

CURRENT SITUATION AND DEVELOPMENT TREND OF CHINESE SOLAR SALT PLASTIC FILM APPLIED TECHNIQUE

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DEVELOPMENT PROCESS OF CHINESE PLASTIC FILM SEALING TECHNIQUE

China is a big country of sea salt production with lower natural condition. Because of the influence of climatic condition, Chinese sea salt production can only adopt short-term crystallization technology. Thus the quality of salt is quite bad and the mechanized level is low.

For the sake of changing the unprogressive situation, in 1965 Nanbao salt field in Hebei province carried out a comparative test between plastic film sealing crystallization ponds and horizontal solarization in two pieces of small crystallization ponds, each of which is 4 are.

Comparative trial was carried in two pieces of 33 hectare experimental beaches in Jiangsu. The result showed that unit production per hectare crystallization area increased 33.14%, purity raised 4%.

The remarkable effect made this technology rapidly popularize and apply in various regions from 1967. But China is vast in territory, climate characteristic difference a lot, various regions, great variety, lack of systematicness and some corresponding auxiliary project had not been able to follow up. All of these problems restricted the development of this technology.

In the mid-70s, ministry of light industry and local governments set up the project to support the improvement and coordinated reforms of plastic film sealing (PFS) technology. The popularization rate of PFS technology increases continuously. For example, in Jiangsu province the PFS area of crystallization ponds occupied 25% from 1971 to 1973; occupied 37% from 1974 to 1976 and achieved 100% after

1980.

In the early 90s, national key scientific and technological project set up projects to investigate pulling and pushing and floating and rolling PFS in order to solve some technical problems, such as difficult to collect the films in pulling and pushing process, low efficiency, the influence of low velocity in floating and rolling, reliability and so on.

During the unceasingly modified processing in this 40 years, the country put in lots of funds to research and develop this technology. A mount of investigation and innovation has been done like the improvement of plastic film, sealing method, removing dilute technology, anticorrosion and maintenance; change the structure of beach field, take in & put away the equipments and so on. As the results, large quantities of achievements in scientific research are obtained. The popularization and application of PFS technology totally changed the original ways of production, which is unprogressive and low efficient. It also increased the operating factor of evaporation, changed the batch working to continuous production, realized the continuously crystallization and collected the salt in mechanization way. This can be seen as a significant revolution in phylogeny of Chinese sea salt.

CURRENT SITUATION OF CHINESE PLASTIC FILM SEALING TECHNOLOGY

PFS technology refers to the special technology. It uses the sealing in crystallization ponds, isolate rain water above plastic film, discharges the rain water outside the pond after raining. Thus the salt formation and saturated brine are protected.

Brief introduction of plastic film sealing technology

PFS technology includes launch and recover technology, removing dilute technology, windproof and aseptic technique; rebuilding beach field structure, maintenance technology and managerial technique. After more than 40 years unceasingly improvement of launch and recover technology, it become the key technology in PFS. There are two kinds of launch and recover technology which are widely used in the production. One is pulling and pushing, the other is floating and rolling method.

Pulling and pushing is a kind of technology that adopts many traction floating slabs of crystallizing ponds derived by one hoister sealing the crystallization ponds with plastic film. The advantage of pulling and pushing is low investment. The disadvantages are high intensity of labor, difficult to collect the film and low efficiency of removing dilute. Lifetime of plastic film is 3-4 years, which fix with 6000 square meters of crystallizing ponds. Along with the economical development, floating and rolling method is replacing the pulling and pushing gradually.

Floating and rolling method is developed base on pulling and pushing. It takes use of floating and rolling axle synchrony operation to realize the mechanical operation of collection and discharge. The advantages of floating and rolling method are high degree of mechanization, powerful function of removing dilute and prevent ageing. The lifetime of plastic film is over 6 years. The shortcoming is the disposable investment is huge. The plastic film suits about 10000 square meters of crystallizing ponds.

Plastic film sealing technology as an important measurement in Chinese sea salt product technique has obtained widespread approval of solar salt enterprise from north part of China.

Up to 2007 output of Chinese sea salt is 32,037,700 tons, crystallization producing area amounts to 368 square kilometers and over 90% of crystallization area carried out PFS.

Uses the technology of PFS could protect brine, salt and pond board. It also able to resume production quickly, take fully use of evaporation and favor the realization of "new, deep, long" crystallization technique. Except those, the PFS technology could ensure sea salt in stable production, high production and high quality, concentrate the collection of salt, make the production easy for continuity and mechanization, reduced the production cost and raise labor productivity.

After the realization of PFS crystallization, cryst-

allized brine generally is above 20 centimeters. Deep brine crystallization is achieved, which balance the crystallization velocity of raw salt and improve the quality of salt.

Take Jiangsu as an example to make a contrast:

Content of NaCl	
Non-PFS technology	86.65%
PFS technology	95.13%

In the past, with Non-PFS technology the production of evaporating brine in the sun to make salt was very passive. Whenever was raining, rush to put the salt back, protect the brine and maintain the ponds saturated brine were necessary, in order to avoid diluting the brine and salt by heavy rain. After using PFS technique, before rainy season, all of the saturated brine is poured into pond to reduce the loss. After raining, thin film could be opened betimes, then evaporating crystallization would continue to process. In addition, crystallized brine is quite deep so it can absorb more solar energy to increase the evaporation. The yield per unit of area increased 27.4% to 36.7%.

Moreover, after using PFS crystallization, collection of salt 5 times per year in the past reduces to 1 or 2 times per year. When collecting salt, the salty thickness could reach 10-18 cm. As a result, mechanized production was easy to achieve, labor productivity was raised, crystallization cycle was prolonged, some unnecessary step could be reduced for the purpose of saving crystallizing evaporation, the pond did not need to be repaired for many years and also increase pond unit operation and the quality of salt.

After using PFS crystallization, the structure of salt field has also been changed. Distributed salt field was transform into centralized or relatively centralized salt field. The proportion of evaporation to crystallization changed from 8--10:1 to 16-20:1, so the efficiency of used land was raised. Therefore, this technology obtained widespread approval of solar salt enterprise in north and enhanced using proportion in the whole country year by year.

DEVELOPMENT TREND OF PLASTIC FILM SEALING TECHNOLOGY

The field of application is extending continuously

Evaporation tank anti-seepage----adopts plastic film covering the bottom to anti-seepage is start to

popularize and apply. In the early 90s, under the construction of Laizhou salt field in Shandong province, the technology of using plastic film to cover the bottom was adopted on 16 square kilometers in the area of making brine to anti-seepage. In 1996 the same technology was used on the Gobi Desert to anti-seepage in Qijiao well salt field Xinjiang province. Since the 21st century, this technology has been applied in amount of sandy soils to anti-seepage in Shandong salt field. The advantage of the technology of using plastic film to cover the bottom is that it can reduce the infiltration capacity from daily over several millimeters to below 0.1 millimeters.

Sealing on brine storehouse----Along with the development of PFS technology, for the purpose of protecting the brine, the technology is started applying in brine storehouse with higher concentration.

After research and experimentation, PFS technology is successfully applied in the brine storehouse and equalization basin, and prepared the

ground for providing enough raw materials of brine to crystallizing pond. 90% of domestic large-scale solarization saltern implement PFS.

Stacking salt sealing----in 1984 scientific research of stacking salt sealing technology was done in Nanbao salt field in Hebei province by Salt Research Institute China National Salt Industry Corporation, which changed the traditional backward way in solarization saltern. The advantages of this technology are high anti-rain ability, low cost, easy to operate and no pollution to solar salt. These advantages enable the technology popularizing and applying in the whole country rapidly.

Equipment technology trends standardization

Along with the perfection of PFS technology, the equipment used to spread out and put back in domestic is finalized the design into two type: one is pulling and pushing, the other is floating and rolling.

Main performance parameter table of LJ pulling and pushing sealing equipment

Model	LJ-1
Capacity of sealing (m ²)	<6000
Speed of sealing (m/min)	8
Power of motor (kW)	11
Number of motor	1
Number of pond being derived	6
Voltage of operating system (V)	36

Main performance parameter table of LJ floating and rolling sealing equipment

Model	SJ-350	SJ-450
Capacity of sealing (m ²)	<9000	<11000
Speed of sealing (m/min)	9~12	9~12
Power of motor (kW)	3	4
Number of motor	2	2
Diameter of floating and rolling axle (mm)	350	450
Diameter of roller (mm)	340	440
Voltage of operating system (V)	36	36

The plastic film is specially used for salty film. The lifetime is more than 7 years. Discharging the dilute, windproof, anticorrosion, rebuilding the structure of beach field, maintaining and managerial technique is coming more and more standardization day by day.

The application field of PFS technology is receiving

welcome from Southeast Asian countries

Because this technology is very suitable to solar salt production in rainy area, this technology researched by Salt Research Institute China National Salt Industry Corporation has been exported to Philippines and Vietnam since 1995. Along with the approval of this technology, it will applied in more and more solar salt enterprises.