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Study on the critical dynamics of compound erosion in the Pisha sandstone area

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The Pisha sandstone area which distributed in Ordos of Inner Mongolia was the main source area of Yellow River sediment, The area has a characteristic of serious composite erosion and fragile ecological environment, So, which identifying the critical force occurrence conditions of compound erosion is an important prerequisite to prevent and control the multiple composite erosion. Using the method such as field observation, simulation experiments and literature review, this study preliminarily summarizes the dynamic critical conditions and key influencing factors of water erosion, wind erosion and freeze-thaw erosion. (1) Water erosion is affected by rainfall, rainfall intensity and soil moisture status, Rainfall and rainfall intensity are the two critical factors under the certain soil moisture status. the one critical conditions of water erosion was $P > 34\text{mm}$ under the soil moisture of $\theta_v \approx 10\%$, and the other critical conditions was rainfall intensity $I > 1.2\text{mm/min}$ (soil moisture $\theta_v \approx 36\%$) or rainfall intensity $I > 3.1\text{mm/min}$ soil moisture $\theta_v \approx 4\%$. (2) The wind erosion is affected by the surface covering particles and soil moisture. When the wind speed reaches more than 5 m/s , the soil particles of diameter $d < 0.5\text{ mm}$ will be blown up. So the wind erosion is easier happens on exposed surface and slipped particles. Increasing the surface covering and water content can reduce wind erosion; (3) Freeze-thaw mainly occurs from November to March of each year, which destroys soil structure mainly through soil mass melting and particle fall down. The alternation times and moisture content of freeze-thaw are the key factors that affect freeze-thaw erosion. When the soil moisture is more than 10% and the freeze-thaw alternation is more than 10 times, the freezing and cracking damage is obvious. Therefore, the phenomenon of sliding and peeling off the exposed steep slope is common in Pisha sandstone area. (4) Multi dynamic composite erosion distributed by seasonal in the year, Wind and freeze-thaw composite erosion happened in the transition of autumn to winter and winter to spring, Water erosion mainly occurred in summer, and accompanied by wind erosion, Meanwhile, wind and freeze-thaw erosion products were all carried away by runoff. The results can provide theoretical basis for the measures selection of composite erosion control.

Key words: Pisha sandstone area, composite erosion, water erosion critical, wind erosion critical, freeze-thaw erosion critical, influencing factors