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Measuring the size of pendant water drop generated by hypodermic needles for construction of rainfall simulator for soil erosion research

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Abstract

Dripping rainfall simulators for soil erosion research generate pendant water drops of simulated rainfall with different types of drippers, such as plastic and glass tubes, drippers in a form of holes, irrigation drippers and hanging yarn, among which metal tubes are the most commonly used. Metal tubes appear in the form of capillaries with a flat tip or in the form of hypodermic needles. Hypodermic needles are suitable for this purpose because their diameter size is standardized with relatively small deviations from the standardized dimensions, they are available on the market, relatively cheap, made of stainless material and have a threaded connector (Luer taper). Since scientific papers that used dripping rainfall simulators are often incomplete in terms of data for diameter, length, and type of hypodermic needle as a dripper, as well as data on pendant water drop size that needles can generate, a performance analysis of hypodermic needles was performed. For the purpose of this study, dripping rainfall simulator was originally designed and made for laboratory use. Pendant water drops are generated with 11 different needles, ranging in size from 16 G to 32 G, at different dripping intensities. Obtained water drops size ranging from 3.70 to 1.48 mm, were acquired using weight measuring method. Based on research data, two nomograms were made for determination of interconnected parameters of simulated rainfall: pendant water drops size under different dripping intensity, drippers discharge, number of drippers, and kinetic energy of water drops for the given falling height. The results of research facilitate the design of dripping rainfall simulators for soil erosion research.

Keywords: water drop size, water drop diameter, hypodermic needles, rainfall simulator, dripping intensity

References

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