Reasonable Adjustment of Reserve Capacity of Brine Adjustment Pool

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Abstract: The depth of brine in adjustment area has been recommended in the article in accordance with the sea salt production technology, the decrease of brine concentration in our sea salt field. It is suggested to modify or reconstruct brine adjustment pool, and the results after reconstruction have also been predicted. It will provide some guidance for reforming of sea salt field.

Key words: the sea salt production; brine adjustment pool; brine; the depth of brine in adjustment

INTRODUCTION

The production of solar sea salt is a kind of outdoor work which needs a lot of area. New tech-nology with plastic tarpaulin crystallization ponds has been researched and put into production in sea salt manufacturers in North China since 1970. With the promotion and application of the technology of plastic tarpaulin crystallization ponds, the sea salt production has achieved the crystallization all the year around, as well as the objective of steady production and high production capability.

There are two types of plastic tarpaulin crystallization ponds. One is called compression-type launch and recovery and the other is roller-type launch and recovery. The compression type method is used for smaller pond normally, i.e. around 1,500 m^2, while the roller type is used for larger pond, around 10,000 m^2. In the recent years, Tang-Gu Salt Works has gradually been transforming the smaller crystallization ponds with plastic tarpaulin into the larger ones. (By the end of 2003, larger ponds take up 75% of crystallization pond area). As a result, crystallization ponds need more brine at one time to change the brine. The adjustment capability of the present brine adjustment ponds is not in line with the demand of brine for crystallization production. The reforming of these brine adjustment areas has been put in agenda in order to make the brine production and reserve capacity in adjustment area meet the need of larger plastic tarpaulin crystallization ponds.

CURRENT SITUATIONS WITH BRINE ADJUSTMENT PONDS

In the recent 20 years, Tang-Gu Salt Works has performed technical reform for evaporation ponds and crystallization ponds one after another. About 25% of evaporation ponds have been transformed to brine reserve ponds with depth of more than 1 m. However, brine adjustment ponds have not been reformed yet. The brine depth in adjustment ponds at present is only about 40 cm, so that the effect of clear brine in adjustment ponds can not performed well. With the shallow brine reserve depth in the ponds, brine is diluted by the rainfall very much, and the function of reserving brine is very limited. It is difficult to achieve the sea salt production normally and has become the bottleneck in the production line.

THE ANALYSIS ABOUT THE BRINE DILUTION OF RAINFALL IN DIFFERENT BRINE RESERVE DEPTHS

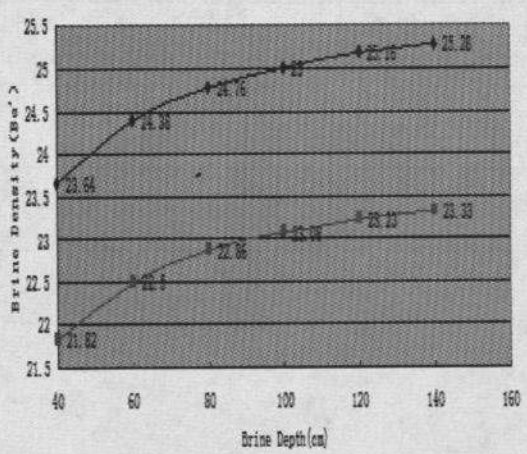
In the natural conditions, brine reserve depth will influence directly the dilution degree of per unit volume brine. The deeper the brine reserve depth is, the smaller the dilution degree is; the shallower the brine reserve depth is, the bigger the dilution degree is. Taking the rainfall of 40mm and 60mm as a typical example, with the hypothesis that rain is mixed with brine fully, the situation of brine dilution in different brine reserve depth is shown in Table 1 and 2.

The changing chart of brine concentration with 40 mm precipitation is shown in Figure No.1.

The changing chart of brine concentration with 60 mm precipitation is shown in Figure No.2.

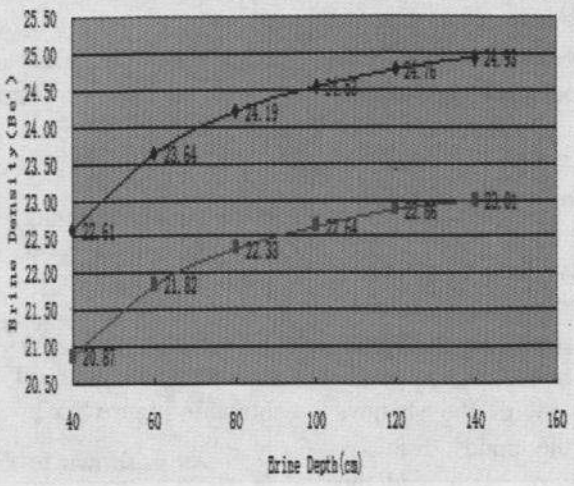
As is shown in Fig 1 and 2, although after raining the brine concentration decreased with the increase of brine reserve depth, the decrease rate of brine concentration became smaller. This means the effect of only increasing the brine depth to reduce the rainfall loss becomes small obviously when brine depth is up to 1m to 1.2m. Theoretically, brine adjustment ponds should be kept at the brine depth in adjustment of 1m to 1.2m.

Fig No.1 The changing chart of brine depth with 40 mm precipitation



Note: Blue—Series 1; Red-Series 2

Fig No.2 The changing chart of brine depth with 60 mm precipitation



Note: Blue—Series 1; Red-Series 2

Table No.1 Analysis of brine concentration after dilution with 40mm precipitation

Rain Precipitatio (mm)	Brine Depth (cm)	Concentration Changes/^{0}Be′		Concentration Changes/^{0}Be′	
		Concentration Before raining	Concentration After raining	Concentration Before raining	Concentration After raining
40	40	26	23.64	24	21.82
40	60	26	24.38	24	22.50
40	80	26	24.76	24	22.86
40	100	26	25.00	24	23.08
40	120	26	25.16	24	23.23
40	140	26	25.28	24	23.33

Table No.2 Analysis of brine concentration after dilution with 60 mm precipitation

Rain Precipitation (mm)	Brine Depth (cm)	Concentration Change/^{0}Be′		Concentration Change/^{0}Be′	
		Concentration before raining	Concentration after raining	Concentration before raining	Concentration after raining
60	40	26	22.61	24	20.87
60	60	26	23.64	24	21.82
60	80	26	24.19	24	22.33
60	100	26	24.53	24	22.64
60	120	26	24.76	24	22.86
60	140	26	25.28	24	23.01

CURRENT MAJOR PROBLEMS OF BEACH FIELD

According to above analysis and the current situation of beach field in Tang-Gu Salt Works, the major problems is as follows:

1) In the brine adjustment ponds brine reserve capacity is low; the effect of clear brine is difficult to achieve. It can not meet the needs of large plastic tarpaulin crystallization ponds to on brine adding.

2) Rain precipitation has diluted brine concentration too much. As a result, not only the brine concentration in brine reserving ponds in adjustment area is lower than that in the evaporation ponds, but also the production recovery is hard to achieve quickly after raining.

3) The depth of brine reserve in adjustment area is lower. It will take more areas for keeping certain amount of brine in the ponds. This will also limit the capability of brine production in adjustment area.

PROPOSED SOLUTIONS

According to many-year production practice, based on the theory analysis about the brine dilution due to rain precipitation in different brine reserve depths, the following respects should be concentrated on in order to solve the problems above mentioned.

(1) The brine reserve depth in brine reserve ponds in adjustment area shall be modified to between 1m and 1.2m. This will clarify brine and meet the needs of larger plastic tarpaulin crystallization. Additionally, brine concentration can be kept and production can be restored as soon as possible after raining.

(2)Re-arrangement of the brine adjustment area should be made. The four primary adjustment ponds which are close to water wheels can be combined into two larger brine reserve ponds with the depth between 1 m and 1.2 m. It will achieve the adding of brine from brine adjustment ponds to crystallization ponds.

(3) Transformed brine adjustment ponds will be covered with plastic tarpaulins to reserve brine, which will help to reduce the brine dilution by raining further.

EXPECTED RESULTS AFTER REFORMING

(1)As for 40 mm rainfall precipitation, the situation of brine dilution of brine reserve ponds before and after reform is as follows:

Before reforming: brine concentration of 26^0 Be′before was changed into 23.64^0Be′after raining; brine concentration of 24^0 Be′before was changed into 21.82^0Be′。

After achieving reforming, under the premise that the depth of brine in adjustment is 1m, brine concentration of 26^0 B′before was changed into 25^0Be′after raining; brine concentration of 24^0 Be′before was changed into 23.08^0Be′after raining; therefore, the effect of brine in adjustment is improved; and the brine dilution from rainfall is increased.

(2) If certain amount of brine will be reserved in the ponds, the area will be different due to the difference of brine depth in adjustment. The area with the depth of brine in adjustment of 40 cm is about 2.5-3 times bigger than that with the brine depth in adjustment of 100 cm-120 cm. Take one workgroup of Tang-Gu Salt Works as an example, for reserving 14000m^3 brine in half beach; it needs 3.5 ha if the brine depth in adjustment is 40cm. However, with brine depth of 100cm to 120cm, it needs only 1.4ha to 1.17ha. It can save more than 2.0 ha areas to produce brine. In this way, each workgroup can save more than 4.0 ha to produce brine, so about 300 tons industrial salt will be produced additionally per year.

(3) After covering plastic tarpaulin, calculating with water evaporation by 70% in raining season, 22.4 m^3 water will be discharged every 100 m^2 areas. It may produce 7 tons of salt more. Each team in Tang-Gu Salt Work will produce 140 tons of salt additionally per year.

From the above three points it can be seen that on one hand, plastic tarpaulin reduced the dilution by raining precipitation and brine loss and increased the discharge rate of fresh water; on the other hand, it has improved brine production capability in the adjustment area because less area of brine in adjustment is required for the same amount of brine. There will be an increase of salt production of about 10,000 tons yearly if proper transformations are performed to No.2 Workgroup of Tang-Gu Salt Works.

CONCLUSIONS

Considering and analyzing the practice of Tang-Gu Salt Works, this article pointed out what is reasonable depth of brine in adjustment in adjustment areas, and also described the necessity of reasonable adjustment of reserve capacity of brine adjustment area as well as the effect predicti-on after transformations, which can provide guidance for salt field transformation.