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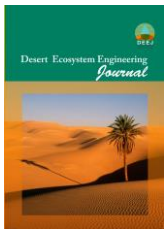

Operational, Environmental and Economic Feasibility of Using Steel Slag as Mulch for Controlling Wind Erosion

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Extended abstract

Introduction: Wind erosion and the influx of sandy soils to economic facilities and biological resources are one of the main problems in the country. 14 provinces, located in arid and semi-arid regions, face wind erosion. Wind erosion and the influx of sandy soils are two important indicators in the occurrence of desertification and a serious threat to arid areas. The best and lasting way to prevent erosion is to deploy natural vegetation in areas at risk. But this will require a minimal fit for environmental conditions for the environment, and vegetation cannot be established in areas where these conditions are not met. For this reason, non-physical methods, such as the use of wind turbines and various types of mulches, are also of interest, each of which can, in certain circumstances, have the highest efficiency and efficiency. The mulch is defined as a coating that protects the soil from contact with the wind erosion current. In this study, the use of steel slag as a mulch for controlling wind erosion from different dimensions has been investigated.

Materials and Method: The selected area for field studies was located in Zebarkhan district of Neyshabour, near YousefAbad village. This area was selected according to the characteristics of erosion soil and regular wind power regime. Soil sampling was used to study the soil characteristics of the area and acidity and its salinity were determined. The atomic absorption method was used to measure the amount of heavy metals in the slag compound which is important in terms of environmental issues. The appropriate size of slag was 3 to 4 cm. Two thousand square meters were used for treatment and erosion measurements in YousefAbad area of Neyshabour. The two pieces were placed on the ground, both of which are perpendicular to the direction of the dominant and erosion of the wind. To determine the effect of applying slag mulch on each treatment and control part, nine fixed trays were placed on each 15 mm soil tray. Then, at 1-month intervals, the depth of soil was measured on each tray by a caliper and accurately one hundredth of a millimeter. The results of these two groups were compared using t-coupled test.

Results: The soil of the study area was Aridisol and its salinity was 1.408 dS m-1 and its pH was 7.48. Soil study using hydrometric method showed that 56% of this soil was Silt, 31% sand and 13% Clay. So, the texture of this soil is silty loam;

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one of the most erodible types of soil in wind erosion. The results of measurements of heavy metals of chromium, cobalt, lead and cadmium by atomic absorption method showed that the amount of lead, cadmium and cobalt in slag is less than the critical level defined for them and their presence in the slag compound will have small impacts on the environment. But in the case of chromium, it was significantly high and should be considered as a potential risk factor. The results of measurements of soil changes in the studied parts showed that not only erosion was controlled in the slag mulch treatment part but also to the sedimentation occurred. However, there has been significant soil erosion in the control unit. The results of the comparison of these two groups using the t-test showed that there was a significant difference between them at 1% level and therefore, slag treatments had a positive effect and was able to control wind erosion in the study area. Considering all costs, the application of this kind of treatment in the studied area cost 642 thousand Tomans.

Discussion and Conclusion: The amount of heavy metals in most cases except chromium was not alarming. Considering the fact that chromium is one of the most hazardous substances for the environment, steel and iron slag should not be used without the precautions at large scales. Of course, it's important to note that only chromium 6 (Cr VI) is known as a toxic compound, and it quickly turns into chromium 3 (Cr III) in nature, which is a micronutrient needed by various living organisms. Also, since this chromium may not be free at all, the issue of the release of chromium in slag by natural processes should also be considered. According to the results of the measurements carried out in this study, it can be confidently stated that the use of slag mulch has a clear effect on reducing wind erosion in studied area. Even with regard to the results, it can be argued that this mulch, in addition to preventing soil particles from being removed by wind, can also trap eroded particles that are transported by wind in the creeping or jump process. Therefore, from an operational point of view, slag can definitely be recommended for the wind erosion control. These results are similar to those of Safaie (2012) and Babakhani (2011). Also, the results of Li et al. (2001) showed that the pebble mulch has not only the ability to control erosion, but also has a high capacity to trap wind deposits. If there is no potential area for effective vegetation cover in erosion control, or if wind erosion and dusts are required to be controlled quickly, this type of mulch by the coverage rate of 75% and the proposed particle size (3-4 cm) can do it well.

Keywords: Dust, Feasibility, Sediment, Slag, Wind Erosion.