

^{18}O values can provide significant $\delta^{15}\text{N}$ and δ information to understand variation of nitrate sources of groundwater. Groundwater samples were collected during summer and winter in the karstic city, $^{18}\text{O}-\text{NO}_3^- \cdot \delta^{15}\text{N}-\text{NO}_3^-$ at Guiyang, southwest China and analyzed for major ions, ^{18}O values were determined on Finnigan MAT 252 mass spectrometer by $\delta^{15}\text{N}$ and δ combustion tube method. $\text{NO}_3^-/\text{Cl}^-$ ratios of most groundwater were higher in summer than those in winter, which indicates that nitrate contents increased due to atmospheric or anthropogenic input in most cases into groundwater and/or Cl^- . $^{15}\text{N}-\text{NO}_3^-$ in groundwater is +7.0‰. The mean values in winter, and +4.1‰ in summer, showing that nitrate in winter was more enriched in $^{18}\text{O}-\text{NO}_3^-$ in groundwater. The mean values of +12.5‰ in winter, and +10.7‰ in summer, showing that nitrate in winter was slightly enriched in ^{18}O relative to that in summer. The mean values of $^{18}\text{O}-\text{NO}_3^-$ in rainwater were +1.5‰ ($n=21$) and +34.2‰ ($n=14$), which means that the nitrogen deposition just contributes a little nitrate to groundwater due to the isotopes and low contents. It is likely that chemical fertilizer and nitrification contributed nitrate to suburb groundwater, ^{18}O values of nitrate. It is considered that $\delta^{15}\text{N}$ suggested by the high input of nitrate (chemical fertilizer and septic effluents) into the groundwater of Guiyang in summer, as evidenced by the variations of chemicals and isotopes with fast response of groundwater to rain in karst environment.

Key words groundwater; nitrate; nitrogen isotope; oxygen isotope; water chemistry

The effect of acid deposition on base cation cycling in a karstic-forested catchment: Evidence from strontium isotopes

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Bedrock weathering and atmospheric deposition are the two primary sources of base cations (K^+ , Na^+ , Ca^{2+} and Mg^{2+}) to forest ecosystems. Therefore, the key problem is to understand the relative inputs from these two sources and the cycling in the ecosystem. This study focuses on the effects of acid deposition on cation cycling in a small-forested karstic catchment in Guizhou Province. Sr isotope ratios were used as a tracer for understanding the transport process between the different cation pools: rock, soil, surface water, atmospheric deposition and plant. The samples of wet deposition, total deposition, throughfall, surface and ground waters, vegetation, and soil were monthly collected. The exchangeable Sr^{2+} and Ca^{2+} in soil samples were extracted by using 1 M ammonium acetate. The leaf-tissue samples were ashed at 550°C, and the residue was digested in ultrapure HClO_4 and HNO_3 . All water samples were filtrated through 0.45 μm aperture filter paper. Base cation concentrations and Sr isotopic composition were analyzed for all the samples. The results show that acid deposition (average pH 4.9) frequently occurred in the studied region. Cation abundance follows an increasing manner from rainwater, throughfall, to surface water or ground water samples, suggesting that acid deposition at first eluviates Ca^{2+} , Mg^{2+} and Sr^{2+} from leaf, then the exchangeable cations from soil, and at last cations accumulate in surface water or ground water. Sr isotopic compositions show that Ca^{2+} in surface water or ground water is mainly derived from rock weathering, and that crown and soil have a buffered effect up to some extent for the acid deposition. Rain fall may have different effects on base cation cycling in small forested catchments, and heavy as well as moderate rain fall takes base cations away from the catchment, while small rain events favor inputs to the catchment system.

Key words acid deposition; base cation; karst; Sr isotope

Quantitative study of landscape patterns in homogenous carbonate rock distributed regions in Guizhou

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With the utilization of GIS software, research is conducted on (a) the characteristics of cells, fragmentation, and patch fractal of landscape based on homogenous carbonate rocks in Guizhou; (b) causes of the formation of these characteristics. It has been found that under the influence of lithology, the landscape of the study region as a whole shows consistency, yet embodies distinct diversity

inside. The consistency is embodied in the following aspects: (a) the preponderant landscape consists of bushes and small woods; (b) secondary landscape is characteristic of forests and grounds covered with grass; (c) of all the patches making up the study area small patches are in the majority, with positive-skewed distribution of patches—as a result, steep peaks are characteristic of the charts showing the distribution of patches. The factor of scale is not taken into account in the study of patches. The shapes of patches tend to be regular with strong disturbances from human activities, and consequently, the values of fractal dimensions of landscape types tend to get smaller. The fragmentation of patches is more apparent in landscape under influence of human activities than the one without these disturbances. Compared with regions characteristic of homogenous dolomite, the characteristics of homogenous limestone areas are described as follows: (a) low utilization rate of water resource; (b) uneven distribution of diversified landscape; (c) weak resistance against disturbances from human activities; (d) the continuous degradation, ever-increasing fragmentation, intensification of spatial heterogeneity, and the deteriorating stability of landscape. All the above characteristics make homogenous limestone areas likely to develop in karst rocky desertification.

Key words homogenous limestone; homogenous dolomite; landscape pattern

Degradation of potassium-bearing minerals by thermophilic *Aspergillus fumigatus* and its optimal conditions

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Potassium fertilizer is in short supply in China. However, there is a considerable resource of insoluble potassium resources in the soil mineral or potassium-bearing low-degrade rocks. Most of these kinds of potassium exist in aluminous silicate minerals from which potassium cannot be absorbed directly by plants. So it is very important to study how to release potassium from soil minerals or rocks by using biological action. Recently, a large number of researches on degradation of potassic mineral by bacterial but few by fungi have been reported. In order to study the degradation of potassic mineral by fungi, we isolated a strain of thermophilic fungi TH003, which can use potassic rock as nutrient source. The strain was identified as *Aspergillus fumigatus* based on its morphological characters and molecular biology. In this paper, the direct and indirect processes of mineral powder degradation with the strain of TH003 were studied: mineral powder was added in medium directly for cultivation so as to investigate the direct process. For the purpose of studying indirect process, mineral powder was wrapped up in a parcel using membrane with pore size of 0.22 μm , and then the parcels were added in the medium. The interaction between mineral granules and mycelia was observed by using TEM and AFM at different stages during the whole experimental procedure. The results showed that the effect of direct process is stronger than that of indirect process. For instance, the content of K^+ is higher in both culture media and mycelia. Direct process includes mechanical demolition, adsorption, parceling, phagocytosis, erosion and comprehensive effect, while indirect process only refers to erosion on the surface of mineral granules by metabolic products of mycelia. The technology of fermentation engineering was employed to study the biological effects of the strain of *Aspergillus fumigatus* TH003 on the minerals bearing low-grade potassium. Nutrition factors and culture conditions that affect the process of mineral powder degrading with the strain of TH003 were studied in this paper. The results showed that glucose and corn steep are the optimal carbon and nitrogen resources in the strain culture medium, and that pH values range from 3.0 to 9.0. Mineral powders can be degraded by the strain in the range of 30°C to 55°C. Response surface methodology (RSM) was employed to optimize the process variables of major factors. Results showed that the optimal conditions are that glucose is 38.2 g/L, corn-steep 13.8 g/L, initial pH value 5.8, temperature 47.3°C, time 18d, rotary speed 100r/min and inoculum amount 9.4% (V/V). The percentage of dissoluble potassium in the supernatant of culture is up to 7.67% under the above conditions. The results can be an important reference for the study of mechanism between fungi and minerals and for the mineral biological process technology.

Key words thermophilic fungi; *Aspergillus fumigatus*; K-bearing mineral; K^+ ; fermentation

Analysis of soil biogeochemical characteristics in the process of karst rocky desertification

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