UNIVERSITI TEKNOLOGI MARA

EMPIRICAL MODEL OF SEDIMENT AND SOLUTE TRANSPORT IN DIFFERENT RAINFALL PATTERN CONDITIONS

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ABSTRACT

Previous experimental and field works studied that sediment transport is influenced by hydraulic properties of flow, physical properties of soil, and surface characteristics. Many investigation on the relationship of solute transport and rainfall erosion had been done, however the relationship of rainfall patterns to both sediment and solute transport has rarely been investigated. This study aims at determining the effect of different rainfall patterns (constant pattern, increasing pattern, increasing-decreasing pattern, and decreasing pattern) on the surface runoff, sediment and nutrients (ammonia nitrogen, nitrate nitrogen and phosphorus) loss by done triplicate of 4 types of rainfall patterns on a sandy loam soil plot. Furthermore, to establish the selected parameters that contribute to the sediment transport capacity in overland flow conditions under different rainfall pattern conditions and to evaluate their significance. The findings from experimental works showed that there are significant effects caused by different rainfall patterns, where decreasing pattern generated the highest amount of runoff, highest amount of sediment accumulated, and resulted in more severe nutrient loss as compared to other patterns. The establishment of independent variables was performed using the dimensional analysis approach that is Buckingham's π theorem. The final result obtained are series of independent parameters; the Reynolds number (Re), dimensionless rainfall parameter $\left(\frac{iL}{\nu}\right)$, hydraulic characteristics $\left(\frac{Q}{L\nu}\right)$ that related to the dependent parameters; dimensionless sediment transport $\left(\frac{q_s}{\rho v}\right)$. The relationship indicates that 63.6% to 72.44% of the variance in the independent parameters in regards to dependent parameter. From the iteration method, the estimation of constant and regression coefficient values is presented in the form of the general formula for linear and nonlinear model equations. The linear and nonlinear model equations have the highest model accuracy of 93.1% and 81.5%, respectively. However, nonlinear model equation has the higher discrepancy ratio that is 54.9%.

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