Spatial variation and hydrogeochemical behavior of the shallow high-fluorine groundwater

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Introduction

In this research, spatial variation and pollution sources of shallow high-fluorine groundwater in Lower Liaohe River plain were evaluated by the means of multivariable statistical analysis. The hydrogeochemical behavior and the high-fluorine grounwater zones were analysed and obtained in a small-scale coastal area in this plain.

Results

The results indicate that the distribution of F^- in shallow groundwater is obviously diverse in the whole area with high spatial autocorrelation and low spatial randomness. The high-fluorine groundwater area is mainly located at high HCO_3^- concentration region and has little proportional relation with Ca^{2+} affected by the solubility product. The high concentration of F^- was derived from the local fluorine ore and soil. The fluoride contaminant transferred with the swift groundwater runoff and enriched under the condition of slow groundwater runoff and strong vertical evaporation condition. The evaporation and concentration effect, seawater intrusion and agriculture pollution has a little influence on the high-fluorine groundwater.

According to the groundwater components balance calculation and calcite mineral saturation index in the small-scale area, the saturation index increases from negative value representing dissolved state in the northwestern part to the positive value of enrichment state benefiting for $CaCO_3$ precipitate in the southeastern part. It reveals that the calcite controls the geochemistry evolutionary process in this region. Combination with the characteristic of groundwater flow, the solution and transfer zone of high-fluorine groundwater is located around BeiNing City and LingHai City in the northern area and the transfer and enriching zone is in the southern area.