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Development and Utilization of Potash Resources in Lop Nor, Xinjiang

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The Lop Nor saline lake in the east Tarim basin, extends 115 km from the south to the north, and 90 km from the east to the west, which covers an area of 10350 km². It is the world's largest dry saline lake, and is also so far the largest potassium-bearing brine deposit discovered after the Qarhan salt lake in Qinghai. This study did scientific and systematic researches on brine mining, technology and engineering technology in order to develop resources reasonably, sustainably and efficiently, as illustrated below.

1. The northern area of the Lop Nor saline lake contains many seams, and the brine composition varies greatly. This study revealed the brine burial depth and thickness of the brine-bearing layers in the Lop Nor lake. Through (hierarchical) brine tests, three-dimensional models were constructed for reservoirs, and differential well deployment and brine slicing mining were adopted to solve difficulties of industrial brine mining and mixing brine for salt crystallization, and thus to achieve high-strength, large-flow and continuous mining.

2. The brine in the Lop Nor saline lake contains high sulfur content and low potassium content, having long potassium salt evaporation crystallization route length, and has high content of potassium-bearing minerals varying in a large range. On one hand, we changed the original brine evaporation crystallization route by mixing brine based on phase diagram theory, to make a relative concentration of potassium salt and improve the potassium grade. On the other hand, multiple potassium-bearing minerals were converted to soft leonite to simplify mineral flotation process, making subsequent processing be easy.

For the high temperature in Lop Nor, the precipitated sylvite and epsomite tend to convert to kainite, and

potassium chloride is difficult to obtain. We separated the potassium salt crystallization line through experimental study, and obtained raw material for producing potassium chloride from carnallite in the post evaporation stage. The Lop Nor salt saline lake is greatly lack of water, and thus we adopted low-magnesium saturated brine to decompose carnallite using the principle of phase diagram. This not only saves freshwater resources, but also improves recovery rate in processing cycles.

3. We studies the hydraulic mining machine cutting head structure, form and material based on rock and soil mechanism, and achieved recovery and transport of kainite ores having great hardness and easy to agglomerate. Multi-level modeling and finite element analysis were conducted on crystallizer using super element and mesh technology, in order to study the flow filed distribution and characteristics. This made the crystallizer have functions of reaction, growth, clarification and finished product area, which meets the reactive crystallization of potassium sulfate requirements, and provides convenience for the subsequent product dehydration and drying.

This technology has advantages of high recovery ratio (57.5%), stable product quality (52% K₂O), little water consumption per product (4.7 t) and less energy consumption (22 kg standard coal), and has won several national and provincial and ministerial-level science and technology awards. It has been applied to construct the world's biggest sulfuric acid potassium plant in Lop Nor, which has accumulatively produced 380 t of potassium sulfate, achieved a profit of 5.79 billion yuan, and paid tax of 2.87 billion yuan. The products have more than 76% of the domestic market share, and the use of this technology has made great economic and social benefits.

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