

THE UTILIZATION AND ENVIRONMENTAL PROTECTION OF QINGHAI SALT-LAKE RESOURCE

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Abstract: In this paper, the current situation of the salt lake resources, utilization and environmental protection are introduced, the strategies for the sustainable development of the salt-lake resource and environmental protection were advanced.

Keyword: Salt Lake; Utilization; Environmental Protection

1. INTRODUCTION

The salt resources in Qinghai Province are mainly distributed over Qaidam Basin, in which the 18 orefields of salt deposits have been proved up, such as the kalium-magnesium deposit orefields in Qarhan (which include four orefields: Bieletan, Dabuxun, Qarhan and Huobuxun), the kalium deposit orefields in Dalang lake, the lithium deposit orefields in Yipingli and East-West Jinaier lakes, the boron deposit orefields in Big-small Chaida lake, the salt deposit orefields in Chaka and Keke lake. The proved reserves of NaCl is 326,285 million ton which maintain the country's total reserves 85%.

The two Salt-lakes of Chaka and Cake have been developed over 40 years to yield salt, which the basic conditions of manufacture such as resource, environment, infrastructure and economy have been formed.

(1) Chaka salt lake

Chaka salt lake in Qinghai Province is located in the chaka town of Ulan country. The location of the salt lake: east longitude

99°02'-99°12', north latitude 36°18"—36°45", a mountain basin, belong to a new generation of down-faulted zone. The transport facilities are convenient, the Qinghai-Tibet highway through the north side of the lake, the special railway-line is 43km long from lake zone to the Chahannuo station on Qinghai-Tibet railway.

The salt lake area is 105 km² in which the solid salt and liquid brine are co-exist together. The rock salt is layered with 4.9m average thickness and 15m the maximal thickness. The total reserves is 480 million ton, in which the solid phase is 459.58 million ton, the liquid phase is 20.17 million ton. Chemical type of the Lake-water is magnesium sulfate subtype. The composition of rock salt: NaCl 82.94%; Na₂SO₄ 0.1—20%; MgCl₂ <5%; KCl <1%, LiCl <0.01%; B₂O₃ <0.2%; Br <0.001%; I <0.001%. The brine depth is generally 0.2-0.3m in the wet period and more shallow in the dry period. The compositions of the brine are shown in table -1.

Table-1: The composition of Chaka salt lake Brine

Salinity g/L	322.486				Relative density	1.2178	PH	6.80	
Ionic mg/L	Na ⁺	K ⁺	Mg ²⁺	Ca ²⁺	Cl ⁻	SO ₄ ²⁻	CO ₃ ²⁻	HCO ₃ ⁻	
	80231	4473	26506	124.5	187705	23625	172.7	26.54	
	Li ⁺	Br ⁻	I ⁻	NO ₃ ⁻	NH ₄ ⁺	PO ₄ ²⁻	As ³⁻	Se ⁴⁺	
	8.8	52.0	0.15	1.80	32.5	0.90	0.25	0.08	

(2) Keke salt lake

Keke salt lake in Qinghai Province is located in the Keke town of Ulan country. The location of the salt lake: east longitude 97°58'-98°30' north latitude 36°50'-37°06'.

The transport facilities are convenient, the Qinghai-Tibet highway through the north side of the lake, the special railway-line is 43km long from lake zone to the Chahannuo station on Qinghai-Tibet railway. The salt lake area is 116 km² in which the solid salt and liquid brine are co-exist together belongs to the magnesium sulfate subtype. The main composition of the solid is rock salt. The total reserves is 1030 million ton, in which the solid phase is 994.26 million ton, the liquid phase is 33.69 million ton. The rock salt is layered to 6 layers with 9.48m average

thickness and 26.75m the maximal thickness. The composition of the salt mine are not only rock salt, but also Glauber's salt, astrakhanite, gypsum, epsomite, in which NaCl 73.55%、Na₂SO₄ 1.84%、MgSO₄ 1.16%、CaSO₄ 3.35%、MgCl₂ 0.98%、KCl 0.15%、CaCl₂ 0.13%、Water Insolubles 9.84%

Two types brine are include in the Keke salt-lake, face brine and intergranular brine. A little face lake-water distribute in some areas in the northeast and southwest of the salt-lake, but in the rainstorm period. The area the lake water is generally 1.5km², the depth is 0.1-0.2m in the dry period and 0.5m in the wet period. The compositions of the intergranular brine are shown in table -2.

Table-2: The composition of Keke salt lake Brine

Salinity g/L		326.383			Relative density		1.2168	PH	6.75	
Ionic mg/L	Na ⁺	K ⁺	Mg ²⁺	Ca ²⁺	Cl ⁻	So ₄ ²⁻	Co ₃ ²⁻	Hco ₃ ⁻		
	80045	4618	27396	230.5	190519	23433	131.08	38.06		
	Li ⁺	B ³⁺	I ⁻	B ₂ O ₃	Sr ²⁺	B ²⁻	F ⁻	Rb ⁺		
	7.27	53.33	0.136	171.72	5.33	49.95	3.13	0.29		

(3) The Natural conditions

The characteristic of the natural condition of the chaka and keke salt-lake is drought, loss rain and more west wind. The annual average temperature is 2—4℃, the air pressure is 725mkay, the wind speed 20—22m/s, the annual sunny days normally is 320—360 days, the annual rainfall<50mm., the annual evaporation capacity is 2000—3000mm, the maximal evaporation capacity is 3700mm.

2. PRODUCTION STATUS

The only product for the chaka and keke salt lake in the tradition is salt. The deposit mining methods which depend on the conditions of the state of rock salt deposit and the conditions of intergranular brine, could be divide to three methods: (i) recovery the raw rock salt deposit directly, (ii) produce the second birth salt in sunshine method for the intergranular brine in the region which after the raw deposit recovery, (iii) Draw out the intergranular brine to produce the solar salt in the salt pan which inside or outside the lake region.

The rock salt deposits contain a little amount silt, humus, and some chemicals such as gypsum, Glauber's salt and other Salt deposits.

These impurity also pack in the rock salt crystal. The intergranular brine has a high content of NaCl, normally 310-320g/l, which could easily be used to produce second birth salt, the thick of the second salt layer of 220-270mm could be form each year. The second birth salt could be full in the deposit recovery region in 3-4 years, which has a high purity of NaCl, and could be the salt product after simple treat of washing.

3. THE DEVELOPMENT AND UTILIZATION OF THE SALT-LAKE RESOURCES

The salt deposit distribution in the Qaidam Basin is 15600 km², which contain several kinds of material: kalium, rock salt, lithium, bromine, iodine, rubidium, cesium, gypsum, Glauber's salt, natural alkali, celestite. The deposit amount in Chaka and Keke salt are 1500 million ton and have the resources of Na₂SO₄、MgCl₂、KCl、B₂O₃ richness. The two companies of salt making are 750 kiloton/a and 650 kiloton/a, that are Chaka salt company and Keke sat company. The mainly professional works of the two companies are raw salt excavating and cooking salt making. The two product lines of iodized salt, one is 150 kiloton/a, the other is 160 kiloton/a. The

iodized salt product is widely sale to the province of Qinghai, Shaanxi, Gansu, Guangxi, Anhui etc.

The new product with the brand of "ZangQing Salt" which clean and non-polluting is produced by the technology of "sunshine pan" has had a test-market in Japan.

Some other multi variety salts which based on the product lines of iodized salt, such as calcium added salt, zinc added salt, selenium added salt were output. The pepper salt has the characteristics of ethnic minorities and widely sale to the Qinghai and Tibet.

New the salt products of comminute-washing salt, ZangQing salt and refined salt (iodized salt) have been certified through the National Green Food Certification Center, and obtained the right to use green products logo. However, the traditional produce methods are only recovery the salt product. It is undeveloped to the other material, in one side it pollute the salt-lake resources. On the other side it is the waste of the salt-lake resources.

4. THE UTILIZATION OF THE CHAKA AND KEKE LAKE BRINE

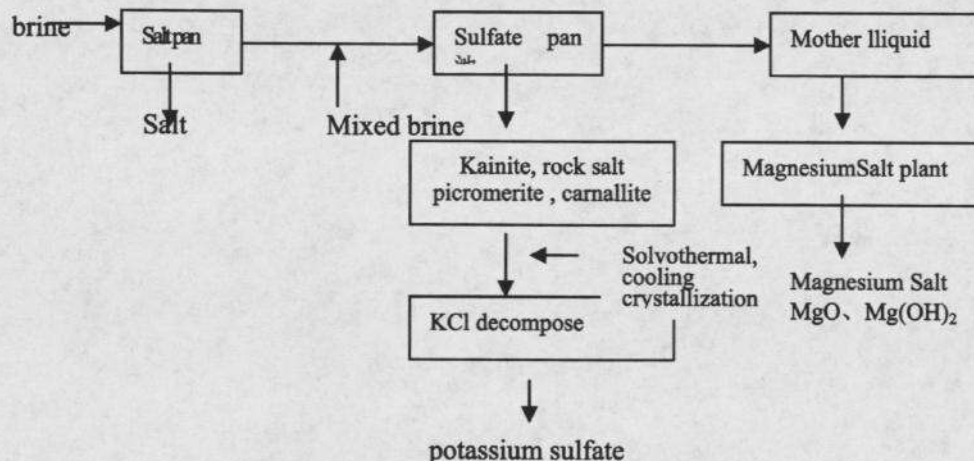


Figure-1: The schematic diagram of salt lake brine utilization

- (1) The salt lake brine was evaporated in the sunshine pan to produce salt,
- (2) Continue to evaporate the salt mother liquid, and mixed with other brine to control the composition of the brine to produce the kainite by solvothermal method and to produce potassium sulphate by cooling crystallization.
- (3) The kainite mother liquid which saturated with MgCl_2 can be used to produce MgO or Mg(OH)_2 (flame retardant degree) in brine-ammonia method.

5. CONCLUSION

Qinghai takes full advantage of strong sunshine, low rainfall, high evaporation and other natural conditions, it is propitious to the production of sunshine salt, kainite, concentrated MgCl_2 brine. The kainite removed salt by solvothermal method, can be used to produce potassium sulphate by cooling crystallization. The concentrated MgCl_2 brine can be used to produce MgO or

Mg(OH)₂ (flame retardant degree). It is an effective way to solve problem of "magnesium harm" in the process of lake salt production, and through products of NaCl, potassium-magnesium fertilizer, potassium sulfate, magnesium oxide and magnesium hydroxide to extend the industrial chain of the salt lake. In the same time, the realization of the sustainable development of lake resources, it is better to the economic efficiency and social benefits.

References

- [1] "Qinghai Mining Overview". 1988. 12
- [2] BAI Fu-yi. Salt Lake Technology[M]. 1998. 04
- [3] ZHU Jun-cai. The Geological conditions and the possibility of the construction of salt pan of Chaka and Keke salt lake[M]. 1991. 04
- [4] Salt Lake Research[J] 2000. pp 24—28.

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