Study on the rainfall change in Pisha stone area

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Abstract: Rainfall and raindrop characteristics have an important impact on the erosion of sandstone soil. The LPM laser raindrop spectrometer is used to analyze the rainfall characteristics of the Ordos City in the Yellow River Basin, including the distribution characteristics of the velocity and size of a natural rainfall raindrop. Statistical analysis shows that with the gradual strengthening of rainfall intensity, the number of raindrops per unit time, the size and speed of raindrops will increase parabolically. However, the natural rainfall process finds that the diameter and velocity of the raindrop are relatively scattered. During this measurement, the velocity of raindrops is mainly distributed between 1-3.4m / s, and most raindrops are distributed at 1-1.8m / s. The diameter of the raindrops is mainly distributed in the range of 0.125-0.5 mm. The raindrops with a diameter of 0.125mm are mainly distributed between 0.8-3.4m / s, the raindrops with a diameter of 0.25mm are mainly distributed between 1-2.6m / s, and the raindrops with a diameter of 0.375mm are mainly distributed between 1.0-2.2 m/s, and the diameter of 0.5 mm is mainly distributed in the range of 2.2-2.6 m / s.

1. Introduction
The soil erosion in the Pisha area is very serious, and it is the main area of the coarse sediment of the Yellow River. Therefore, it is necessary to vigorously carry out soil and water conservation control in this area [1-2]. However, due to many factors affecting soil erosion, and the limitations of current research methods and instruments, it is impossible to explain all the scientific problems [3]. Some research fields, such as how to quantitatively express rainfall erosivity, how to change rainfall process, raindrop characteristics Problems such as being linked to soil erosion have not been resolved [9]. Although there has been some progress around the world [4-8], these shortcomings directly limit the understanding and governance of soil erosion [10]. This paper studies the distribution characteristics of natural rainfall by observing the characteristics of natural rainfall [11], which can lay a foundation for further study of soil erosion mechanism and establishment of mathematical models.

In order to establish a mathematical model of soil erosion, the energy composition of rainfall must be quantitatively studied, and the raindrop characteristics are the basis for calculating rainfall energy [12-20]. This paper mainly studies the velocity and diameter of raindrops, providing basic data and analysis basis for further theoretical research.

2. Experiment design and data acquisition

2.1 Experiment design of runoff plots
The experiments in this paper were carried out at the Ordos Test Base of the Yellow River Conservancy Science Research Institute. The experimental plot was set up in the field. The length, width, depth and slope data of the runoff plot were 5m, 1m, 60cm and 20° respectively.

2.2 Test method
Five measuring lines are set on the slope of the experimental community. The LPM laser raindrop spectrometer was used to collect raindrop eigenvalues of natural rainfall, including rainfall intensity, diameter of raindrops, velocity of raindrops, and the number of raindrops of various diameters. These data are automatically recorded by the computer terminal, and the data is periodically downloaded manually.

3. Results and analysis
In this paper, five typical rainfall time points in natural rainfall on July 10, 2018 (hereinafter referred to as 20180710) were selected. The length of each time point was 1min. The particle size of raindrops in the min length, the speed of raindrops, and the number of raindrops with the same raindrops were collected by LPM laser raindrop spectrometer. The raindrops characteristics were also analyzed. The results were as follows.

During the rainfall period that occurred in 201107010, we measured the particle size and velocity of the raindrops within the first minute of rainfall, and their distribution is shown in Figure 1. The figure shows that the velocity of the raindrops is mainly distributed between 0.6 and 6.6 m / s, the maximum probability of velocity is distributed at 1.4 m / s, and the number of raindrops is 92, accounting for 15% of the total number of measured raindrops. The raindrop diameter is mainly composed of raindrops of 0.125-0.5mm. The raindrop velocity with a diameter of 0.125mm is mainly distributed between 0.6-4.2m / s, the raindrop velocity with a diameter of 0.25mm is mainly distributed in the range of 0.8-3.4m / s, and the raindrop velocity with a diameter of 0.375mm is mainly distributed at 1.0- 2.6 m / s, the raindrop velocity of 0.5 mm in diameter is mainly distributed at 1.4-2.6 m / s.
During the second minute of the rainfall process, the distribution of raindrops and the velocity of the raindrops are shown in Figure 2. The speed of raindrops is mainly concentrated at 0.8-5.8 m/s. In all measured raindrops, the speed of 1.4 m/s is 138, accounting for about 21%. The analysis also shows that the raindrops are mainly composed of raindrops with a diameter of 0.125-1 mm, of which the velocity of 0.125 mm is 0.6-3.4 m/s, the raindrop of 0.25 mm is 0.8-2.6 m/s, and the diameter of 0.375 is 1-2.2 m/s, the diameter of the diameter of 0.5 mm is distributed at 1-2.2 m/s.

According to the observation data, the distribution of raindrops and the velocity of raindrops in the third minute of the rainfall process are shown in Fig. 3. The speed of raindrops is mainly concentrated at 0.8-5.8 m/s. In all measured raindrops, the speed of 1.0 m/s is 170, accounting for about 21%. The analysis also shows that the raindrops are mainly composed of raindrops with a diameter of 0.125-0.5 mm, wherein the velocity of the 0.125 mm particle size is 0.8-3.4 m/s, the raindrop velocity of 0.25 mm is 0.8-3.4 m/s, and the diameter of the raindrop is 0.375. 1-2.2 m/s, a diameter of 0.5 mm diameter distribution between 2.2-3.4 m/s.
We also analyzed the raindrop diameter and velocity distribution during the fourth minute during the natural rainfall of 20180710 (Figure 4). Statistics show that the speed of raindrops in the fourth minute is mainly concentrated between 0.4 and 7.4 m/s. The maximum number of raindrops is 1.4 m/s, and the number of raindrops is about 75, accounting for about 15% of the total number of raindrops. It can also be seen from Fig. 4 that the raindrop diameter is mainly distributed in 0.125-1.0 mm. Among them, the raindrop speeds of 0.125 mm, 0.25 mm, 0.375 mm and 0.5 mm are mainly concentrated in 0.8-4.2 m/s, 1-4.2 m/s, 1-2.6 m/s, 1-3.4 m/s, respectively.

Figure 5 shows the distribution of raindrop size and velocity during the fifth minute of rainfall. It can be seen from Fig. 5 that the speed of raindrops in the 5th minute of rainfall is mainly concentrated between 0.6-7.4 m/s. Among all the measured raindrops, the most measured raindrop velocity was 1.0 m/s, and the number was 81, accounting for 16% of the total number of measurements. The analysis also showed that the raindrops were mainly composed of raindrops with a diameter of 0.125-1.25 mm. Among them, the raindrop speeds of 0.125 mm, 0.25 mm, 0.5 mm and 0.75 mm are mainly concentrated in 0.6-4.2 m/s, 1-4.2 m/s, 1-2.6 m/s, 1-3.4 m/s, respectively.
4. Conclusions

Through the above research and analysis, the following main conclusions can be obtained:

(1) During natural rainfall, changes in rain intensity generally exhibit a parabolic change. With the increase of rainfall intensity, the number of raindrops, raindrop diameter and speed per unit time showed an increasing trend. During natural rainfall, the values of parameters such as raindrop diameter and velocity show a relative dispersion trend.

(2) In this measurement process, the velocity of raindrops is mainly concentrated between 1-3.4m / s, and the probability distribution of raindrop velocity is between 1-1.8m / s. The raindrop diameter of this rainfall is mainly distributed between 0.125-0.5mm. The raindrop velocity of 0.125mm in diameter is mainly distributed between 0.8-3.4m / s. The raindrop velocity of 0.25mm is mainly distributed between 1-2.6m / s, and the raindrop velocity of 0.375mm is mainly distributed in 1.0-2.2. Between m values, the raindrop velocity with a raindrop diameter of 0.5 mm is mainly distributed in the range of 2.2-2.6 m / s.

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