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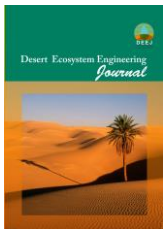

Investigating and Comparing the Absorption and Maintenance Efficiency of BSNE and Siphon (3rd Generation) Sediment Traps Under Laboratory (Wind Tunnel) and Natural Conditions

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Extended Abstract

Introduction

Various tools have so far been developed with different efficiency to measure the flow of wind deposits. In this regard, two types of absorption and maintenance efficiency tools are commonly used as technical criteria in selecting sediment traps, bearing the lowest amount of wastage. Accordingly, this study set out to compare and contrast the adsorption and retention efficiency of BSNE and Siphon (3rd generation) as wind erosion sediment trap tools.

Materials and methods

The efficiency of siphon traps (3rd generation) and BSNE were investigated and measured at different wind speeds of 7, 8, 9, 11, and 13 m/s using the wind tunnel laboratory of the Faculty of Natural Resources and Desertology. The efficiency was also measured in different events within the natural environment using Wind Erosion Monitoring stations. On the other hand, to check the absorption efficiency, the test tray was filled with air sediments, and the sediment catchers were placed inside the device. Then the sediments collected in the device were measured in terms of different speeds. Moreover, to measure the retention efficiency, the sediment traps were filled with 100 grams of wind-induced sediment, and the amount of lost sediment was measured at different wind speeds. After the sediments were granulated with the help of a shaker machine, the granulation indices of the sediments were obtained using the grain gauge software G.R. Graph.2. Finally, the data collected regarding the efficiency and performance of the two types of sediment traps were analyzed. It should be noted that the results were obtained in terms of 7, 8, 9, 11, and 13 m/s speed rates under different laboratory conditions (wind tunnel) and natural environment or desert at the wind erosion measurement station of Yazd University.

Results and Discussion

According to the results of the study, the absorption efficiency of the siphon trap was found to be 2 to 5 percent greater than that of the BSNE trap. Moreover, the study found that while the increasing trend of the siphon sediment trap's efficiency against the wind speed of 13 m/s reached its maximum at roughly 94.6%, the maximum efficiency of the BSNE sediment trap was recorded at the speed range of 11 m/s (92%). Both

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sediment traps experienced a decline in wind-borne sediment capture efficiency at wind speeds of 11 meters per second. In both traps, the capture efficiency decreased with increasing height above the surface. However, the siphon sediment trap consistently demonstrated a higher capture efficiency compared to the BSNE trap. On the other hand, it was found that at heights lower than 50 cm from the ground, the absorption efficiency of 3rd generation siphon traps was approximately 1.5 times greater than that of BSNE traps. While at higher altitudes, the absorption efficiency of both approaches. Furthermore, the 3rd generation siphon sediment trap could maintain almost 100% retention efficiency due to its special tank design when the wind speed increased to rates over 11 meters per second under super-critical conditions. However, due to the design of the BSNE sediment trap, approximately 3% of the total captured and trapped sediment was lost from the reservoir and escaped into the surrounding environment.

The results suggested that the numerical index of the particles collected in siphon sediment traps was lower than that of BSNE, which could partly be attributed to the exit of some of the fine particles when trapped in the reservoir of BSNE sediment traps. Moreover, the numerical value of the skewness index of the sediments collected in each type of sediment trap decreased with an increase in wind speed, tending towards fine particles. In other words, the increased population of fine particles caused a decrease in the average value of the median diameter or D50.

Conclusion

The results indicated that the highest absorption efficiency rates were 94.6 and 92% for 3rd generation siphon trap and BSNE, respectively. Also, compared to the BSNE, the siphon trap performed relatively better in terms of sediment storage and retention under physical and aerodynamic conditions. On the other hand, as for the retention efficiency of both types of sediment traps, it was found that the 3rd generation siphon trap performed 100% successfully at all investigated speeds. However, the efficiency of the BSNE sediment trap decreased from 100% to 97% when the speed increased from 11 m/s to 15 m/s, indicating that by increasing the speed and creating a twisting current inside the chamber of the BSNE sediment trap, part of the fine-grained sediments were thrown out of the trap, thus reducing the retention efficiency of the trap. It could generally be argued that the absorption and retention efficiency of the siphon trap is about 10 to 40% greater than that of the BSNE. Therefore, as the siphon trap is designed and built in Iran, it bears more advantages than its American counterpart.

Keywords: Sediment Trap, Wind Erosion, Siphoning, BSNE, Absorption Efficiency, Maintenance.

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