

Abstract

Nitrate leaching into groundwater is a complicated process that involves a number of different biochemical transformations. These biochemical transformations include immobilisation, mineralization, nitrification, volatilization, crop absorption, and nitrate leaching into groundwater. Groundwater nitrate contamination is a developing challenge that requires precise analytical and numerical solutions. Various approaches to measuring nitrate leaching have been developed from a range of measurement and modelling techniques, but all suffer from one limitation or another due to the complexities, challenges and assumptions made in quantifying nitrate leaching in groundwater. This calls for new approaches in which nitrate leaching can be analysed to gain a better understanding of nitrate fate and transport processes for the proper management of groundwater. The advection-dispersion equations are updated in this research work to simulate nitrogen leaching in soils with variable depth, duration, volumetric water content, and porosity. Graphical representations of numerical simulations of the concentration of nitrate in the soil at varying depths and times can be achieved with the help of MATLAB software. According to the findings of the study, the proportion of soil porosity to soil water volume is directly proportional to the amount of nitrate that leaches into the groundwater. Therefore, it is recommended that measures be taken to reduce the potential for groundwater contamination. These measures include reducing the amount of nitrogen used, avoiding overwatering, and developing a test that helps farmers measure the amount that is already present in the groundwater.