

Effects of Ca²⁺ on migration of dissolved organic matter in limestone soils of the southwest China karst area

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Abstract

The capacity of carbon sequestration of limestone soils in karst areas is unclear and needs to be studied, and there are few reports on the effect of calcium ions content on the migration and transformation of soil dissolved organic matter (DOM). In this paper, the leaching process of DOM from four-layered soil samples of two limestone soil profiles was systematically studied by soil column experiment with different Ca²⁺ concentration runoff. The results show that the elution of DOM can be divided into two stages, a rapid release and dilution stage and a nearly stable DOM release stage. After the elution, the average DOC loss rates are 61.9%, 75.5%, 70.9% and 49.1% for four samples, H1, H2, S1, and S2, respectively. When the Ca²⁺ concentration of eluent increases, the following phenomena occur: 1) The DOC loss rate decreased, which was reduced by 0.6-7.5% in this study. 2) The elution rate decreased and the desorption activation energy increased. 3) The molecular weight and the aromaticity of effluent DOM increased and decreased respectively. 4) The humic-like components were eluted less. The results demonstrate the higher Ca²⁺ concentration reduces the elution of soil DOM, improves the aromaticity of retained soil organic matter (SOM), and may inhibit SOM utilization and degradation by microorganisms. This study helps to understand better the transport and fate of SOM in karst regions, and provides theoretical support for soil planning management and carbon sink increase in karst areas.

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