J. Sci. & Technol. Agric. & Natur. Resour., Water and Soil Sci., Vol. 19, No. 73, Fall 2015, Isf. Univ. Technol., Isf., Iran.

Effective Factors in Fine-Grained Soil Stabilization to Prevent Dust Generation

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(Received: Jan. 1-2014 ; Accepted : July. 25-2015)

Abstract

A laboratory research program was arranged to study the effect of different factors influencing the stability of fine soils against wind action. For this purpose, a laboratory wind tunnel was stabilized and several soil samples were examined by putting the sample trays inside the wind tunnel for different rates of wind velocities. The tray for soil samples was 20×30 cm^2 with the depth of 5 cm, and the fine soil samples were chosen with different sizes of particle and porosity. Because the main aim of this research was to investigate the effect of some polymer additives to the soil, many samples were made of the soils improved by different additives in different percentages. Furthermore, the effect of infiltration of the liquid additives was also examined, which could show different infiltration heights as functions of soil type, additive type and the height of pouring. Some of the results were examined by using software. The lab results in this research were compared with some proposed theoretical ones. It was found that as the average diameter of particles increases, erodibility under the same wind velocity decreases, and the applied polymer emulsions decrease the erodibility up to 90% compared to the initial condition. Impacts of dust emission due to the suspended dispersion of fine particles and creeping movements of coarse particles are mitigated as a result of treatment with these emulsions. Variations in erosion of soils at various wind velocities depend on the value of threshold friction velocity with the result that the soil erosion values in case of coarser soils after the increase in velocity would be higher than those of threshold friction velocity. Finally, a relationship is proposed for estimation of soil erosion in terms of wind velocity. The results are consistent with the transport rate relationships proposed by different scholars.

Keywords: Wind erosion, Open-loop wind tunnel, Dusts, Stabilization by polymeric emulsions.

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