Geophysical Research Abstracts
Vol. 14, EGU2012-13116, 2012
EGU General Assembly 2012

Evaluation of leaf litter leaching kinetics through commonly-used mathematical models

J.V. Montoya, A. Bastianoni, C. Mendez, and J. Paolini

Centro de Ecología. Instituto Venezolano de Investigaciones Científicas (IVIC). PO Box 21827, Caracas 1020-A, Venezuela.

Leaching is defined as the abiotic process by which soluble compounds of the litter are released into the water. Most studies dealing with leaf litter breakdown and leaching kinetics apply the single exponential decay model since it corresponds well with the understanding of the biology of decomposition. However, during leaching important mass losses occur and mathematical models often fail in describing this process adequately. During the initial hours of leaching leaf litter experience high decay rates which are not properly modelled. Adjusting leaching losses to mathematical models has not been investigated thoroughly and the use of models assuming constant decay rates leads to inappropriate assessments of leaching kinetics. We aim to describe, assess, and compare different leaching kinetics models fitted to leaf litter mass losses from six Neotropical riparian forest species. Leaf litter from each species was collected in the lower reaches of San Miguel stream in Northern Venezuela. Air-dried leaves from each species were incubated in 250 ml of water in the dark at room temperature. At 1h, 6h, 1d, 2d, 4d, 8d and 15d, three jars were removed from the assay in a no-replacement experimental design. At each time leaves from each jar were removed and oven-dried. Afterwards, dried up leaves were weighed and remaining dry mass was determined and expressed as ash-free dry mass. Mass losses of leaf litter showed steep declines for the first two days followed by a steady decrease in mass loss. Data was fitted to three different models: single-exponential, power and rational. Our results showed that the mass loss predicted with the single-exponential model did not reflect the real data at any stage of the leaching process. The power model showed a better adjustment, but fails predicting successfully the behavior during leaching's early stages. To evaluate the performance of our models we used three criteria: Adj-R2, Akaike's Information Criteria (AIC), and residual distribution. Higher Adj-R2 were obtained for the power and the rational-type models. However, when AIC and residuals distribution were used, the only model that could satisfactory predict the behavior of our dataset was the rational-type. Even if the Adj-R2 was higher for some species when using the power model compared to the rational-type; our results showed that this criterion alone cannot demonstrate the predicting performance of any model. Usually Adj-R2 is used when assessing the goodness of fit for any mathematical model disregarding the fact that a good Adj-R2 could be obtained even when statistical assumptions required for the validity of the model are not satisfied. Our results showed that sampling at the initial stages of leaching is necessary to adequately describe this process. We also provided evidence that using traditional mathematical models is not the best option to evaluate leaching kinetics because of its mathematical inability to properly describe the abrupt changes that occur during the early stages of leaching. We also found useful applying different criteria to evaluate the goodness-of-fit and performance of any model considered taking into account both statistical and biological meaning of the results.