EGU2020-3278
https://doi.org/10.5194/egusphere-egu2020-3278
EGU General Assembly 2020

Effects of Rainfall and Vegetation Conditions on Colloid Transport in Saturated Vegetative Filter Strips

Congrong Yu and Yufeng Sun
State Key Laboratory of Hydrology-Water Resources and Hydraulic Engineering, Hohai University, College of Hydrology and Water Resources, Nanjing, China (cryu@hhu.edu.cn)

Non-point source pollution has become the main pollution source of surface water , among which colloidal pollutants are a kind of important non-point source pollutants. Rainfall runoff is the main factor that causes non-point source pollutants to migrate to water. Vegetative filter strips is an effective measure to control non-point source pollution. Vegetative density is one of the important factors affecting pollutant removal efficiency. In order to clarify the removal efficiency of colloidal non-point source pollutants by vegetative filter strips with different densities under rainfall conditions, it is necessary to study the effects of vegetative density and rainfall intensity on the migration and removal mechanism of colloids in vegetative filter strips. Based on the numerical model established by coupling non-Darcy flow water balance equation and colloid transport equation, combined with laboratory experiments and numerical simulation, the removal mechanism of colloid at different migration distances was studied under the conditions of fixed inflow, different rainfall intensity and vegetative density.

The results show that: 1) Although there is no infiltration, the colloid diffuses from surface water into saturated sand, which increases the removal efficiency of colloid. 2) Increasing vegetative density will increase the removal efficiency of colloids in vegetative filter strips. With the increase of density, the velocity of flow decreases, which decreases the deposition capacity of colloids on vegetative and increases the diffusion of colloids from surface water to soil. 3) Under rainfall conditions, the presence of rainfall increases the removal efficiency of colloids by vegetative filter strips. Although rainfall weakens the ability of vegetative to deposit colloids, it enhances the ability of colloids to diffuse to soil. The deposition capacity of colloids on vegetative increased with the increase of rainfall intensity. 4) The interception ability of vegetative enhances the diffusion ability of colloids to soil, and enhances the removal efficiency of colloids by vegetative. 5) In the vegetative filter strips, the adsorption coefficient of colloids decreases with the migration distance, mainly due to the heterogeneity of colloids. In the process of colloid migration, the absolute value of surface potential and the colloid with smaller particle size along the course are easy to be removed by vegetative filter strips because of the smaller barrier between colloid and plant, the smaller second energy potential well and the strong adsorption capacity of colloid deposition.

The research results provide important theoretical basis and reference for designing vegetative filter strips to remove colloidal non-point source pollutants under rainfall conditions.