Study on Activation Characteristics of Trace Elements in Black Soil Region of Central Jilin Province

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Introduction

Studying available contents of trace elements is the basis of making rational utilization of the land resources and improving soil quality as the effective state of soil elements is the available part in the process of crop utilization and absorption. In recent years, effects of soil trace elements on crop growth and quality have caught more attention, and the previous studies indicate that the consumption of trace elements in soil will increase with the improvement of crop yields, therefore, studying the activation characteristics of soil trace elements and the influence factors is of great significance.

Material, Method, Results and Discussion

This paper analyzes and determines the total contents and available contents of 10 trace elements (As, B, Cr, Cd, Cu, Mo, Mn, Ni, Se, Zn), collected from 62 surface soil samples in black soil region of central Jilin province, NE China, and correlation analyses are done by SPSS both between the total and available contents of trace elements, and between soil pH value and activation indexes of 10 soil trace elements, respectively. Statistics results show that the activation indexes (available contents of elements in soil accounting for total contents) of different trace elements in black soil region of central Jilin province make a great difference and activation index of Mo is 26.19%, reaching the highest while that of Cd is only 0.03% —the lowest. The total and available contents of Cu and Mn exhibit extremely significantly positive correlations while these of As have extremely remarkable negative correlations, and there are no significant correlations between the total and available contents of B, Cd, Cr, Mo, Ni, Se and Zn, respectively. Additionally, the activation indexes of Cr, Cd, Mn, Mo, Ni, Se and Zn have extremely significantly positive correlations with soil pH value, respectively.

Conclusion

Taken together, the above analysis indicates that the total contents of soil trace elements are not the only control factor effecting on the available contents, but soil physical and chemical properties also have some degree influence on activation characteristics of trace elements.

Thus, taking reasonable measures of soil management according to soil characteristics in study area is of vital importance to trace elements management during the agricultural production process.

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Mg isotope variation in a ferromanganese crust from Line Seamount in the Central Pacific Ocean

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Marine hydrogenous ferromanganese crusts grow slowly (a few mm/Ma) and contain distinctive laminar growth layers which have potential to document the long term evolution of ocean chemistry and/or deep ocean temperatures. In this study, we explored the evolution of Sr and Mg isotope variation in successive layers of a marine hydrogenous ferromanganese crust, MP2D06, from Line Seamount in Central Pacific Ocean.

Eighteen layers from this sample were subjected to a series of incremental leaching steps, using various concentrations of ammonium acetate, acetic acid, hydroxylamine hydrochloride-acetic acid, and hydrochloric acid, to leach out metals from different phases (including surface adsorbed metals, and those associated with carbonate, Fe-Mn oxides, silicates and phosphate phases). Leachates from each independent step were passed through three chromatographic columns to remove interfering metals prior to analysis (particularly Fe, Mn, and Ti). The high-precision isotopic compositions of Sr and Mg for each leachate at every layer were determined by MC-ICP-MS (Neptune) at Yale University.

Preliminary results show that hydroxylamine hydrochloride-acetic acid can dissolve Fe-Mn oxides and leachates after three serial leaching steps contain Sr and Mg associated with predominantly Fe-Mn oxides. Strontium isotopic ratios for leachates from this leaching portion are consistent with seawater $^{87}Sr/^{86}Sr$ ratios, indicating this manganese crust started to grow at about 40 Ma years ago when compared to the standard seawater Sr isotope record. Mg isotope compositions of the leachates are all greater than the contemporary sea water value-the surface layer, for example, is highly enriched in ^{26}Mg compared with contemporary sea water (+1.7 versus -0.82‰ relative to DSM). The $\delta^{26}Mg$ decreases gradually with increasing age. This decrease implies either an increases in ocean bottom temperature and/or decrease of $\delta^{26}Mg$ values of seawater in the last 40-50 Ma years.