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Attenuation of Arsenic in Karst Subterranean Stream and Analysis of Its Influence Factors: Hydrogeochemical Factors

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The arsenic pollutants generated by the As industries and mining enterprises in karst area flow into subterranean streams and contaminate groundwater easily because of the unique hydrogeological characteristics, which is a serious threat to the water ecological security and human health. In order to elucidate the reaction mechanisms of As in karst subterranean streams, analysis of water quality and characterization of the sediments from Lihu subterranean river in Nandan county, Guangxi province, Southwest China, were conducted by ICP-MS spectrometry, ICP-AES and X-ray fluorescence spectrometer. The results show that inorganic As occupies most of the total As in subterranean rivers, while organic As including monomethylated arsenic and Dimethyl arsenic are not detected or trace. Reducing environment in subterranean river makes As(III) dominante in inorganic As, which accounts for 53% of the total. Attenuation rates of As, As(III) and As(V) in the Lihu subterranean stream were studied and the rates are 58%, 35%, and 67%, respectively, after 25.6km underground distance. To understand the main influencing factors of arsenic

attenuation in karst subterranean streams, principal component analysis and patero analysis in SPSS and Minitab software were applied. Seven main factors are extracted from 13 indicators, i.e. sediment Fe (SFe), sediment Al (SAl), sediment Ca (SCa), sediment organic matter (SOM), sediment Mn (SMn), water Ca^{2+} (WCa^{2+}) and water HCO_3^- (WHCO_3^-). However, the influence ranks of those factors on As speciation are different. For As and As(III), the order is $\text{SCa} > \text{SFe} > \text{WCa}^{2+} > \text{SOM} > \text{SMn} > \text{SAl} > \text{WHCO}_3^-$, while the order for As(V) is $\text{SFe} > \text{SCa} > \text{WCa}^{2+} > \text{SMn} > \text{SOM} > \text{SAl} > \text{WHCO}_3^-$. Conducting the main influence factors on sediments As of Ca and HCO_3^- in karst area distinguishes from the findings of the non-karst area sediment researches due to high calcium and alkaline value in karst water. Therefore, calcium and alkaline should be pay enough attentions during As treatment processes in karst subterranean streams.

Key words: karst subterranean streams; sediment; arsenic; influencing factors; principal component analysis

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