2009 CSREES National Water Conference; St. Louis, MO

Effect of Diffusion and Raindrop Impact on Dissolved Chemical Transport from Soil Surface to Overland Flow

Laosheng Wu, Xiaonan Shi, Weiping Chen
University of California Riverside

Abstract:
Interfacial diffusion and rainfall drop impact both affect solute and particulate pollutant transport from soil to overland runoff water. In this study, we propose a new model to describe the transport of dissolved chemicals from saturated soil to overland flow. The model is built upon the concept of a diffusion-like model taking into account the impact of raindrop dispersion. A new interfacial transfer coefficient was introduced to integrate interfacial diffusion by concentration gradient and raindrop dispersion. The model was solved analytically under non-infiltration conditions. Experimental data were collected for model parameters estimation and model validation. The results showed the interfacial diffusion by concentration gradient contributed nearly 80% of chemicals transported from soil to runoff while raindrop dispersion function contributed 15%. Neither function can be neglected. The model can predict well both the chemical concentration in runoff and soil. The sediment content in overland flow was linearly related with chemical concentration of runoff. The concentration of runoff water decreased rapidly at the beginning of rainfall event; 900 s after rainfall start it showed a linear relationship with the concentration in the soil surface layer.

Impact Statement:
Understanding the transfer of agricultural chemicals at the interface of soil surface and overland flow is essential to develop best management practices to reduce non-point source pollution in surface waters. In this study, theoretical analysis and laboratory experiments were carried out to investigate the effect of diffusion and raindrop impact on chemical transfer at the interface. Results indicate that the interfacial diffusion due to concentration gradient contributed nearly 80%, while raindrop dispersion contributed about 15% of the chemicals transported from soil to runoff.

Category: Conservation and Resource Management
Type of Presentation: Poster Presentation