M.M. Bakhshi[1], B. Ayati[2,*] , H. Ganjidoust[3]

[1] M.Sc. Student, Tarbiat Modares University, Civil and Environmental Eng. Faculty, Tehran
[2] Corresponding author, Tarbiat Modares University, Assoc. Prof. Civil and Environmental Eng. Faculty, Tehran
[3] Tarbiat Modares University, Full Prof. Civil and Environmental Eng. Faculty, Tehran

ABSTRACT: Today, wind erosion and the dust caused by it, as an environmental problem, affects not only the desert regions of Iran, but also the entire country. The beginning of haze crisis in Iran originates in the last two decades. At first, the haze entered the country through the west and southwest of the country and gradually reached the central areas. The dust can be caused by various natural and artificial factors. There are different methods for soil stabilization, such as using windbreak, planting and use of mulch. The use of new soil stabilization methods, due to reduced environmental impacts, is a suitable alternative for oil mulch. Soil stabilization by using Nano polymer polylatice creates a uniformly coherent cortex that is resistant to high wind speed and has less environmental degradation effects. In this research, the soil of the Hossein Abad area, near the salt lake of Qom, has been used for wind erosion test to verify the stabilization with the use of nano polymer polylatice. After passing through a 2 mm sieve, the soils were stabilized with concentrations of 1, 1.5 and 2 L/m2 of polylatice in trays with dimensions of 80*80*3 cm. These specimens were exposed to wind by three different velocities, including 10, 15 and 20 m/s, during 7 and 30 days and their stabilities were analyzed against wind. The concentration of dust of the Hossein Abad area in the 7 and 30-day stabilization decreased by 60 and 50 times at a wind speed of 20 m/s, respectively and as time passed by after adding mulch, the amount of particles deposited along the channel were also decreased significantly.

Review History:
Received: 2019-05-22
Revised: 2019-09-22
Accepted: 2019-09-24
Available Online: 2019-10-23

Keywords:
Soil Stabilization
Wind Erosion
Mulch, Nano Polymer Polylatice
Hossein Abad Qom

1. INTRODUCTION

Dust is the result of various natural and artificial factors; but by applying appropriate techniques, timely planning and preventive measures, it is possible to prevent it from extending and intensifying. Implemented strategies are generally meant to stabilize the soil and to control the effective factors in land degradation. Soil stabilization is done by planting or additives. Some of these methods which generally prevents soil erosion and desertification are: planting trees resistant to hot and dry weather condition, installing living and non-living windbreaks, stabilization of sand dunes by creating a green zone or stabilizing the soil using polymers and petroleum products, such as mulch, but today stabilization using polymer mulch as a new technique has become more prominent [1-4]. Researchers have used various mulches for soil stabilization, including, bio-crust [5], polyacrylamide [6,7], acetate [8], polyethylene [9], Polyvinyl Alcohol [10], Polyvinyl acetate [11], Methyl Methacrylate [12].

In this study, soil consolidation using this material was studied considering different conditions, including time interval, different percentages of polymer concentration and variable velocities of wind in Hossein Abad of Qom province.

2. ELEMENTS OF THE EXTENDED ABSTRACT

Hossein Abad study area is a large part near the village of Hossein Abad of Qom, which is limited by the Qom Salt Lake from east and by city of Qom from west, and affects the weather of Qom.

Three iron trays with dimensions of 80* 80* 3 cm were prepared and soil specimens were poured into the trays to decide the optimal concentration of polylatice. The parameters of the experiment are shown in Table 1.

Table 1. Parameters and scope of testing

Parameter	value
Polylatice Densities (L/m^2)	1, 1.5 & 2
Wind Speed (m/s)	20
Time Span (days)	7 & 30

*Corresponding author's email: ayati_bi@modares.ac.ir

3. RESULTS AND DISCUSSION

Wind erosion experiment of primary soil

At the beginning of the study, the wind erosion test of primary soil samples of the Hossein Abad was implemented to determine the stability threshold against different wind speed in September of 2017 at an average temperature of 36 OC. According to the results, the primary soil sample lost its stability against wind at a speed of 5 m/s and concentration of suspended particles in the air reached to 3.5 mg/m3 (Fig. 1).

Soil wind erosion test after adding mulch

The soil wind erosion test was carried out after 7 and 30 days of adding mulch at different concentrations and at 20 m/s. The results are presented in Fig. 2. According to the results, the particle concentration increased significantly at 1 L/m2 and 20 m/s speed due to the instability of the sample under these conditions, but with increasing polylatice the samples increased withstand the wind.

Also, the results of 30 days stabilization of wind erosion test show that by increasing the amount of polylatice, the soil stability against high wind speed is increased and the concentration of suspended particle is decreased.

Fig. 1. Wind erosion test of primary soil samples

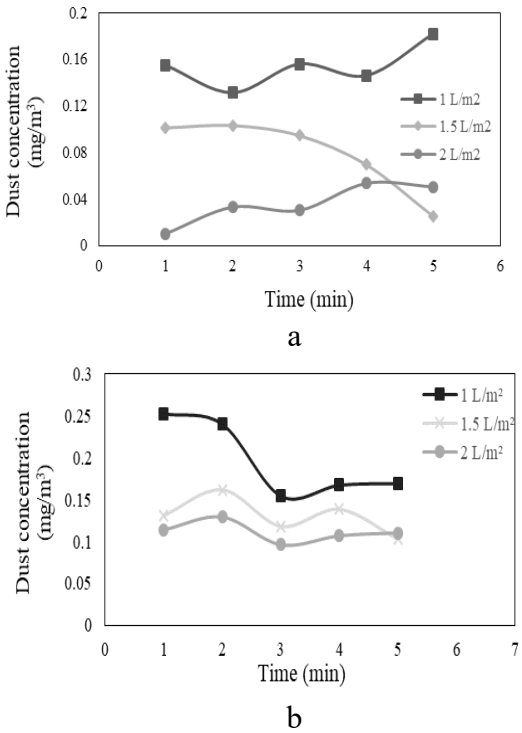

Fig. 2. Changes in dust concentration of the stabilized soil at speed of 20 m/s and different concentrations of stability polylatice a) 7 days b) 30 days

4. CONCLUSION

To seven days stabilizing, for regions that wind speed was below 17 m/s. The amount of mulch is needed 1 L/m2. Also, for regions that the wind speed was below 20 m/s with considering same soil stabilizing effect of two amount 1.5 and 2 L/m^2. The amount 1.5 L/m^2 of mulch was chosen as the optimum amount. To stabilized soil in during 30 days for regions that speed wind dominated is below 20 m/s amount of polylatice is 2 L/m^2 and for regions that wind speed is below 10 m/s the amount of polylatice with 1 L/m2 is recommended.

REFERENCES

[1] A. Inbar, M. Ben-Hur, M. Sternberg, M. Lado, Using polyacrylamide to mitigate post-fire soil erosion, Geoderma, s 239–240 (2014) 107-114.

[2] S. Iyengar, E. Masad, A. Rodriguez, H. Bazzi, D. Little, H. Hanley, Pavement subgrade stabilization using polymers: characterization and performance, Journal of Materials in Civil Engineering, 25 (2013) 472.

[3] S.H. Sadeghi, Z. Hazbavi, H. Younesi, N. Bahramifar, Trade-off between runoff and sediments from treated erosion plots and polyacrylamide and acrylamide residues, CATENA, 142 (2016) 213-220.

[4] A.B. Zezin, S.V. Mikheikin, V.B. Rogacheva, M.F. Zansokhova, A.V. Sybachin, A.A. Yaroslavov, Polymeric stabilizers for protection of soil and ground against wind and water erosion, Advances in Colloid and Interface Science, 226 (2015) 17-23.

[5] M. Sweeney, E. McDonald, V. Etyemezian, Quantifying dust emissions from desert landforms, eastern Mojave Desert, USA, Geomorphology, 135 (2011) 21-34.

[6] A. Genis, L. Vulfson, J. Ben-Asher, Combating wind erosion of sandy soils and crop damage in the coastal deserts: Wind tunnel experiments, Aeolian Research, 9 (2013) 69-73.

[7] K. Yang, Z. Tang, Effectiveness of fly ash and polyacrylamide as a sand-fixing agent for wind erosion control, Water Air and Soil Pollution, 223 (2012) 4065-4074.

[8] K.N. Nwankwo, S. United, A. Federal Highway, D. Wisconsin, Wisconsin, C. Bureau of Highway, S. Pavements, Polyacrylamide as a soil stabilizer for erosion control, TRID (2001).

[9] A. Corti, S. Muniyasamy, M. Vitali, S. Imam, E. Chiellini, Oxidation and biodegradation of polyethylene films containing pro-oxidant additives: Synergistic effects of sunlight exposure, thermal aging and fungal biodegradation, Polymer Degradation and Stability, 95 (2010) 1106-1114.

[10] A. Zandieh, S. Yasrobi, Study of factors affecting the compressive strength of sandy soil stabilized with polymer, Geotechnical and Geological Engineering, 28 (2010) 139-145.

[11] Z. Song, J. Liu, Y. Bai, J. Wei, D. Li, Q. Wang, Z. Chen, D. Kanungo, W. Qian, Laboratory and field experiments on

the effect of vinyl acetate polymer-reinforced soil, Applied Sciences, 9 (2019) 208-215.

[12] Z. Han, T. Wang, Z. Dong, Y. Hu, Z. Yao, Chemical stabilization of mobile dunefields along a highway in the Taklimakan Desert of China, Journal of Arid Environments, 68(2) (2007) 260-270.

HOW TO CITE THIS ARTICLE

M.M. Bakhshi, B. Ayati, H. Ganjidoust, Soil Stabilization by Nano Polymer Polylatice (Case Study: Hossein Abad Area of Qom Province), Amirkabir J. Civil Eng., 52(12) (2021) 793-796.

DOI: 10.22060/ceej.2019.16402.6211