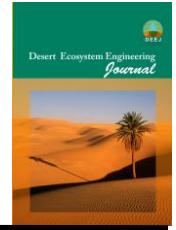




University of Kashan

Desert Ecosystem Engineering Journal

Journal homepage: <http://deej.kashanu.ac.ir>

Investigation on the Capability of the Win Area Device in Automatic Granulation of Desert Pavement

Farnaz KHosravi¹, Mahdi Tazeh*², Mohammad Ali Saremi Naeini³, Saeideh Kalantari⁴

Received: 03/03/2021

Accepted: 08/12/2021

Extended Abstract

Introduction: Pediments are vitally important geomorphological units. Desert pavement feature is used for their classification. The characteristics of desert pavements are a function of geomorphological conditions and have unique properties in terms of different granulation parameters. A variety of methods are employed to determine granulation. The most common method is the sieving test, in which the particle size distribution curve is obtained using the cumulative weight of the grains passing through the sieve. Using image processing methods facilitates the identification, measurement, analysis, and spatial distribution of particles. The present study aims to prove that digital image processing is a viable alternative for traditional methods as the results from both procedures are similar.

Methodology: Yazd-Ardakan plain is located in the range of 15 53 to 50-54 easts and in 31-15 to 45 45 north. In this study, ten points were randomly selected in 40 40 40 square plots in plain areas in Yazd-Ardakan plain basin. Sediment granulation was done by the mechanical sieving method. In order to granulate sediments, the samples were taken and transferred to the laboratory, and placed in a shaker to separate the particles according to their large diameter size by the sieves in the machine. After performing the calculations via Excel software, a graph related to the granulation of each point was achieved. WinArea-UT-11 can measure most physical coefficients of products such as perimeter, area, and the largest and smallest particle diameters. The parameters measured by the device were particles' length and width.

Results and discussion: In this section, the granulation results by mechanical sieving as well as the results obtained from the Win Area machine are presented. The following table, Table 1, is an example of calculating the weight percent and the percentage of cumulative frequency of particles in a mechanical sieve.

Table (1): Weight percentage and cumulative frequency percentage of particle diameter in mechanical sieving

Cumulative percentage of particles	Particle weight percentage	Particle diameter (mm)
14.97	14.97	2
46.73	31.75	4.76
59.19	12.46	9.525

¹ MSc of Desertification Combating, Department of Nature Engineering, Faculty of Agriculture and Natural Resources, Ardakan University, Iran

² Associate Professor, Department of Nature Engineering, Faculty of Agriculture & Natural Resources, Ardakan University, P.O. Box 184, Ardakan, Iran; mtazeh@ardakan.ac.ir

³ Assistant Professor, Department of Desert and Arid Zones Management, Faculty of Agriculture and Natural Resources, Yazd University

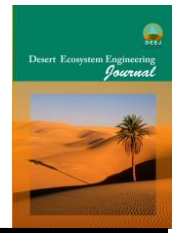
⁴ Assistant Professor, Department of Nature Engineering, Faculty of Agriculture & Natural Resources, Ardakan University, P.O. Box 184, Ardakan, Iran.

DOI: 10.22052/deej.2021.10.33.59



University of Kashan

Desert Ecosystem Engineering Journal

Journal homepage: <http://deej.kashanu.ac.ir>

89.54	30.35	12.7
100	10.45	19.05

Sizing by mechanical sieving was followed by placing the collected samples on the Win Area device, and photography was performed. The information obtained from the pebbles was saved in Excel software after shooting. A rectangular shape for each pebble is assumed. According to the length and width of the pebble device, the Pythagorean equation was used to calculate the particle diameter.

Table (2): Weight and cumulative percentage of length, width and diameter of the machine using sieve diameter

Percentage of cumulative frequency of device diameter	Percentage of frequency of device diameter	Percent cumulative frequency of width	Frequency percentage of device width	Percent cumulative frequency of length	Frequency percentage of device length	Cumulative frequency percentage	Frequency percentage	Diameter (mm)
0	0	0	0	0	0	14.97	14.97	2
0	0	2.33	2.33	0	0	46.73	31.75	4.76
1.16	1.16	55.68	53.35	9.62	9.62	59.19	12.46	9.525
22.15	20.99	88.04	32.36	63.73	27.11	89.54	30.35	12.7
60.05	37.9	96.2	8.16	69.38	32.65	100	10.45	19.05
80.75	20.69	99.19	2.91	87.46	18.07	100	0	25.4
98.68	17.92	99.7	0.58	98.83	11.37	100	0	38.1
99.85	1.16	100	0.29	99.41	0.58	100	0	50.8
100	0.29	100	0	99.7	0.29	100	0	63.5
100	0	100	0	100	0.29	100	0	80

According to the results obtained from the Pearson test in SPSS software, the correlation between the results of the cumulative frequency percentage of the parameters of length, width, and diameter of particles with the percentage of cumulative frequency calculated by the particles' diameter in the mechanical sieve is above 70%. Additionally, the mean level particle content in all three parameters of particles' length, width, and diameter is less than 0.05.

Conclusion: The results of the granulation diagram of each of the parameters of particles' length, width, and diameter visually show that the graphs are almost correlated and coordinated with each other. Among these, the correlation between the mechanical sieve granulation diagram and the particles' width is more consistent than the particles' length and diameter granulation diagram. According to the grading results of each parameter in comparison with the mechanical sieving method, if a few number of grading diagrams of length, width, and diameter are shifted, the diagrams will completely match. Pearson test, obtained by importing the percentage of cumulative frequency of particles' length, width, and diameter, shows that in samples 1, 2, 3, 4, and 5, which are related to the pediments, the grading diagram of a mechanical sieve is more similar to Particles' width grading diagram. In samples with higher mean diameters, the similarities between the grading values of the mechanical sieve are approximately the same as the granulation of particles' width and length.

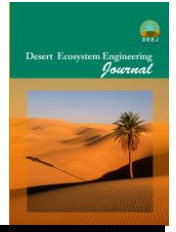
Table (3): Pearson correlation results at 95% confidence level Granulation of particle length, width and diameter by mechanical sieving

Results of diameter correlation with sieve	Results of width correlation with sieve	Results of length correlation with sieve	points	pediment
0.83	0.96	0.88	1	epandage
0.74	0.91	0.81	2	



University of Kashan

Desert Ecosystem Engineering Journal

Journal homepage: <http://deej.kashanu.ac.ir>

0.76	0.95	0.84	3	
0.76	0.79	0.85	4	
0.96	0.94	0.98	5	
0.81	0.91	0.87	mean	
0.96	0.94	0.98	6	
0.97	0.96	0.99	7	
0.92	0.73	0.89	8	bare
0.93	0.96	0.95	9	
0.91	0.97	0.95	10	
0.93	0.91	0.95	mean	

This study illustrates the similarity between the grading curve drawn from the mechanical sieving and the results obtained with the win area machine, and the drawn curves are visually matched with some shifts. Also, according to the results of comparing image processing methods with traditional methods, it is found that there is a significant correlation between the two methods, meaning that the results of digital image processing methods are similar to conventional methods. Therefore, the digital image processing method can perfectly replace the traditional methods.

Keywords: Granulation, Mechanical Sieving, Geomorphology, Particle Size Distribution, Win Area Device.