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## HYDROCHEMICAL AND ISOTOPIC CHARACTERISTICS OF KARST WELL WATER IN THE LONGZICI SPRING CATCHMENT AND ORIGIN

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### Abstract

Karst water from Longzici Spring is the primary water source for agriculture, industry, and residential use in Linfen, China. Understanding its pollution characteristics and origins is essential for optimizing the use of this vital resource and ensuring ecological protection in the Spring Catchment. This study utilized isotopic analysis and hydrochemical methods, including the Durov diagram, ion ratios, Gibbs diagram, sulfur isotopes, and hydrogen and oxygen isotopes, to investigate the hydrochemical characteristics of the karst well water in the Longzici Spring Catchment. The analysis revealed distinct hydrochemical patterns across different zones, such as the stagnant zone, recharge zone, runoff zone, and drainage zone. The karst water was primarily classified as  $\text{HCO}_3\text{-SO}_4\text{-Ca}\cdot\text{Mg}$  and  $\text{SO}_4\cdot\text{HCO}_3\text{-Ca}\cdot\text{Mg}$  water, with sulfate ( $\text{SO}_4^{2-}$ ) concentrations ranging from 20.2 to 1384.5 mg/L (mean = 280.6 mg/L). The primary sources of  $\text{SO}_4^{2-}$  were determined to be the dissolution of gypsum and the oxidation of pyrite ( $\text{FeS}_2$ ) found in coal-bearing strata, with 22.3% of the  $\text{SO}_4^{2-}$  attributed to  $\text{FeS}_2$  oxidation. Isotopic analysis (H, O, and S) indicated that approximately 85% of the karst water in Longzici Spring is affected by acid drainage from coal mines. Phreeqc simulations further revealed that the hydrochemical characteristics of the study area are primarily influenced by the dissolution of dolomite, halite, and gypsum, as well as the process of dedolomitization. These findings provide valuable insights into the sources and processes shaping water quality in the Longzici Spring Catchment and offer guidance for sustainable water resource management in the region.

**Key words:** Gibbs diagram, hydrochemical characteristics, hydrogeochemical simulation, stable isotopes, source of  $\text{SO}_4^{2-}$

Received: January, 2024; Revised final: April, 2024; Accepted: April, 2024; Published in final edited form: August, 2024

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