

Abstract

Nitrogen is a vital nutrient that enhances plant growth which has motivated the intensive use of nitrogen-based fertilizers to boost crop productivity. However, Pollution by nitrate is a globally growing problem due to the population growth, increase in the demand for food and inappropriate Nitrogen application. The complexities and challenges in quantifying nitrate leaching have led to development of a range of measurement and modeling techniques. However, most of them are not widely applied due to their inaccuracy. This calls for new approaches in which nitrate leaching can be analysed in order to give better understanding of nitrate fate and transport process for proper management of groundwater. This study presents a mathematical model to analyse nitrate leaching into groundwater from the advection-dispersion equation. The advection-dispersion equation is modified by incorporating soil porosity and volumetric water content of the soil. The stability of the model has been performed by the Von Neumann stability condition after performing descritization using the Cranck-Nicolson scheme and finite difference scheme. The model is conditionally stable for all ranges of angle(κ), when Von Neumann stability condition is applied for both the Cranck-Nicolson scheme and finite difference scheme. The results provide science-based input into best alternative mathematical model which can be used to analyse leaching of nitrate into groundwater.