IMPROVING THE LAST EFFECT TO FULFILL PRODUCTION POTENTIAL OF STAND-ALONE EQUIPMENT OF THE DOMESTIC SALT MAKING PLANT

Ye ZhaoYou, Gao MuChun, Yue LiJuan

1、 Henan Salt logistics Ltd of China National Salt Industry Corporation. ye county, Henan Province, 467200;
2, Haolong salt co.， Ltd of China National Salt Industry Corporation, Henan Pingdingshan, 467001; 3, Salt Bureau of Henan Province, Zhengzhou, Henan Province, 450000

Abstract: This paper introduced the actualities of the production vacuum degree of domestic the salt making industry. And the factors causing low vacuum degree was discussed. It also discussed the feasibility and necessity of improving vacuum degree of the last effect, and the proposed methods improving the vacuum were brought forward.

Key words: Vacuum salt; Degree of vacuum; Production

1, THE RUNNING SITUATION OF DOMESTIC- SALT STAND-ALONE EQUIPMENT

Up to the May 2000, our country has more than 160 enterprises to get fixed salt production licenses, with the exception of a small portion of them focus on secondary processing of incoming salt, most of which produce, process salt products directly. The production capacity of the biggest stand-alone equipment is 300,000 tons per year, of which there are some companies utilizing domestic equipment; there are also some companies introduced the whole set of foreign equipment and technology. According to the Statistics Report, few of the enterprises mentioned above can meet or exceed the design capacity. Depending on the analysis, it is not hard to know that, in addition to insufficient production time, the major reason is the low in vacuum degree of last effect, the total temperature difference and production capacity. Therefore, China National Salt Industry Corporation decide to reduce production by 10%, decrease the number of salt enterprises by 20% to speed up development of the salt companies in the direction of automation, multi-effect, large-scale and highly efficient energy-saving.

2, THE STATUS QUO OF DOMESTIC LAST EFFECT VACUUM DEGREE OF VACUUM EVAPORATION SALT

According to Statistics result from the intelligence information technology of Well and Rock Salt, the vacuum degree of salt making companies generally range from 0.080 to 0.092MPa, some better companies can meet or exceed 0.095Mpa. In term of the vacuum evaporation theory and the performance of the existing vacuum equipment, the figure is obviously on the low side, there are obvious differences compared with the foreign enterprises.

3, THE ANALYSIS OF THE REASONS IMPACTING THE VACUUM DEGREE

3.1 the influence of the water quality of circulating cooling water

The water quality of circulating cooling water make a difference in continual circulating heating and cooling process due to the contamination by the outside world and its own evaporation:

3.1.1 Increasing the salt content, decreasing the specific heat of circulating water can increase the temperatures of circulating water. On the process evaporation of Four-effect evaporation tank, it is easy to holding some salt into the circulating water system for the high vacuum degree, especially when it did not use the unpurified brine. According to the requirement of circulating cooling water quality standard, the salt content should less than 2500mg/L, while on the actual production process, because of the high fee of water and sewage(tap fee of Pingdingshan is 1.3 yuan / t, add up to 1.6 yuan / t),the circulating water is still in use when the salt content in water is several times or more than ten times the standard. The increase in salt content of recycled water reduces the heat capacity. Which lead to the increase in water temperature.

3.1.2 The increase in Turbidity and viscosity. The circulating water in cooling tower contacted with the air in the cooling process, the dust in air came into the circulating water system. At the same time, the brine brought in the evaporation system brings some of the impurities with low solubility such as $CaSO_4$ and so on. Which both increase the turbidity in the water. At the same time, the viscosity was also increased simultaneously and the water diffusion rate and heat transfer rate were decreased.

3.1.3 Changes in water pH. Because of the increase in alkalinity and temperature in the circulating water, the circulating water changes in pH, which is higher than the pH of added water. The pH of used recycled water is general about 9. The increase in pH will increase the concentration of CO_2, accelerate the precipitation of $CaCO_3$, resulting in the speeding up of the scaling.

3.1.4 The increase in dissolved Oxygen and other ingredients in Water. The dissolved oxygen, nitrogen increase substantially, reaching or close to the saturated concentration under the temperature and pressure condition of the air. When the mixed condenser experienced degassing, the emissions of was increased, and so did the load of vacuum pump.

it is can be seen from the above analysis that the change of the water quality of circulating water in the circulating process cause the deformation of scaling and the decrease in ventilation and filler. The Pingdingshan Haolong Co., Ltd had replaced the filler of cooling tower twice because that the scaling blocked tubes from the end of 1994 to March 2000.when the device was overhauled in March 2000, the distribution pipes were seriously scaled, the pipeline have been cut and replaced. The vacuum degree was significantly improved, the total temperature increased by more than 5 ℃, and the daily production increased by about 100t.

3.2 The effects of cooling system on vacuum degree

Only several companies out of more than 120 existing salt companies were founded in nearly 10 years, most of them were old Salt Plant. So the equipment of the vacuum cooling system were very old. On the other hand, due to financial problems, the salt factories are invest the limited funds on replacement of the critical equipment such as the circulating pumps, centrifuges, drying beds and the heating tube of core equipment, without the ability to take into account the auxiliary facilities - cooling system.

3.2.1 The low performance of vacuum pump or decrease in performance due to the use of long time. The pumping capacity and vacuum extraction is a powerful guarantee for improving vacuum degree. the extraction capacity of current domestic vacuum pump is between 650-750mmHg, if the existing vacuum pump in low in the pumping capacity or long-term wear and tear, it will seriously affect the improvement of vacuum degree.

3.2.2 The structure and properties of the mixed condenser is a key influencing the vacuum degree. The selected condensers of most factories are the air mixed condenser. Internal water spaying board should ensure the long-term smooth. But in fact, the hole of halftone was filled by the debris, migma and sand due to poor water quality, which impact the dispersion effect of water separated plate,

directly impact on the improvement of vacuum degree.

3.2.3 the impact of cooling towers. Cooling tower consist of the tower body, water set pool, dehydrator, and hair dryer, air distribution devices, etc. With the exception of the actual needs of heat exchange of cooling water, all parts above should deploy reasonably to achieve the purpose of effective decrease. Namely the goal of Overall the actual allocation of water, ventilation evenly, distributed high efficiency, good effect in removing water, air resistance is small, low energy consumption. That is why there is national specific inspection requirements for the cooling tower: cooling capacity of cooling towers should be examined after the installation and put into operation within one year. There are 16 optional items in assessment items, but a lot of manufacturers have never test above parameters from the production to the end-of-life of the cooling tower. The things can be done by the manufacturers is record the temperature and amount of water, and the main parameters impact the upper and lower temperature of air into the tower, wind speed distribution, water spraying density distribution were seldom known, the factors that influence the parameters has never been analyzed, so the cooling effect of cooling tower is self-evident bad.

3.3 The cooling system lack normal maintenance

The bad water quality of the cooling system of domestic vacuum evaporation salt cause a gradual decline in performance, which is a common problem. Except for the long term of stopping operation due to the requirement of complex maintenance, the main reason is that it did not receive great attention. the number of overhaul lasting more than 10 day is no less than 2 one year for the domestic enterprises. Stop operation for more than 10 days can carry on thorough cleaning and maintenance to the cooling system, but few companies do it. If things continue this way, water distribution systems, water spray system, condensers and so on will form fouling layer, which gradually increase cooling water temperature. On the other hand, due to lack of disrepair of vacuum pump, the ability to vacuumize will decrease. Then the vacuum degree will decrease though other conditions remain unchanged.

4.THE NECESSITY TO IMPROVE VACUUM DEGREE

The production of multi-effect vacuum evaporation salt is directly proportional to the effective temperature difference, effective temperature is determined by the temperature difference of first effect secondary steam and last effect secondary steam. When the pressure of the first effect steam is constant, the lower the temperatures of the secondary steam of last effect, the higher the effective temperature. The temperature of the second steam of last effect is determined by the cooling system, the higher the vacuum degree, the lower the temperature of secondary steam of last effect. On the other hand, reducing the vacuum degree of last effect can increase the effective temperature difference significantly. For example, the vacuum degree increase from -88kPa to -95kPa, if it Reach the international advanced level, the effective temperature difference can increase by 8℃, and the output increased by approximately 20%. In fact, this figure is the production potential of the existing equipment of the domestic salt industry. Furthermore, enhancing the vacuum degree of last effect and the production, the consumption target will be reduced significantly, which will enhance competitiveness of the domestic salt industry to participate in the international market.

5.THE FEASIBILITY OF MODIFIED COOLING SYSTEM AND ENHANCING VACUUM DEGREE

5.1 The cooling towers used in salt industries are small and medium-sized towers, transforming cost are in the range of 200-300 thousand which is relative low and general salt making plant can afford it.

5.2 The outcome of the economic development of our country since the Third Plenary Session has completely changed the situation of backward industry, there are adequate conditions to provide fine vacuum equipment for the salt industry.

5.3 In recent years, salt industry reserve and grow a number of young technical backbones.

Under the co-operation of the existing universities and research institutes, we are fully capable of developing the methods and measures to enhance the water quality of circulating cooling water.

6. THE TRANSFORMATION METHOD OF COOLING SYSTEM

6.1 utilizing the features of salt itself, improve the circulation water quality.

6.1.1 The quantity of condensed water from last effect is large, which contains a very small amount of salt in water and is in line with the requirements of the circulation water. However, the temperatures are high and generally between 60-80 ℃. As if make use of it, a cooling tower should be added at first so that the temperature of condensed water can drop to the temperature below 50 ℃, the it can be used as the supplementary recycled water, the discharged water was delivered to the mine to mine Brine.

6.1.2 Because of evaporation and mining recovery rate of less than 100% of the reason, always want to add salt water system. For the effective use of well water, salt design, will complement the water factory located at the forthcoming water (well water, river water or tap water) are added to the circulating cooling water for the water to send down the Ministry of Geology and Mineral Brine, In this way, cycle to improve water quality, reduce the cycle of water temperature, but also improve mining brine temperature, increasing the concentration of Brine.

6.2 cleansing cooling system periodically

As for the salt making company that can not change or replace the water quality, chemical method can be used to clean the fouling layer periodically, or added related reagents at the circulation water to prevent or inhibit fouling.

6.3 National focus of the production of vacuum equipment

Making use of the favorable condition that salt is a monopoly in this country, China National Salt Industry Corporation can use salt Fund Corporation to research, develop or introduce vacuum equipment production technology to serve the national salt industry.