

Chemical Characteristic and Utilization of Coal Bed Methane Produced Water in Qinshui Basin, China

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Approximate 1/10 of coal bed methane resource reserves deposited in Qinshui Basin of Shanxi province, China. In 2015, the national ground extraction was 4.4 billion m³, of which 3 billion m³ was produced from Qinshui Basin. Qinshui Basin has become one of China's most important coal bed methane development bases. The management of produced water (PW) associated with CBM production is a major environmental challenge of CBM industrialization. According to the statistics, the PW volume of CBM wells in Qinshui Basin ranges from 2.8~20.6 m³d⁻¹ in a single well, and the total volume was over 3 × 10⁴ m³d⁻¹ by the end of 2015. Based on the water quality monitoring data the PW of coal bed gas field is divided into five categories: (1) PW with suspended solid (coal powder, rock powder and other suspended solids); (2) the flow back of fracturing fluid (suspended solids, high COD, complex organic matters); (3) PW with high salinity (high salinity, low level of Ca²⁺ and Mg²⁺, but high level of Na⁺); (4) the PW with high fluoride; (5) PW with high iron and manganese. The chemical characteristics of PW in coal bed gas fields vary widely in different stages. The hydrochemical type of fracturing fluid flow back with total salinity of 4125.4-4965.1 mgL⁻¹, is mainly characterized by Cl-Na type, high level of organic matter and COD (768.9-2003.2 mgL⁻¹). The total salinity of the PW from the coal gas field in the normal production stage is 678.1-1621.7 mgL⁻¹; the water quality is dominated by HCO₃-Na; and the organic matter is low with COD of 2.1-92.7 mgL⁻¹. According to the chemical type differences among different production stages, a coal bed methane production water treatment process and demonstration project was conducted. (1) Treatment of PW from recovery stage with fracturing fluid: multiple oxidation method involving iron micro-electrolysis-Fenton combined can be used, and effluent could meet water discharge requirement. In addition, effluent can be deeply treated for a production and living usage. (2) Treatment of PW during normal production stage: The flocculation-precipitation technology was applied and effluent was discharged when it met the standard. Additionally, reverse osmosis technology can be used for drinking purpose.

Keywords: Coal bed methane produced water, Water chemical type, Wastewater treatment