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研究报告

酸性森林土壤中$Al_i/(Ca+Mg)$摩尔比值的分布特征及影响因素

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摘要 研究了西南和华南酸性森林土壤中$Al_i/(Ca+Mg)$摩尔比值的分布特征与影响因素,用主成分分析(PCA)和偏最小二乘法(PLS)回归综合评价各种影响因素及其相对重要性. 2000～2002年连续3年的监测结果表明,大多数土壤水中该摩尔比值都小于临界值1.0,说明土壤铝释放还未对植被造成显著伤害.偏最小二乘法(PLS)回归显示,土壤铝饱和度(AlS)是影响A层土壤水中$Al_i/(Ca+Mg)$摩尔比值的首要因素;土壤铝饱和度愈高,土壤水中$Al_i/(Ca+Mg)$摩尔比值愈高.5个流域中,尽管流溪河流域酸沉降量偏低,但由于土壤铝饱和度较高,A层土壤水中$Al_i/(Ca+Mg)$摩尔比值高于其他流域.土壤水中无机铝(Al_i)浓度是影响深层(B_1、B_2、BC层)土壤水中$Al_i/(Ca+Mg)$摩尔比值的主导因素;土壤水中无机铝浓度愈高,$Al_i/(Ca+Mg)$摩尔比值愈高.各流域内摩尔比值沿土壤深度的变化与无机铝浓度的变化基本一致.可以认为,土壤铝饱和度是影响土壤水中$Al_i/(Ca+Mg)$摩尔比值区域性差异的主要因素,土壤水中无机铝浓度是影响$Al_i/(Ca+Mg)$摩尔比值纵向差异的主要因素.

关键词 $Al_i/(Ca+Mg)$摩尔比值 酸性森林土壤 酸沉降

分类号

Distribution characters and affecting factors of $Al_i/(Ca+Mg)$ molar ratio in acid forest soils

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Abstract

By using principle component analysis (PCA) and partial least square (PLS) regression, this paper studied the distribution characters and their affecting factors of $Al_i/(Ca+Mg)$ molar ratio in acid forest soils in southern and southwestern China. The monitoring data from 2000 to 2002 showed that in most cases, the $Al_i/(Ca+Mg)$ molar ratio in soil moisture was lower than assumed critical value 1.0, indicating that significant aluminum toxicity to vegetation was not occurred in the study regions. PLS regression suggested that soil aluminum saturation (AlS) was the dominant factor affecting the $Al_i/(Ca+Mg)$ molar ratio in soil A horizon. Higher AlS led to a higher $Al_i/(Ca+Mg)$

molar ratio in soil moisture. Despite of its lower acid deposition, Liuxihe basin had a higher $Al_i/(Ca+Mg)$ molar ratio in soil A horizon than other catchments, mainly due to its higher AlS. In deeper soil horizons (B_1, B_2 and BC), the inorganic aluminum (Al_i) in soil moisture was the main factor affecting $Al_i/(Ca+Mg)$ molar ratio. Higher inorganic aluminum concentration resulted in

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higher $Al_i/(Ca+Mg)$ molar ratio. In each of study catchments, the vertical distribution of $Al_i/(Ca+Mg)$ molar ratio was basically identical with the distribution of inorganic aluminum (Al_i) through soil profile. It was concluded that soil aluminum saturation was the main factor controlling the regional variation of $Al_i/(Ca+Mg)$ molar ratio in soil moisture, and the vertical distribution of soil $Al_i/(Ca+Mg)$ molar ratio in each site was mainly due to the vertical change of inorganic aluminum in soil moisture.

Key words $Al_i/(Ca+Mg)$ molar ratio Acid forest soil Acid deposition

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