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 c o m p l e x i t i e s and challenges in quantifying nitrate leaching h a v e 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 s t u d y has d e v e l o p e d a mathematical model to a n a l y s e n i t r a t e leaching into groundwater from the advection-dispersion equation. The advection-dispersion equation is modified by incorporating soil porosity and tran sfo rmed to a second order o rd ina ry differential equation by Laplace and solved. Simulations showing the variation of soil porosity is presented using the MATLAB software. The study has shown that nitrate leaching to groundwater is directly proportional to soil porosity such that more porous soil will allow more nitrate to reach to the groundwater within a short time leading to faster contamination of groundwater. The results is useful to farmers, policy makers, researchers and the general public for the purpose of understanding movement of nitrates through the soil and also provide science-based input into best alternative mathematical model which can be used to analyse leaching of nitrate into groundwater.